** HIGHLY CONFIDENTIAL **
UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TENNESSEE
GREENEVILLE DIVISION
Civil Action No. 2:14-CV-00196
----------x
DENTSPLY INTERNATIONAL, INC. and TULSA DENTAL PRODUCTS LLC d/b/a TULSA DENTAL SPECIALTIES,

Plaintiffs,

- against -

US ENDODONTICS, LLC,

Defendant.
----------x

September 30, 2014
8:35 a.m.

Videotaped Deposition of A. JON GOLDBERG, Ph.D., taken by Plaintiffs, pursuant to Notice, held at the offices of Kenyon & Kenyon LLP, One Broadway, New York, New York, before Todd DeSimone, a Registered Professional Reporter and Notary Public of the State of New York.

APPEARANCES:

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ALSO PRESENT:

DMITRY ZVONKOV, Videographer

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THE VIDEOGRAPHER: Good morning. My name is Dmitry Zvonkov with Veritext. Today's date is September 30th, 2014. The time on the video monitor is 8:35 a.m.

This deposition is being held at the offices of Kenyon & Kenyon located at One Broadway, New York, New York. The caption of the case is Dentsply International, Inc., et al, versus US Endodontics LLC, in the U.S. District Court for the Eastern District of Tennessee. The name of the witness is Dr. Jon Goldberg.

Will counsel please identify themselves for the record.

MS. BRENNER-LEIFER: Elizabeth Brenner-Leifer from Rothwell Figg Ernst & Manbeck for plaintiff Dentsply.

MR. NOLAN: Jason Nolan from Rothwell Figg Ernst & Manbeck for plaintiff Dentsply.

MR. GINSBERG: Jeff Ginsberg of Kenyon & Kenyon for defendant US Endodontics and the witness.

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MR. JESIC: Slaven Jesic, Kenyon & Kenyon, on behalf of US Endodontics and the witness.

THE VIDEOGRAPHER: Will the reporter please swear in the witness.

* * *

A. JON GOLDBERG, Ph.D., called as a witness, having been first duly sworn, was examined and testified as follows:

EXAMINATION BY MS. BRENNER-LEIFER:

Q. Good morning, Dr. Goldberg.

A. Good morning.

Q. Could you state your name and residence for the record.

A. Yes, Jon Goldberg. West Hartford, Connecticut.

(Goldberg Exhibit 1 marked for identification.)

Q. And you understand you have been subpoenaed for your deposition today?

I'm giving you Exhibit 1 which is your deposition notice.

A. Okay.

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MR. GINSBERG: I don't believe he was subpoenaed.

MS. BRENNER-LEIFER: I'm sorry, the notice for his deposition, I'm sorry.

Q. And you are appearing here pursuant to the notice of deposition?

A. Yes.

Q. You submitted an expert -- or two expert reports in this case; is that correct?

A. Yes.

Q. Have you been deposed before?

A. Yes.

Q. And when was that?

A. Oh, maybe seven, eight years ago.

Q. And was that -- what kind of case was that for?

A. It involved dental materials.

Q. And what was -- was it a patent case?

A. It had to do with a license. It was a patent, but it wasn't an infringement issue.

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Q. A licensing issue?
A. Yes.
Q. And what party did you testify for?
A. The university had licensed a patent to Pentron Corporation and I was asked to --
MR. GINSBERG: I just want to interrupt. I just want to caution you not to reveal any confidential information that may have been involved in that case. You can answer, if you can, but I just don't want you to reveal any confidential information.
THE WITNESS: Thank you.
A. The university had licensed a company. There was a dispute with another company. And the company that had the license from the university asked me to be a witness on their behalf.
Q. Were you a fact witness or an expert witness?
A. Can you distinguish?
Q. Did you submit an expert report

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for that case?
A. I don't recall.
Q. You were just testifying as to your own personal knowledge --
A. That's my recollection.
Q. -- of the facts in the case?
MR. GINSBERG: Dr. Goldberg, please let Ms. Brenner-Leifer finish asking her question before you begin answering, that way the court reporter can get down both the question and the answer.
THE WITNESS: Okay, thank you.
Q. Maybe this is a good time to go over some preliminaries. Since you have been deposed before I will just go over this again since it has been you said eight years.
You must answer my questions truthfully. You are testifying under oath today. You need to answer verbally and avoid uh-huhs or huh-uhs or nods of your head or shakes of your head which the court reporter can't record very well.
It is important for the court

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reporter and for our questioning today that we try not to talk over each other, so there is no rush, we have got some time. And if you just take your time and let me finish asking my question and then answer, and I will do my best to do the same and not to interrupt you too.
A. And I will do my best to do that also.
Q. If you don't hear a question that I ask, ask me to repeat it, or if you don't understand a question that I'm asking, you can ask me to clarify it. If you don't ask me to clarify it, I will just assume that you understand the question.
Your attorney can object from time to time about my questions. Unless he instructs you not to answer my questions, you have to answer the question.
Do you have any questions for me before we start?
A. No.

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Q. Do you take any medications that might affect your memory?
A. No.
Q. Or any medications that might affect your ability to answer truthfully and accurately today?
A. No.
Q. Is there any reason why you can't provide truthful and accurate testimony here today?
A. No.
Q. How did you prepare for your deposition?
A. Mainly reviewing the articles that we had been preparing over the last couple of months and reviewing the questions -- the assumptions that the attorneys had asked me to make and coming up with particular opinions.
Q. What were those assumptions?
A. Well, for example, there are some issues relative to what permanent deformation might mean and what the atmosphere was that these files are

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heat-treated in. So they would ask me to consider if this was what would be your opinion, those sort of assumptions.

Q. And who did you meet with? Who did you meet with to prepare for your deposition?

A. Well, most of the deposition I prepared on my own. I did meet with the attorneys at Kenyon & Kenyon just prior to this deposition.

Q. Yesterday?

A. Yesterday and on Sunday.

Q. You were starting to tell me about your other depositions. Were you deposed in any other cases?

A. Not that I recall.

Q. Have you ever testified at trial or in a hearing?

A. Yes. There was another case maybe 15 years ago. I don't recall the particulars. But it was before a judge.

Q. Were you a fact witness in that case?

A. I just don't recall. I wasn't

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a party to the issue, if that's what you are asking. So I was there to provide information, but I'm not -- you would have to explain to me what a fact witness is.

Q. Well, a fact witness is you are testifying on your own personal knowledge and experiences rather than your serving as an expert on a particular subject.

A. Okay. I'm not sure I fully appreciate the difference, but I was asked to testify about dental materials.

Q. And that was a business dispute, too?

A. I don't recall.

Q. What companies were involved in that case?

A. I don't recall.

Q. Was Dentsply a party to that case?

A. I don't recall who the parties were.

(Goldberg Exhibit 2 marked for identification.)

Q. Dr. Goldberg, we have handed

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you what's been marked as Goldberg 2. I believe it's a copy of your curriculum vitae; is that correct?

A. Yes.

Q. Is this complete?

A. I would have to look through it. It would be hard for me to tell if a particular reference was missing or not. I mean, generally -- let me just page through.

(Witness perusing document.)

A. It appears to be.

Q. Did you prepare your curriculum vitae?

A. Yes.

Q. So I just want to go through your background.

A. Okay.

Q. You are a professor at the University of Connecticut?

A. Yes.

Q. In the Dental School?

A. Yes.

Q. And what is the Department of

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Reconstructive Sciences, what does that mean?

A. That's the department that teaches dental restorations, filling materials, caps, crowns, dentures. We also do implants and interface with all the specialties, endodontics, periodontics, oral surgery, orthodontics, because most cases involve input from others.

Q. And you graduated from Drexel in 1970?

A. Yes.

Q. And you got a bachelors in metallurgical engineering?

A. Yes.

Q. And then you got a masters at University of Michigan; is that correct?

A. No. I only have one masters degree, and it is from the University of Michigan in 1971.

Q. And then you got a Ph.D. there also?

A. At the University of Michigan,

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yes.

Q. And you spent, it looks like, most of your education is in metallurgy?

A. And dental materials.

I should comment that my Ph.D. thesis actually had to do with polymers. So I'm familiar with polymers as well as metals and dental materials.

Q. And did you -- it looks like from your CV you just went straight through school?

A. I'm sorry?

Q. It looks like you just went straight through school. Did you have any jobs in between?

MR. GINSBERG: Objection to the form of the question. You can answer.

A. Yes. While at Drexel, it is a cooperative school, so it is a five-year program. Basically you go to normal classes the first nine months and the last nine months, in between you are six months in school, six months working.

So I had a couple of years of

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work experience during my undergraduate.

Q. Where did you work?

A. At the Philadelphia Navy Yard and at Bethlehem Steel Plant in Indiana.

Q. My grandfather worked in the mills in Youngstown, a little bit earlier than that. I think he was retired by then. So I have some familiarity with what you do.

A. We could share stories, I'm sure.

Q. Yeah, I'm sure you could.

So you worked for Bethlehem Steel. So you were doing more industrial metallurgy for companies in big manufacturing?

MR. GINSBERG: Objection to the form of the question. You can answer, if you can.

A. Yes. So when I worked for Bethlehem Steel, it was a brand new steel plant in Indiana and I was asked to go out and work with the chief metallurgist. It was one of the first highly-automated

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facilities.

So my job was to try to confirm, specifically I was measuring temperatures of steel in what's called a hot rolling mill, so the steel gets rolled down, they change temperatures, and all the automation equipment is trying to monitor the temperature changes and then adjust the processing simultaneously with that.

And my job was to actually go down and manually record the temperatures, compare that to what the automated devices were monitoring.

Q. And did you have any other jobs while you were in school?

A. Yes. I was at the Bethlehem Steel -- I'm sorry, at the Philadelphia Navy Shipyard.

Q. And what did you do there?

A. I also worked for the chief metallurgist there, and our job was to do failure analysis from components on ships.

So, for example, if a boiler

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explodes, we would receive samples. We would metallurgically prepare them and then examine them to look at the structure, and then the chief metallurgist would do the interpretation. So I was basically helping to prepare the samples.

Q. When you were in school, did any of your studies involve nickel titanium?

A. Yes, just limited, at Michigan in the area of dental materials, we studied different alloys. I should correct that answer. I know we studied titanium. I just don't recall back in 1970s if we were looking at nickel titaniums at that same time.

Q. So your background is more in metallurgy, not in the dental sciences? You are at the dental school, but you are not a dentist or an endodontist?

MR. GINSBERG: Objection to the form of the question. You can answer, if you can.

A. Yes. As you know, my Ph.D., I

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did my Ph.D. in a combined program between the Dental School and the Engineering School. And at Michigan at that time they were just like a block away from each other. So my laboratory was actually in the Dental School, and most of my time was in the Dental School, and my training was to understand material science, but then understand the applications, in this case, dentistry.

So I would take what are called preclinical courses with the dental students, that is you would be not working on a patient, but in a laboratory, just seeing what the lab technician or the dentists were trying to achieve so we can appreciate the applications.

Q. That makes sense.

On the second page of your curriculum vitae, it has what looks like your job experience.

A. Yes.

Q. Could you go through that for me?

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A. Sure. When you say job experience, this doesn't include the co-op experiences that I had as an undergraduate.

So going from the bottom up, my position, my job at the University of Connecticut was my first job. It has been my only job. I came on, I was an assistant professor, which would be typical rank for a beginning new faculty member, and I have always essentially been in the same department, but the department name has changed over the time from Restorative Dentistry to Reconstructive Dentistry. At one point it also included the term Biomaterials in the name of the department.

Then in 1980 I was successfully reviewed for promotion to associate professor with tenure. So that would indicate that I had achieved a certain level of academic performance that would warrant that promotion and tenure.

Then in 1982, I, at the time,

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had an opportunity to do a sabbatical. So I went to the National Center for Electron Microscopy, which is at the Lawrence Berkeley Laboratory, which, if you are not familiar, is just above the hill from the University of California at Berkeley. They share a large campus.

Then in 1999 I was a visiting scientist at the Department of Biomaterials in relation to dentistry in London at Queen Mary and Westfield College. In 1986 I was promoted to professor, again, which would indicate a certain level of academic achievement.

And in '95 I formed and then became the director of the Center For Biomaterials. So this is a group of faculty members within our department that have an interest in biomaterials, and I try to coordinate those efforts, oversee lab space, and administrative, as well as somewhat less now, but also some issues of what research directions we may want to take as a group.

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And specifically right now the university is going through some major renovations, so when I get back next week I have meetings with the architects to talk about how the labs might be designed.

Q. Do you teach dental students?

A. Yes.

Q. And do you teach a materials class for dental students?

A. Yes.

Q. And have you done that since you started as a professor?

A. Yes. If I can qualify that, I, in addition, have taught what are called residents. So when you say dental students, those are people that are working to get their dental degree. After getting their dental degree, they specialize, orthodontics, endodontics, oral surgery, prosthodontics.

So in the past I have taught dental materials to those groups, and today I also help supervise research projects for those students.

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In addition, I do teach at the Engineering School at the main campus, the University of Connecticut, and supervise students in their research, typically biomedical engineering students.

Q. When you did your Ph.D. in dental materials in 1977, was that at the Dental School?

A. Can you repeat the question, please?

Q. When you did your Ph.D. in dental materials in 1977, was that at the Dental School?

MR. GINSBERG: Objection to the form of the question.

A. So I did my degree from '70, and I should clarify, I started in 1970 at the Engineering School. After one year I began my Ph.D., and that was a joint degree between the Dental School and the Engineering School. So I spent part of my time in the Engineering School and part of my time in the Dental School.

Q. Do you know what classes the

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dentistry students took in metallurgy or materials when you were there?

MR. GINSBERG: Objection to the form of the question.

A. Which school and what time point?

Q. When you were at the University of Michigan in the '70s and studying for your own courses, are you aware of whether the dental students took metallurgy or materials science?

MR. GINSBERG: Objection to the form of the question.

A. Yes. It was not referred to that. Those courses in most dental schools are called Dental Materials, but include material science and metallurgy.

Q. I'm not sure I understood your answer. You said it was not referred to that. Could you please --

A. Correct. This other course in the Dental School would be called Dental Materials.

So Dental Materials, the way

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that it was taught at Michigan was students would learn about basic materials, metals, polymers, ceramics, composites. So in describing how metals work, they are basically taught metallurgy, but the course is not formally called that.

And then they would be taught what the application is and try to understand the basics of the materials so they can understand why that material selected for that case, why it might have gone wrong, why it is manipulated a particular way.

Q. But the average dental student when you were in school in the '70s wouldn't have had all the extensive metallurgy background that you had?

MR. GINSBERG: Objection to the form of the question.

A. When you say average, you mean nationally? At Michigan?

Q. Let's start at Michigan. Let me rephrase my question.

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When you were in school doing your Ph.D. and studying metallurgical engineering in the '70s and you were studying with dental students at some points, right?

A. At some points, correct.

Q. So you are familiar with the classes the dental students were taking?

A. No.

Q. Not all of them?

A. No. I was familiar with the courses that I was taking with them, but they took many other courses that I wasn't taking.

Q. I guess the thrust of my question is, when you were studying metallurgical engineering, your studies of metallurgical engineering were much more extensive than the dental students?

A. Yes.

MR. GINSBERG: Objection to the form of the question.

Q. The dental students only took a couple of classes that would relate to

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materials?

A. No. All dental students are required to take Dental Materials. They cover a wide range of materials. They focus on the the application and they understand -- they are taught basic structures of materials.

I think what you are asking, that's in contrast to an engineering student like myself who might take thermodynamics of materials.

Is that what you are asking me?

Q. Yeah.

A. Yes.

Q. Dr. Goldberg, do you receive research grants from time to time?

A. Yes.

Q. And do you receive research grants from any companies, private companies?

A. I have in the past.

Q. What companies? Let's just talk about the last five years.

A. Let me just think. None in the

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last five years.

Q. None?

A. Yes, from companies.

Q. Were they government grants?

MR. GINSBERG: Objection to the form of the question.

A. Some were government grants, yes.

Q. Could you tell me more specifically what the government grants were?

A. Sure, I would be glad to.

Right now my major federal support, in fact, my only federal support right now is a training grant. So the National Institutes of Health would like to maintain researchers and pipelines to deal with the questions that are of interest to them. So to do that they fund either individuals or universities to train these people.

So myself and a colleague, Dr. Mina Mina, are co-directors of the training grant in skeletal, cranial,

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facial and oral biology. So that is the kind of like biological aspects around the oral cavity. It is a $4 million grant.

Right now we probably have actively funded 12 students, but maybe there is another half dozen that have been funded by us or will be funded by us. So our job is to provide them research training.

Q. Have you ever received any research grants or stipends from Dentsply?

A. Not that I can recall.

Q. Have you ever received any research grants or stipends from US Endodontics?

A. No.

Q. Have you received any research grants or stipends from any dental companies?

A. Yes. But my hesitation is some of those are in confidence, so I don't know if I can describe them to you. I probably shouldn't.

Q. Well, we can mark this

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transcript confidential.

MR. GINSBERG: That won't cure it. If he is subject to confidentiality agreements that he is not permitted to disclose the names, then I would caution the witness not to disclose those names.

MS. BRENNER-LEIFER: I'm just asking for the name of the company with regard to financial bias.

MR. GINSBERG: And I repeat, please listen, if he --

MS. BRENNER-LEIFER: I heard what you said. I'm asking him more questions.

MR. GINSBERG: I'm --

MS. BRENNER-LEIFER: I heard what you said.

MR. GINSBERG: I'm going to state the objection on the record.

MS. BRENNER-LEIFER: I heard your objection. You already stated it.

Q. He does not want you to reveal anything that's confidential. I'm just probing to understand whether it is truly

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confidential.

A. It is a court mandate. So I don't know if that -- that to me is different from confidential. In other words, I might have a confidentiality agreement which I think would not allow me to start, but this was related to a legal settlement.

Q. Have you received any financial payments from any U.S. dental companies?

A. Yes.

Q. And can you just tell me the name of the company? I don't need to know anything specific.

A. I can tell you the name of one of them was Ormco Corporation, it is an orthodontic company.

Q. Could you spell that, please?

A. Ormco, O-r-m-c-o.

Q. Any other companies?

A. The other companies involved -- some of the support did involve this case that I'm talking about, so I'm -- it was a legal settlement. There was

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confidentiality. I guess I'm not sure what else I can say without breaking that confidentiality.

Q. So that relates to payments that related to work you did for the case?

A. No.

Q. I'm asking specifically about any kind of research or financial support you get for your work.

A. For this case?

Q. No, at the university or otherwise in your normal business.

A. Right. So, first of all, I don't receive the money personally. When we get a grant, it goes to the university. There was no support related to this case.

I have had support from companies for my research at the university, and that has gone to the university to support the laboratory.

Q. Are you on any advisory boards for companies?

A. No.

Q. Do you give talks from time to

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time?

A. Yes.

Q. And do you receive money for those talks?

A. It depends. Generally I don't.

Q. The university does?

A. No. Generally I talk at academic and professional meetings or academic societies, and they only pay my expenses to give the talk.

Q. Have you ever given any talks sponsoring a particular company for their products?

A. I'm sorry, I didn't hear the question.

Q. Have you ever given any talks sponsoring a particular company for their products?

MR. GINSBERG: Objection to the form of the question.

A. I'm not sure what you mean by sponsoring the company.

Q. Well, sponsoring a company's products.

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A. Oh, sponsoring a company's products. When we developed the beta titanium alloys for orthodontic application, I was asked to give talks describing the materials. So I did that. But I wasn't paid for that.

And I also -- we did some development work in fiber-reinforced composites, and that company asked me to go to certain dental meetings and give talks about that. I don't recall if I was paid or not, I don't believe so, I think they just paid my expenses.

This was the concept that it was new products, new materials, so dentists and lab technicians would be interested in understanding it, and I was in a position to explain what the rationale was for the materials, why they had benefits, those sort of things.

Q. And what companies are you referring to?

A. Those two cases were Ormco and Pentron Corporation.

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Q. Was Ormco for the beta titanium?
A. Yes.
Q. And could you spell the other --
A. I'm sorry, I think that's what was actually called the A Company. I just don't recall. It was either A Company -- maybe it was Ormco. I just don't recall which of those two. It is O-r-m-c-o. And the other was just capital A Company.
Q. And what was the company for the fiber-reinforced composites?
A. Pentron, P-e-n-t-r-o-n.
Q. Do you know anyone that works at US Endo?
A. No.
Q. Do you know anyone that works at Edge Endo?
A. No.
Q. Did you become an expert in this case through their attorneys?
MR. GINSBERG: Objection to the form of the question.

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A. I'm sorry, through which attorneys?
Q. Through US Endo's attorneys.
A. Well, I assume that means Kenyon & Kenyon, and yes, they were the ones that contacted me.
(Goldberg Exhibit 3 marked for identification.)
Q. Dr. Goldberg, we have marked for the record as Exhibit 3 your supplemental expert report.
A. Yes.
Q. When did you prepare this report?
A. Within the last couple of weeks.
Q. And what precipitated you to prepare that report?
A. The attorneys at Kenyon & Kenyon asked me to look at the section of I think it was Sinclair or Luebke and their definition of ordinary skill, and I felt it was nonspecific, most notable it would have allowed somebody with training

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in a totally unrelated field to be considered one of ordinary skill, so working together we revised the definition.
Q. Why didn't you include a definition of a person of ordinary skill in your first report?
A. I wasn't asked to do so.
Q. Had you given it any thought?
A. No.
Q. In your --
A. Let me say that whenever I'm reading documents and it says person of ordinary skill, then I'm thinking about what that person should be. But as far as modifying the definition, the attorneys called me and specifically asked me to look at that, and then in reading it closely, the Sinclair and Luebke definitions, I felt that it was nonspecific, particularly as it relates to allowing somebody with no training in materials or dentistry to potentially be considered one of ordinary skill.

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Q. But when you wrote your first report, your attorneys did not ask you to define who a person of ordinary skill in the art was?
A. I don't recall. But if it wasn't in the report, then I imagine they did not.
(Goldberg Exhibit 4 marked for identification.)
Q. Dr. Goldberg, having offered a supplemental report in this case and having had an opportunity to supplement your first report, do you feel that you've now provided a complete summary of your opinions for this case?
MR. GINSBERG: Objection to the form of the question.
A. Yes, of the opinions I've been asked to, I have.
Q. We have marked as Goldberg Exhibit 4 your first expert report.
MR. GINSBERG: I will just object. It is not his first expert report. It is incomplete. It does not

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include the exhibits.

And since we are getting into a document that has been marked highly confidential pursuant to the protective order, I would like to designate this transcript highly confidential pursuant to the protective order.

Q. Could you look at the body of this document and tell me if this part is complete.

MR. GINSBERG: Objection to the form of the question. And regarding completeness, as I have stated, we object to this document as it does not include the exhibits.

(Witness perusing document.)

A. Other than the references, it appears to be complete.

Q. You mean the prior art references that were attached to your report?

MR. GINSBERG: Objection.

A. All the references that were attached to the report.

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MS. BRENNER-LEIFER: I would like to take a five-minute break.

THE VIDEOGRAPHER: This ends tape number one. We are off the record at 9:17.

(Recess taken.)

(Goldberg Exhibit 5 marked for identification.)

THE VIDEOGRAPHER: This begins tape number two in the deposition of Dr. Jon Goldberg. We are on the record at 9:25.

BY MS. BRENNER-LEIFER:

Q. Dr. Goldberg, we have marked as Exhibit 5 U.S. Patent 8,727,773. Do you have that in front of you?

A. Yes.

Q. Do you recognize this as one of the patents upon which you have given your opinions in your report?

A. Yes.

Q. And you have expressed opinions about both infringement and invalidity?

A. Yes.

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Q. And you have some -- also some opinions about claim construction?

A. I was asked to consider, make certain assumptions, and then what my opinions would be about claim construction given certain opinions, given certain assumptions.

Q. So what were the assumptions you were asked to give?

A. For which aspects of the claims?

Q. Well, you just said you were asked to -- you were asked to make certain assumptions. What assumptions are you talking about?

A. Okay. Well, the two that I recall had to do with the definition of what atmosphere was present during the heat treatment. That's just one that I recall offhand.

Q. Do you mean the atmosphere that was present during the heat treatment of what, in the patent?

MR. GINSBERG: Objection to the

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form of the question.

A. Yes. I was asked to -- let me start that again. I was asked to examine whether or not -- how the claim should be interpreted as far as the heat treatment, particularly relative to what atmosphere would be involved.

Q. Any other assumptions?

A. I just don't recall sitting here. I know -- I just don't recall.

Q. Did your attorneys at Kenyon explain to you the difference between an independent and a dependent patent claim?

A. Yes.

Q. What's your understanding of the difference?

A. My understanding is that -- let me put it this way. A dependent claim is limited by the claim that it is attached to plus the additional information in the dependent claim itself.

Q. You have the last page of the patent in front of you?

A. Yes.

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Q. In claim 1, which is at the bottom of the column 9, do you see any reference in claim 1 to atmosphere?

A. No.

Q. You don't see that as a limitation in claim 1?

MR. GINSBERG: Objection to the form of the question and to the extent that it calls for a legal conclusion. You can answer.

A. The atmosphere isn't specifically described in the claim, but my understanding is most of the phrases or terms in the claim are defined by what's described in the specification.

So in that case, if you look in the specification, whenever heat treatment is mentioned or an atmosphere is mentioned, it's in a particular type of atmosphere.

Q. Would you look at claim 2 of the patent.

A. Yes.

Q. Is an atmosphere described in

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that claim?

MR. GINSBERG: Objection to the form of the question and to the extent that it calls for a legal conclusion. You can answer.

A. Well, that would -- claim 2 would include claim 1, and claim 1 does mention the heat treatment, and the heat treatment, the atmosphere for the heat treatment is described in the specification.

Q. And what about claim 3?

MR. GINSBERG: Same objections.

A. And same answer.

Q. Do you see any reference to "atmosphere" in claim 3?

MR. GINSBERG: Same objections.

A. Again, 3 includes 1. 1 describes the heat treatment. And the heat treatment atmosphere is described in the specification.

Q. And what about claim 4?

MR. GINSBERG: Same objections. Objection to the form of the question and

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to the extent it calls for a legal conclusion.

A. Yes, so claim 4 does say it's in any atmosphere, but it is still part of claim 1, which refers to the heat treating, and in the specification the atmosphere during those heat treatments are described.

Q. So your understanding is claim 4, that it encompasses any atmosphere?

MR. GINSBERG: Objection to the form of the question. Mischaracterizing the witness' testimony, and I object to the extent it calls for a legal conclusion.

MS. BRENNER-LEIFER: It says it right there.

MR. GINSBERG: Objection to the extent it calls for a legal conclusion.

A. Can you repeat the question?

Q. So claim 4 explicitly states any atmosphere, as you stated previously, correct?

MR. GINSBERG: Objection to the

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form.

A. Right. But, as I've said, claim 4 would include claim 1.

Q. So is it your understanding that claim 4 is actually narrower than any atmosphere?

MR. GINSBERG: Objection to the form of the question and to the extent it calls for a legal conclusion.

A. I guess I'm not an expert in independent versus dependent claims. I mean, my understanding is that a dependent claim would include the independent claim. So in this case, whatever might be said in 4 still is also limited by what's in 1.

Q. And as you mentioned earlier, claim 1 doesn't refer to any specific atmosphere?

MR. GINSBERG: Objection to the form of the question and to the extent that it calls for a legal conclusion.

A. Again, as I said earlier, it describes heat treating. One aspect of heat treating is the atmosphere and that's

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mentioned several times in the specification.

Q. I understand there is atmosphere as it is discussed in the specification. But I'm asking you to consider just the claims.

MR. GINSBERG: Objection. Wait for a question.

Q. For instance, there is a reference to argon in the specification, correct?

A. You would have to point that out to me. I just don't recall.

Q. Well, we don't need to do that right now. But there is no specific atmosphere recited in claim 1, and claim 4 specifically says "any atmosphere"; is that correct?

MR. GINSBERG: Objection to the form of the question.

A. Again, I'm not sure how these independent and dependent claims formally work.

My simple understanding is that

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whatever is in claim 1 would also apply to claim 4. So I guess I would say, I'm not an attorney, but if one part is more limiting, I don't think you could expand it with another part. I think the dependent claims have to limit more than expand, but that's my legal opinion.

MR. GINSBERG: I object to you giving a legal opinion.

Q. You don't need to do that. But you are correct that the claim -- the dependent claim has to narrow the independent claim, and so claim 4 has to be narrower than claim 1.

MR. GINSBERG: Objection to the form of the question. Misstating the law. I object to the legal characterization. It is incorrect and I object to that question, multiple grounds.

A. Can you repeat the question, please?

Q. Actually, it wasn't a question. So you can ignore all his objections because there really wasn't a question

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there.

MR. GINSBERG: I object to the misstatement then.

Q. So looking at claim 5.

A. Yes.

Q. Claim 5 says "The method of claim 4 wherein the atmosphere is unreactive, ambient, or any other acceptable heat treatment process."

MR. GINSBERG: Is that a question?

Q. Do you see that?

A. I see that.

Q. And do you understand that claim 5 further limits claim 4?

MR. GINSBERG: Objection to the form of the question and to the extent that it calls for a legal conclusion.

A. Yes, so 5 is dependent on 4, and 4 is dependent on 1. I don't know if I'm saying that correctly.

Q. So 5 gives examples of specific atmospheres which can be unreactive or ambient or any other acceptable heat

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treatment process. You see that, right?

A. Yes.

Q. And you understand what that means?

A. Yes.

Q. So I just want to make sure we are on the same page with these claims here, specifically claims 1 through 5, or 1 through 6 -- or 1 through 5. So claim 1 is a method for manufacturing or modifying endodontic instrument.

And do you understand what an endodontic instrument is?

MR. GINSBERG: Objection to the form of the question.

A. Yes.

Q. How would you define endodontic instrument?

MR. GINSBERG: I will object to the extent it calls for a legal conclusion. You can answer.

A. I imagine there is many endodontic instruments, some of which I'm not familiar with. I answered as, you

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know, thinking a file would be an example, but it is not inclusive of all instruments.

Q. And claim 1 recites an endodontic instrument for performing root canal therapy. You see that?

A. Yes.

Q. And that would include a file?

A. It would include a file, yes. If I can expand on that, in every case you might not have to use a file, you might use a reamer.

Q. So you understand claim 1 would also include reamers?

MR. GINSBERG: Objection. Calls for a legal conclusion.

A. Well, I can only repeat what it says. It would be an instrument used in performing root canal therapy on a tooth. So I would think of instruments such as files and reamers.

Q. What about a broach?

MR. GINSBERG: Objection to the form of the question.

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A. I'm not sure exactly what that is, but I believe it is a type of endodontic instrument.

Q. The first limitation in claim 1 is (a). Do you see that paragraph?

A. Yes.

MR. GINSBERG: Objection to the form.

Q. "Providing an elongate shank." Do you understand what a shank is?

A. Yes.

Q. What is a shank?

MR. GINSBERG: Objection to the form of the question to the extent it calls for a legal conclusion.

A. In this context, they are speaking about the part of the file other than the handle, or the part of the instrument other than the handle, but I'm envisioning this being a file, and I note you have pointed out that it's not specifically limited to that.

Q. Would a reamer have a shank?

A. I believe so.

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Q. And limitation (a) says "providing an elongate shank having a cutting edge extending from a distal end of the shank along an axial length of the shank."

Do you see that?

A. Yes.

Q. Do you understand what that means?

A. Yes.

Q. And what's a cutting edge?

MR. GINSBERG: Objection to the form of the question, to the extent that it calls for a legal conclusion.

A. I'm envisioning a file, so I will answer the question based on that. So the file has a twisted section where the edges have been sharpened so that when the file is turned or rotated, those cutting edges remove part of the tissue that's being removed during the endodontic therapy.

Q. What is an obturator?

MR. GINSBERG: Objection to the

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form of the question.

A. In what context?

Q. In the endodontic context.

A. I'm not sure what the obturator is in endodontics. I'm not sure exactly how those are used or what they would be.

Q. What is your experience working with endodontic files?

A. Mainly reading articles and reviews relative to the mechanical properties and the structures of the files.

Q. Have you ever done any of your own research on files?

A. What I recall is an endodontic resident coming to me asking how we might measure some of the mechanical properties of files. I gave him some advice as to how that might be done. I don't recall if we actually did that in my lab or not.

Q. Can you recall any other work related to endodontic files?

A. Only in the sense that there is lots of commonalities between orthodontic

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nickel titaniums and endodontic nickel titaniums, so when we have done work in orthodontics, I have relied on references from the endodontic field.

Q. And you teach classes in orthodontics?

A. I teach materials, so right now I teach materials to our dental students. Part of that course is on orthodontic dental materials. I used to specifically teach the residents that included the orthodontists.

Q. And what about endodontists?

A. They were also included in that class.

Q. Did you teach any classes specifically relating to endodontics?

A. Do you mean specifically and only to the endodontic residents?

Q. No. I mean relating to the subject of endodontics.

MR. GINSBERG: Objection to the form of the question.

A. So I'm interpreting your

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question to mean did I give a course that was entirely focused on endodontics, and I have not done that.

Q. Did you give any courses that were partially focused on endodontics?

MR. GINSBERG: Objection.

A. Yes.

Q. What classes?

A. Dental Materials.

Q. And how did that relate to endodontics?

A. Well, in Dental Materials we teach about all the materials that are used, so that would include the materials used in endodontics.

Q. Going back to claim 1 in limitation (a), there is a further limitation that recites "the shank comprising a superelastic nickel titanium alloy."

Do you see that?

A. Yes.

Q. And what do you understand that to mean?

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MR. GINSBERG: Objection to the extent it calls for a legal conclusion. You can answer.

A. Well, are you asking --

Q. Let me break down the question.

A. Yes, thank you.

Q. Are you familiar with the term "superelastic"?

A. Yes.

Q. And what does that mean?

A. That means you deflect the material that returns to its original shape.

Q. Are there some properties of nickel titanium alloy that are not superelastic?

MR. GINSBERG: Objection to the form of the question.

A. Yes, there are definitely properties that are different than superelasticity.

Q. And what other properties are those?

A. I would think about the

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ultimate strength, the modulus of elasticity. Those would be the first two that I would think about.

Q. And what do you mean, ultimate strength?

A. So ultimate strength is referring to a typical stress-strain curve which would be a measure of the stress and strain, and the maximum value of stress on those curves would be the ultimate strength.

Q. And what do you mean by modulus of elasticity?

A. That would be the slope of the initial part of the stress-strain curve.

Q. And what do you mean by stress and strain?

A. So stress would be a force applied to a material divided by the cross-section layer that is supporting that stress.

And strain would be the amount of deflection while under stress divided by the original dimension.

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Q. Let's turn to step (b) of claim 1.

A. Okay.

Q. It says "after step (a), heat-treating the entire shank at a temperature from 400 degrees Celsius up to, but not equal to, the melting point of the superelastic nickel titanium alloy."

Do you see that?

A. Yes.

Q. It has several components, heating, the shank, and a specific temperature range. Do you see that?

MR. GINSBERG: Objection to the extent you are mischaracterizing the step.

Q. Do you see that?

A. I see that step -- I see that section (b), yes.

Q. And then after step (b) there is a "wherein" clause that states "the heat-treated shank has an angle greater than 10 degrees of permanent deformation after torque at 45 degrees of flexion when tested in accordance with ISO Standard

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3630-1."

Do you see that?

A. Yes.

Q. So breaking that down, it's measuring degrees of permanent deformation using a specific test, correct?

MR. GINSBERG: Objection to the form.

A. Yes.

Q. And the test is set forth in the ISO Standard 3630-1; you understand that?

A. I understand that, but that's not part of ISO Standard 3630.

Q. What do you mean, that's not part of ISO?

A. Well, measuring the permanent deformation.

Q. Okay. And are you familiar with the term "permanent deformation"?

A. Yes.

Q. And how is that ordinarily used?

MR. GINSBERG: Objection to the

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form of the question.

A. Can you define what you mean by ordinarily?

Q. Is that a term of art?

MR. GINSBERG: Objection to the form.

A. I'm sorry, I'm just trying -- because obviously it can have many meanings.

Q. Let me start over. Is "permanent deformation" a term of art?

MR. GINSBERG: Objection to the form of the question.

A. In dental materials?

Q. In metallurgy.

A. In metallurgy, yes.

Q. And is the term "permanent set" also a term of art?

MR. GINSBERG: Objection to the form of the question.

A. I would consider that more commonly used in dental materials.

Q. Do they have different meanings?

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A. It is just that you were asking if they are commonly used, and I'm explaining that I believe permanent set is more commonly used in dental materials. Permanent deformation is more commonly used in metallurgy.

Q. Well, is the term "permanent deformation" used in dental materials?

MR. GINSBERG: Objection to form.

A. Yes.

Q. And is that a term of art when used in dental materials?

A. Yes, in the context that we have been discussing it.

Q. And what is the ordinary meaning of permanent deformation when used in the context of endodontics?

MR. GINSBERG: Objection to the form of the question.

A. Well, in general, permanent deformation would mean you deform a sample and it doesn't return to its original shape or dimensions.

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Q. And what does permanent set mean?

MR. GINSBERG: Objection to form.

A. Permanent set in dental materials could have many meanings. It could have to do, for example, probably commonly used with curing of methacrylates for dentures and removal of partial dentures and composites.

So that term is commonly used to describe that the material has cured or hardened.

Q. So going back to step (b), step (b) recites a temperature range of "400 degrees C up to, but not equal to, the melting point of the superelastic nickel titanium alloy."

Do you see that?

A. Yes.

Q. And you understand what that means?

MR. GINSBERG: Objection to the form of the question and to the extent it

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calls for a legal conclusion.

A. I can just interpret that when the heat treating process is done, the temperature is within that range.

Q. Now looking at claim 2, claim 2 recites the method of claim 1 wherein the temperature is from 475 degrees Celsius to 525 degrees Celsius.

Do you see that?

A. Yes.

Q. Do you see that recites a narrower range?

MR. GINSBERG: Objection to the form of the question and to the extent that it is outside of the preliminary injunction motion and the expert report.

A. Yes, I can see that 475 is greater than 400, and assuming the alloy doesn't melt, 525 would be below the melting point.

Q. And do you understand that claim 2 includes all the limitations of claim 1 and is further limited to that narrower temperature range?

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MR. GINSBERG: Objection. Calls for a legal conclusion.

A. I'm not sure I'm following what you are saying.

Q. Well, a little while ago you were explaining to me how your general understanding is that a dependent claim incorporates the limitations of the independent claim and then adds further limitations, right?

A. Correct.

Q. And I'm just wanting to make sure that you and I are on the same page for claim 2 here.

Claim 2 incorporates the limitations of claim 1 and further limits it to a narrower temperature range?

MR. GINSBERG: Objection to the extent it calls for a legal conclusion.

A. I'm understanding your explanation, yes.

Q. You understand that that's what claim 2 recites?

MR. GINSBERG: Objection to the

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extent it calls for a legal conclusion.

A. Well, I see that it recites that temperature limitation and that it's a dependent claim to claim 1.

Q. And looking at claim 3 at the top of column 10, claim 3 is also a dependent claim. It reads "the method of claim 1," which makes it dependent, and then it says "wherein," and then it says "the shank is heat-treated for one to two hours."

Do you see that?

MR. GINSBERG: Objection to the form of the question.

A. Yes, I see that.

Q. Now, do you understand that claim 3 further limits claim 1 to encompass all of those limitations, but just limits how long the heat treatment is for?

MR. GINSBERG: Objection. Calls for a legal conclusion.

A. I can understand your interpretation, yes.

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Q. And then going to claim 4, claim 4 says "the method of claim 1," again, making it dependent, you understand that, right? And then it says "wherein," and then it says "step (b)," which looking at claim 1 refers to heat-treating from this 400 degrees Celsius up to the melting point; you understand that?

A. Yes.

Q. And then it further limits the atmosphere?

MR. GINSBERG: Objection to the form of the question.

Q. And it just says "any atmosphere"?

MR. GINSBERG: Objection to the form of the question and to the extent that it calls for a legal conclusion.

You can answer, if you can.

A. Yes, I'm following your interpretation.

Q. So you understand that claim 1 -- I'm sorry, so you understand that claim 2 -- I'm sorry, let me start over.

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Claim 4 -- you understand that claim 4 further limits claim 1 by just reciting the atmosphere?

MR. GINSBERG: Objection. Calls for a legal conclusion.

A. Well, this gets back to the questions and answers we had before, and I don't want to misstate what I had said before.

The atmosphere is discussed throughout the specification. I don't know the legal ramifications of expanding an independent claim with a dependent claim. I recognize that it's called a dependent claim.

I'm just trying to explain what I had said before, that there seems to be a conflict between the definitions of the atmospheres in those two. So I don't -- I don't know how to interpret that.

Q. So in your view, if claim 4 is interpreted to mean any atmosphere, it would expand, not narrow, claim 1?

MR. GINSBERG: Objection to the

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extent it calls for a legal conclusion.

A. Again, I'm not sure of the technicalities or how that would work. I understand what a dependent claim is.

But, as I've stated before, I have an opinion on what the heat-treating should include as far as the atmosphere, and that appears to be in contrast to the specific independent claim.

Q. But you agree that claim 1 on its face doesn't recite any atmosphere; is that correct?

A. The words "atmosphere" are not in the claim, correct.

Q. To read claim 1 to encompass a specific atmosphere, you would have to read something in from the specification, right?

MR. GINSBERG: Objection, to the extent it calls for a legal conclusion.

A. My experience is that everything in the claims is described in the specification.

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I mean, you need to have some background to understand what the claims are, so that's how I interpret the atmosphere and heat-treating, based on what's in the specification.

Q. Looking at claim 6, claim 6 recites the method of claim 4 making it dependent on claim 4; you understand that?

A. Yes.

Q. And it further recites "the atmosphere is unreactive." What does "unreactive" mean?

MR. GINSBERG: Objection to the form of the question, to the extent it calls for a legal conclusion.

A. In the context of heat-treating these nickel titanium alloys, it would mean that you would get some sort of oxide or something on the surface if it was reactive. If it was unreactive, you would not expect that.

Q. And it just pertains to its effects on the surface?

MR. GINSBERG: Objection to the

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form of the question and to the extent it calls for a legal conclusion.

A. So I'm going to ask you to clarify because there is different things that can happen.

An oxide can be formed. The gas could diffuse into the metal. It could diffuse into the bulk of the metal. So that you have to just clarify what aspect of unreactive you are referring to.

I offered the one how it has been used in the context of this case, and that was the oxide formation.

Q. What does ambient mean?

MR. GINSBERG: Objection to the form of the question, to the extent it calls for a legal conclusion. It is beyond the scope of the expert reports.

A. Again, in the context of this case I would anticipate that's talking about doing a heating with just using whatever air or environment is around, so that would typically mean in air.

Q. And then claims 5 and 6 both

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recite another atmosphere, or actually they both recite any other acceptable heat treatment process.

Do you have an idea of what that might mean?

A. No.

Q. No idea?

MR. GINSBERG: Asked and answered.

A. No.

Q. Could you please turn to column 3 of the patent.

A. Okay.

Q. Beginning about line 48 there is a paragraph that begins "Figure 6." Do you see that?

A. Yes.

Q. I will read it to you.

"Figure 6 is a graph showing the results of a study of angle of permanent deformation after the flexion test (ADP) reported in degrees of deflection performed in accordance with 'ISO Standard 3630-1 Dentistry - Root

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Canal Instruments - Part 1: General Requirements and ANSI/ADA Specification No. 28, Endodontic files and reamers' for untreated (Control) files, heat-treated files (TT), and titanium nitride coated files (Ti-N)."

Do you see that?

A. Yes.

Q. Would you turn to Figure 6, please.

A. Could you just explain what ADP is in parentheses in the second line?

Q. I believe that -- I believe that is defined somewhere. I think it is angle of deformation permanent, but I'm not sure.

If you look at Figure 6, ADP is on the Y axis.

A. Yes. But I haven't --

Q. And it is referred to as angle.

A. That's not a common abbreviation, so I'm not sure what it means.

Q. Well, I read Figure -- I read

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that paragraph to mean angle of permanent deflection after deflection test, which they are abbreviating to mean ADP.

A. Okay.

MR. GINSBERG: There is no question. It is an attorney statement.

Q. Now, look at Figure 6, please.

A. Okay.

Q. On the X axis, there is a number of files which are numbered, and on the Y axis there is -- there are numbers expressed as angles.

Do you read that to mean angle of deflection?

MR. GINSBERG: Objection to the form of the question and to the attorney characterization.

Q. Do you read that to mean angle of permanent deformation?

A. As I said, ADP, I have never seen that before as an abbreviation. So I'm relying on your definition.

Q. Well, do you have another possible interpretation?

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A. I don't, but I would say when I first looked at that, it also confused me then. I will just make that comment. So I will assume it means angle of --

MR. GINSBERG: No, you don't have to assume.

THE WITNESS: Okay.

Q. And looking at Figure 6, do you understand that the box that is TT are the heat-treated files?

A. Yes.

Q. And the control is the black box on the left?

A. Yes.

Q. And do you see that the heat-treated files have a much greater angle of permanent deformation --

MR. GINSBERG: Objection to the form of the question.

Q. -- for each of the files?

A. Can you repeat the question?

MS. BRENNER-LEIFER: Can you read that back, please.

(The record was read.)

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MR. GINSBERG: Objection to the form of the question.

A. Yes, again, assuming -- I will just, so you understand that I'm trying to be clear, back when it says Figure 6 in the context in column 3, it says "a graph showing the results of a study of angle of permanent deformation." Then it says, and after that it says "reported in degrees of deflection."

So I was just a little unclear about, are we talking about how much it is deflected or how much afterwards? And using a new term didn't help. So that sentence was just unclear to me as to what's being tested. Because it says both "reported in degrees of deflection" and "results are in angle of permanent deformation," it says two things.

Q. Let's turn to column 8. There is an example 4 which I think correlates to Figure 6.

A. Okay.

Q. So why don't you read that

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paragraph and then I will ask you questions on it.

A. Okay.

(Witness perusing document.)

A. I have read it.

Q. Now, looking at example 4, at line 45, or line 46, it says "Ten of each ISO size were untreated."

Those were control, right --

A. Uh-huh.

Q. -- files?

Those are the ones shown in the first box, first one that is in the dark black coloring. Do you see that?

A. Yes.

Q. And then it says "Ten of each ISO size were heat-treated in a furnace in an argon atmosphere at 500 degrees Celsius for 75 minutes and then slowly cooled."

You see that?

A. Yes.

Q. And those are all the files -- and those are the ones that are represented in the second column, TT?

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A. Yes.

Q. Do you see that?

A. Yes.

Q. Then it says, there is a third group, "Ten of each ISO size were coated with titanium nitride using physical vapor deposition with an inherent heat-treatment."

Do you see that?

A. Yes.

Q. So they are heat-treated as well and they also have a physical vapor deposition. Do you see that?

MR. GINSBERG: Objection to the form of the question.

A. I'm saying yes, but I don't know what "an inherent" means in that context.

Q. You have no idea what that means?

A. No.

Q. Are you familiar with a titanium nitride coating process?

A. No.

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Q. Are you familiar with a physical vapor deposition process?
A. I know generally what vapor deposition process is, but just generally.
Q. And would that involve heat?
A. I'm not sure. I would think so because you are trying to generate some vapor, that then is going to condense on to the surface of the sample being treated.
Q. And then it says these are labeled Ti-N in Figure 6. Do you see that?
A. Yes.
Q. So those are the ones in the third column?
A. Yes.
Q. Do you see that?
A. Yes.
Q. So turning to Figure 6, the box on the left for each file type is colored black. It has standard deviation bar there?
A. For the controls, yes.

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Q. You see the small standard of deviation, R there?
A. Yes.
Q. And for each of the files the angle of permanent deformation is less than 5?
A. I will just comment that even as to the example, I'm really not trying to give you a hard time, but this is just not the way this test was designed, and so the wording is a little confusing.
So that first sentence, again, you know, as far as, what does it say, it says "the angle of permanent deformation after flexion defelecting a certain amount of degrees was performed." It is just not 100 percent clear to me.
Q. Okay. Well, we will get into the detail of the tests in a little bit. But I just want to make sure we are on the same page with understanding this figure. Okay?
A. Sure.
Q. So this figure says -- reports

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that the angle -- or the ADP for this test is less than 5 for the untreated, right?
A. Correct.
Q. And for the ones that are TT, the angle of permanent deformation or the ADP is, for each of them, almost 30.
Do you see that?
A. Correct. And I take note that you are helpful and you have defined what ADP is, so I will go on that basis.
Q. And then in the third column for each of the files is the Ti-N, and that's the vapor deposition using some kind of heat process.
MR. GINSBERG: Objection.
Q. And that is also reflecting an increased ADP over control in some intermediate range?
MR. GINSBERG: Objection.
A. I see that.
Q. You agree with that?
A. I see that. That's reported.
Q. And it ranges from about 15 to 25 for that third treatment process?

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A. I would read that more as 18 to 25.
Q. Okay, I'm happy with that. I'm happy with that reading. Okay, thank you.
When you were responding to Dr. Sinclair's report regarding infringement, do you recall that you reviewed an expert report by Dr. Sinclair?
MR. GINSBERG: Objection to the form of the question.
A. If I recall, there were two reports.
Q. And Dr. Sinclair's report referred -- related to infringement?
A. Are you referring to his report or his declarations?
Q. I'm referring to his report.
A. Okay.
Q. Did you look yourself at any US Endo files?
A. I don't believe I have.
Q. Did counsel give you any endodontic files to look at?
A. Yes, but I don't know if those

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were US Endo files.

Q. What files did you look at?

A. They sent me some files and asked me to hold on to them that we might use for subsequent testing.

Q. You don't know what kind of files they were?

A. I don't.

Q. And they were not used as a basis for your expert report?

A. No.

Q. You did not consider those files for --

A. Well, I mean, I saw the files, but we didn't do any testing or analysis.

MS. BRENNER-LEIFER: I want to take a five-minute break.

THE VIDEOGRAPHER: This ends tape number two. We are off the record at 10:18.

(Recess taken.)

THE VIDEOGRAPHER: This begins tape number three in the deposition of Dr. Jon Goldberg. We are on the record at

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10:31.

BY MS. BRENNER-LEIFER:

Q. Dr. Goldberg, are you familiar with the terms "martensitic" and "austenitic"?

A. Yes.

Q. What do they mean?

MR. GINSBERG: Objection to the form to the extent it calls for a legal conclusion. You can answer.

A. Those are general descriptions of possible phases. It could be applied to many different alloy systems.

Q. Are you familiar with the phrase "martensitic transformation"?

MR. GINSBERG: Objection to form.

A. As a general term, yes.

Q. And what does that mean?

A. It means that the lattice structure or the crystal structure is changing from martensitic to something else.

Q. And what kind of change does

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that undergo? Can you explain how that change works?

A. Sure. It is a change in the relative position of the atoms.

So these crystal structures have three-dimensional patterns, and you can define those patterns by the distances between the atoms and the angles that are made by those distances, and so that changes from martensitic to something else. So those distances or angles would be changing.

Q. And with regard to nickel titanium, what would it mean?

A. It would --

MR. GINSBERG: Objection to form.

A. -- have the same general meaning that the martensitic structure would be transforming the atomic arrangement, the distances between the atoms and the angles that they make in martensite phase would be changing to something else.

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So the distances between the atoms and the angles would be changing. They are three-dimensional patterns, so the three-dimensional pattern is changing, if that's more helpful.

Q. So the crystal structure is changing from a martensitic structure to an austenitic structure?

A. It could. It could.

Q. Well, what other options are there?

A. Well, for nickel titaniums there is an R-phase, so it could be changing to that.

Q. And is the R-phase a type of martensitic phase?

A. Not in the context of nickel titaniums. It is a, in some contexts is referred to as martensitic. There are many types of martensites.

But when you ask me about nickel titanium, generally we would refer to martensite as one phase, austenite as another, and R as a third phase.

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Q. But if you are using the term "martensitic" as an adjective, is an R-phase a type of martensitic phase?

MR. GINSBERG: Objection to the form of the question.

A. If I was talking in the context of NiTi, I wouldn't use it that way. If I was talking in the general context of crystal structures, then yes, R would be considered a martensite.

Q. Are you familiar with the phrase "austenitic transformation temperature"?

A. Yes.

Q. And what does that mean?

A. That would be the temperature at which the austenite either begins to form from another phase or goes from the austenite to a different phase.

Q. And what's the different phase?

A. It would depend on the system.

Q. Okay. For nickel titanium.

A. For nickel titanium, the other phases would be either martensite or the

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R-phase.

Q. And are superelastic alloys in the martensitic phase when they are below the austenitic transformation temperature?

MR. GINSBERG: Objection to the form of the question.

A. That's a complex question. I would really have to see the mechanical property data to determine if something is superelastic or not.

Q. Okay. Well, assuming it is superelastic, would a superelastic alloy be in the martensitic phase when it is below the austenitic transformation temperature?

MR. GINSBERG: Objection to the form of the question.

A. Again, let me explain. In my opinion, you can't just determine if something is superelastic based on its crystal structure. So you could have one crystal structure that is superelastic and a very similar one that is not.

So in my opinion, you need to

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see the test that defines superelasticity. I don't think you can infer it from the structure alone.

Q. What test do you need to define superelasticity?

A. There is some sort of stress-strain curve or bending test where you would deform the sample and see how much it recovers.

Q. A material that is considered to be martensitic doesn't have to be 100 percent martensite, correct?

MR. GINSBERG: Objection to the form of the question.

A. That sounds a little contradictory. If you say it is martensite, then it is martensite. If it is not martensite, then it is not martensite.

Q. What if it is biphasic?

A. Then it would be two phases.

Q. And would it be partially martensite?

A. Well, again, if we are talking

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about the nickel titanium systems and you are telling me that it is biphasic and one of the phases is martensite, then yes, one phase is martensite and there would be a second phase.

Q. And what do you mean in your report by biphasic?

A. Two phases.

Q. And how does the nickel titanium have two phases?

MR. GINSBERG: Objection to the form. You can answer.

A. So that's a little bit of a complex question, but I think I can answer simply.

So a phase is defined by the atomic arrangements that I was talking about, the angles and the distances, as well as which atoms are in there. So, for example, this might be a certain arrangement and it is men and women. You could have another arrangement where the distances are a little different and maybe it is all men or all women.

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So those differences in the crystal structure define a phase. So we call a phase men and women and then another phase might be called men only. Materials can have both of those simultaneously in their structure.

Q. Okay. Now let's get back to nickel titanium, not men and women.

A. Okay.

Q. I would like to keep it concrete.

A. I was trying to make it simple.

Q. It is a lot more helpful if we just talk about nickel titanium.

And the austenite phase is a cubic crystal structure; is that right?

A. I believe so.

Q. And the R-phase is like a rhombohedral structure?

A. Yes.

Q. And the martensite phase is -- what do you call that one?

A. Monoclinic.

Q. Monoclinical, which is similar

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to rhombohedral?

MR. GINSBERG: Objection to the form of the question.

A. So to keep it concrete, they are all similar in that they are lattice arrangements, but they are very specific and different from each other, again, by the distances between the atoms, which atoms are present, and the angles.

Those define the lattice structure. There is basically 14 possible patterns, monoclinic, rhombohedral, and cubic are three of those. So you definitely can have two different arrangements within the nitinol at the same time.

Q. Now, if you are heat-treating nickel titanium, and nitinol is the 50/50 composition?

MR. GINSBERG: Objection to the form of the question.

A. Well, again, if we are going to be concrete, I have to ask you, do you mean weight basis or something else?

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Q. It is atomic basis, right?

A. Atomic basis, yes.

Q. It is 50 percent --

A. Atomic, thank you.

Q. 50 percent nickel and 50 percent titanium?

A. Yes.

Q. And they call that nitinol in the art?

A. Nitinol.

Q. Nitinol, thank you.

A. I'm going to have to qualify that. You can vary that composition somewhat off of the one-to-one ratio. It doesn't actually have to be 50 to 50 exactly.

Q. Okay. Well, how much can you vary it?

A. I would say as much as 3 percent, if you are just varying the nickel titanium. But you can also substitute other atoms that would also affect the structure.

Q. Well, if you substitute other

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atoms, would it still be called nitinol?

A. Yes. I'm going to qualify it by saying nitinol we use two different ways. There is Nitinol with a capital N which is the trade name of the nitinol products, and nitinol with a small N which is the generic form.

So the small N would include slight variations, maybe as much as 3 percent, as I mentioned, as well as possible additions, I'm going to estimate as much as 1 percent of third elements.

Q. And do the superelastic properties change if you vary that ratio of nickel to titanium?

A. I would have to see, again, the mechanical property data, but I would expect with a certain degree of variation and composition that you would affect the properties, yes.

Q. And the austenitic temperature is the temperature at which the martensite phase ends and the austenite phase is 100 percent?

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A. Yes. I would say it a little more specifically.

I would say if you are referring to the temperature at which austenite begins to form, then that would be a transition from a lower temperature form, either martensitic or R-phase to martensite, at which case it is martensite plus M or R.

The martensite temperature at which that reaction is complete, then all of the M or R phase would have transformed to martensite and then it would be 100 percent martensite.

Q. What do you mean, martensite plus M or R?

A. So those are two phases or biphasic. So biphasic would mean two phases, so M plus R would be two phases, M plus austenite would be two phases, as would austenite plus R also be two phases.

Q. So just to clarify, the austenite start temperature is the temperature upon which the austenite

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crystal starts to form?

A. How are you defining austenite? There is different ways to define that temperature.

So there is one method, ASTM method, that is defined as -- they use the phrase "austenite start." So that identifies that temperature using a particular method and that's referred to as the As or austenite start.

There are other ways of defining what that temperature is.

Q. What is the standard way of defining it?

A. Commonly it is with that ASTM method.

Q. And the austenite finish temperature is the temperature upon which the austenite crystal is 100 percent?

A. Again, austenite finish is the term associated with that ASTM method. So per the ASTM method, that's the austenite finish temperature. It is 100 percent austenite when the reaction is 100 percent

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complete.

(Goldberg Exhibit 6 marked for identification.)

Q. Dr. Goldberg, we have handed you Exhibit 6, Goldberg Exhibit 6.

A. Yes.

Q. It is titled Heat Treatment Protocol.

A. Yes.

Q. Created by Bobby Bennett.

A. Yes.

Q. Have you seen this document before?

A. No.

Q. You have never seen this document before?

A. No.

Q. You can put it aside, then.

(Goldberg Exhibit 7 marked for identification.)

Q. Dr. Goldberg, I have handed you what has been marked Goldberg Exhibit 7.

It is ASTM, it states -- entitled Standard Test Method for

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Transformation Temperature of Nickel Titanium Alloys by Thermal Analysis.

Do you see that?

A. Yes.

Q. Have you seen this document before?

A. I believe so. I know Dr. Sinclair referred to it. At the time I checked it. I think this was the one, but I don't exactly remember, because there is many, many ASTM methods, even with some similar methods.

But I believe this was the one Dr. Sinclair was referring to.

Q. Would you review this. I want to ask you some questions. I want to give you some time to look it over first.

A. There is a fair amount of information. You want me to --

Q. Spend a few minutes looking at it.

(Witness perusing document.)

A. Okay. I appreciate the time to look it over.

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Q. Dr. Goldberg, have you ever performed this method?

MR. GINSBERG: Objection to the form.

A. Do you mean a DSC of nickel titanium?

Q. Yes.

A. No.

Q. Have you ever read this before today?

A. Yes, I believe this was the one that was attached to Sinclair's report.

Q. Do you recognize this ASTM standard as the standard in the industry for performing DSCs?

MR. GINSBERG: Objection to the form of the question.

A. It is referred to as the standard method, and in industry typically you would use the ASTM method if one exists for the specific purpose that you are trying to achieve.

So if you are trying to achieve ASTM, As or Af values, then you would use

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this.

Q. Just so we are on the same page, the first paragraph of the ASTM standard says Scope 1.1.

A. Yes.

Q. "This test method defines procedures for determining the transformation temperatures of nickel titanium shape memory alloys."

A. Yes.

Q. And that's basically what this standard refers to?

A. Yes, although I would have to admit I was a little surprised to see that shape memory since, again, that has to do with the mechanical property. But I accept that that would be the purpose here.

Q. Would you turn to the second page. Paragraph 10 is where the procedure begins.

A. Yes.

Q. You prepare the sample, you place it in the pan, you turn on some gas,

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use helium, and then you run a cooling and heating temperature -- I'm sorry, a cooling and heating program.

Paragraph 10.4.1 says you use the heating and cooling rates of 10 plus or minus 0.5 degrees Celsius per minute.

Do you see that?

A. Yes.

Q. Do you understand that the rate of heating and cooling is important for a DSC curve?

MR. GINSBERG: Objection to the form of the question.

A. Again, it would depend on the material, but I can understand that the rating of heating and cooling could affect the phases that are present, which would affect the DSC curve.

Q. And then 10.4.2 says you heat the sample from room temperature to a temperature of at least Af plus 30 degrees Celsius.

A. Yes, I see that.

Q. And then you hold the

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temperature for a time at that temperature sufficient to equilibrate the sample with the furnace, and then 10.4.3 says you cool the temperature to a temperature of below Mf minus 30 degrees Celsius, hold for a time sufficient to equilibrate the sample with the furnace and then heat the sample to a temperature of at least Af plus 30 degrees Celsius.

Do you see that?

A. Yes.

Q. Do you understand what that means?

A. Yes.

Q. And then the last paragraph, 10.5, says Data Acquisition, you record the resulting curve from the heating and cooling program from Af plus 30 degrees Celsius to Mf minus 30 degrees Celsius.

Do you see that?

A. Yes.

Q. And then paragraph 11 is entitled Graphical Data Reduction, and it tells you how to obtain information from

the data that you just obtained, right?
A. Correct.
Q. So we are looking at Figure 1. It refers to Figure 1. Do you see that?
A. Yes.
Q. And you have seen that figure before?
A. Yes.
Q. 11.1 says "draw the baselines for the cooling and heating portions of the curve as shown in Figure 1."
Do you see that?
A. Yes.
Q. And where on the curve do you see that baseline?
A. Do you want me to point, or how do I relay that to you?
Q. Draw it.
A. On my --
Q. Yeah, draw it.
(The witness complies)
MR. GINSBERG: Could I see that, please.
Q. So you drew a horizontal line

where those curves would just basically go horizontal?
A. I'm trying to draw a horizontal line that I'm envisioning the peak is resting on. So you see the peak, it comes up and goes down. So to the extreme left it is horizontal and there is nothing happening. Then the peak begins, it goes up and comes down, and the same thing in the reverse.
So the baseline is basically like the support that that curve would be sitting on. That's what I'm trying to represent.
Q. So you drew that for the top curve and the bottom curve?
A. Yes.
Q. And then 11.2 says "draw the tangents to the cooling and heating spikes through the inflection point as shown in Figure 1."
A. Yes.
Q. Can you show me on there what they are referring to?

A. Sure.
Q. Could you label them?
A. I'm going to do that, thank you.
Q. Great.
(The witness complies)
A. I hope you won't hold my handwriting against me.
Q. Okay. It looks pretty good to me.
And then 11.3 says "obtain Ms, Mf, As, and Af as the graphical intersection of the baseline with the extension of the line of maximum inclination of the appropriate peak of the curve is shown in Figure 1."
And are those already identified on Figure 1?
A. They are identified, but it's not showing -- there is no line from Mf or Ms or As or Af to the graph. But it says that it would be the intersection of that tangent with the baseline. So I see that.
Q. Can you draw arrows where you

think those numbers are?
A. Yes. How about if I make a circle, because it is a point we are trying to identify?
Q. Perfect.
(The witness complies)
Q. So looking at the top line in Figure 1, the circle you drew in the top left is the Mf?
A. Correct.
Q. And would you just draw an arrow there so it is clear.
A. Sure. I'm going to draw an arrow from Mf to the circle that I drew.
Q. Great.
(The witness complies)
Q. And could you draw an arrow for where you think the Ms temperature is.
A. Yes.
(The witness complies)
Q. And the same for the Af temperature and As temperature.
(The witness complies)
Q. So what you did just now is the

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ASTM standard method for determining the transformation temperatures for nickel titanium alloy, right?

A. No. What I did was determined Mf, Ms, As and Af per ASTM method.

Q. I thought that's what I just said.

A. They are different.

Q. Okay. How are you clarifying me? I'm just not sure what you are --

THE WITNESS: Can you repeat her question, please.

(The record was read.)

A. Correct. So the transformation temperature is a more general term. What this does is determine specifically terms that are defined as Mf, Ms, As and Af.

And what I'm making the distinction, is there is different places to identify where the reaction is actually beginning and ending. The ASTM method is one way of defining that.

Q. Okay. And that's the standard in the industry?

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A. It is. But I would point you to the appendix, X1.3, that says "Transformation temperatures derived from differential scanning," this method, may not agree with those obtained from other test methods. So there is other methods.

Q. Okay. In this diagram, Figure 1, which is the heating curve and which is thc cooling curve?

A. The peak pointing down is on heating, the peak pointing up is on cooling. And I would say normally those are labeled that way, but they are not here.

Q. And how is it that you can tell?

A. Well, because I'm looking at where Af and As are and Mf and Ms, and so I would expect upon heating that the highest peak would be for the As/Af points which are higher there to the right, and on cooling I would expect to see the Ms and then Mf, and those are on the top peak, and so Ms is at minus 37 and Mf is

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at minus 48, so they are cooling on that peak. The As is at minus 18. The Af is at minus 11. So that is heating.

Q. Is the cooling curve more relevant than the heating curve?

MR. GINSBERG: Objection to the form of the question.

A. In what context? I mean --

Q. If you are trying to determine the composition of nickel titanium.

A. My experience, we would have both the heating and the cooling.

Q. When you were talking earlier about biphasic, I think you were talking about a different graph, representational graph.

But when you are looking at this DSC, is there an area here you would call biphasic?

A. On this diagram?

Q. Yeah.

A. No. Let me take that back, I'm sorry. Oh, absolutely, yes, I'm sorry.

Q. How do you explain -- where

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would it be?

A. Underneath the curve. Because it is transitioning either heating or cooling from martensite to austenite, so everywhere underneath the curve it is a combination of both.

So it begins, if we look at the top curve, this is presented -- well, let's start at the bottom, either one is okay. As you are heating starting someplace before minus 18 C, the transformation begins. So that would mean that the material is austenite plus martensite. And then somewhere to the right of Af the transition ends and it is all austenite.

Similarly, on the cooling curve --

Q. I'm sorry, I just want to make clear, when you are to the left of the As temperature on the bottom curve, you are in martensite phase?

MR. GINSBERG: Objection to the form.

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A. I'm sorry?
Q. I'm looking at Figure 1.
A. Yes.
Q. When you are to the left of the As temperature --
A. Meaning at a lower temperature?
Q. Right, to the left, you are at a lower temperature, you are in the martensitic phase?
A. Correct.
Q. And then at the As temperature there starts to become a transformation into the austenitic phase?
A. The transition begins where the curve begins and then it transitions from the martensite to austenite. So therefore everywhere underneath that peak, that transformation is continuing. It is going from zero percent martensite -- I'm sorry, 100 percent martensite, zero percent austenite, to at the other extreme of the curve 100 percent austenite, zero percent martensite.
So everywhere in between at

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some ratio are some relative portions of austensite and martensite.
Q. Is that what you mean when you use the term "biphasic"?
A. Biphasic, generally I mean there are two phases present, but it came from the interpretation of these curves.
So that meant that we are under those curves or within those curves, so by definition there is two phases present.
Q. And how does this crystal structure from the martensitic structure to the austenitic structure happen, is that like a displacive transformation?
MR. GINSBERG: Objection to form.
A. So I'm not 100 percent sure. I think you are referring to -- what you are referring to is displacement versus diffusion, and in both cases what is happening is the atoms are arranging from one lattice arrangement to a different lattice arrangement.
Q. And for nickel titanium, is

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this a diffusionless transformation?
MR. GINSBERG: Objection to form.
A. I don't know for sure. I think it would depend on the alloy. But many of these are considered diffusionless.
That's by definition sometimes how we define martensitic, that it is a diffusionless transition. But any reaction for which the atoms do not have to move away from the position they are currently in is referred to as a diffusionless transition.
Q. Is the R-phase transition also a diffusionless transition?
MR. GINSBERG: Objection to form.
A. I don't know.
Q. When we were talking earlier about permanent deformation, if a nickel titanium alloy is superelastic nickel titanium alloy, will it permanently deform when it is in the austenitic phase?
MR. GINSBERG: Objection to

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form.
A. It is somewhat of a compound question because, as I said earlier, I don't think you can look at the crystal structure alone, such as the austenitic phase and infer what the mechanical properties are.
So you are asking it -- the main question is, is it permanently deforming or not, and for that I would just have to see the mechanical property data. So I'm not trying to avoid your question, but I have explained that I don't think you can infer the mechanical properties from the phase alone. You would have to see the mechanical. You would actually have to see the mechanical properties.
Q. Okay. Well, if you have a piece of nickel titanium alloy and you bend it and it doesn't permanently deform, would you conclude that it's in the austenitic phase?
A. Again, I don't think you can

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make -- in my opinion, I don't think you can make that clear a correlation between the structure and the mechanical properties data.

I think what's more typically done is you do the mechanical property analysis under different conditions. You study the phases present under those different conditions. Then you go back and you would say okay, under these conditions we had this mechanical property, under these we had this.

Then given that kind of calibration or that standard, you can then go back and say all right, if I take an unknown and I see what the lattice structure is based on my previous data, I can anticipate just like the other way, if it had -- once I have that standard, I have both, I can measure the mechanical properties and infer what the structure might be. But in my opinion, you need to have those established.

Q. Did you review the bend testing

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conducted by Knight Mechanical on the US Endo EdgeFiles?

A. Could I see the document? There just were several -- lots of documents and several with mechanical properties.

So when you say Knight, I just don't recall exactly which one. If I can see the document, I would be glad.

Q. Well, let me step back for a second. I will withdraw that question.

Looking at your expert report --

MR. GINSBERG: Again, I will just note for the record that he doesn't have his expert report in front of him. There is an incomplete version of the report that doesn't include his exhibits.

Q. Looking at Goldberg Exhibit 4 --

A. I'm sorry?

Q. Goldberg Exhibit 4.

A. Okay.

Q. This is the body of your

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opinions for your expert report, correct?

A. Yes.

Q. There is no opinions in this report about any bend testing conducted by Knight Mechanical; is that correct?

A. I would have to page through, but if you say that's the case, I would accept that. I mean --

Q. I want you to confirm.

A. Okay.

(Witness perusing document.)

A. I can just say without going all the way through --

MR. GINSBERG: She wants you to confirm.

THE WITNESS: Okay.

(Witness perusing document.)

A. I do not see any specific reference to the -- I'm sorry, is it Knight or McKnight Mechanical property data that you referred to?

Q. It is Knight Mechanical.

A. Knight Mechanical. But I do see on page 9 that I'm talking about

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Sinclair's data and right underneath that it has to do with the permanent deformation.

So I might have been considering his data at that point, but I don't specifically mention McKnight.

Q. What paragraph are you looking at?

A. 35, and then the subheading above it. I mean, what just caught my attention is I'm referring to Sinclair's data and then that first paragraph has to do with permanent deformation.

So I'm familiar that he did report on the McKnight's data. I'm not specifically commenting on it, but I'm just seeing that mechanical properties, it comes right under Sinclair's data. So that's just catching my eye.

Q. Well, in paragraph 35 you are just talking about the claim language, and the same with 36.

A. Yes. And I'm just noting it under the subheading of Dr. Sinclair's

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data. I mean, I had looked at that data and I read his report, so I don't have any specific reference to the McKnight data, but I couldn't say that I'm not considering all those when I'm developing my opinions.

MS. BRENNER-LEIFER: We need to change the tape, so this is a good time for a break anyway.

THE VIDEOGRAPHER: This ends tape number three. We are off the record at 11:29.

(Recess taken.)

THE VIDEOGRAPHER: This begins tape number four in the deposition of Dr. Jon Goldberg. We are on the record at 11:44.

BY MS. BRENNER-LEIFER:

Q. Dr. Goldberg, could you go back to Exhibit 7, which is ASTM standard.

A. Yes.

Q. Looking at the method that we were just discussing in Figure 1 and paragraph 11, the graphical data

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reduction, do you know why the ASTM standard is to look at these points of intersection where the tangent hits the baseline to get these numbers?

A. Yes. That method is probably more consistent across labs.

Q. So it is a standardization?

A. Well, it is a standard method, and one reason why ASTM might select the method is because it can be more accurately produced across labs. That's why they give that table on page 3 just showing what the variability is typically among Ms, Mf, As, whatever, four different labs.

Q. So you mean that if two labs are testing the same material, they will be more consistent --

A. Yes.

Q. -- if you follow this method?

A. Correct.

MR. GINSBERG: Please let Counsel finish the question before you begin answering. Thank you.

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MS. BRENNER-LEIFER: And I would ask you to let me finish my question before you raise your objection, which you have a bad habit of doing, too.

If everybody would let the other person speak, this deposition would go a lot smoother.

MR. GINSBERG: The record speaks for itself.

Q. And do you know why the ASTM does not look at where the tip of the curve is at the baseline?

MR. GINSBERG: Objection to the form of the question.

A. I don't know why they don't look at the tip. I wasn't involved with developing this standard, so I'm not sure what the considerations were.

Like I said, the reason they are adapting a method like this is so that it can define values such as Ms, Mf, As, Af, and more reliably get those reported if the same test is done in different laboratories.

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Q. And I know you said you never did the DSC curve yourself --

A. For nickel titanium.

Q. For nickel titanium. But are you aware that if you increase the heating rate, it delays the onset of the tip of the curve?

MR. GINSBERG: Objection to the form of the question.

A. Can you repeat that question?

Q. If when you are running the DSC curve and you have a rate of heating and cooling, if you do a -- if you increase the rate of heating, that will delay the onset of the tip of the curve --

MR. GINSBERG: Objection.

Q. -- right?

MR. GINSBERG: I'm sorry, I didn't let you finish. I thought you were finished. Objection to the form of the question.

You can answer.

A. I wasn't aware of that. But just as the ASTM method describes what the

heating and cooling rate should be, that's because it can affect all the values.

Q. That's why there is a standard heating and cooling rate?

A. Correct.

Q. Have you ever heard of the Kissinger analysis?

A. No.

Q. If a nickel titanium alloy is in this biphase, as you referred to it, where it is partially martensitic, if I'm understanding your testimony correctly --

MR. GINSBERG: Objection to the form of the question.

A. I'm sorry, I'm not understanding what the question is.

Q. I believe your testimony earlier was you referred to this biphasic phase or --

A. Structure.

Q. -- structure where it is partially martensitic and partially austenitic?

A. No, I believe I said partially

one phase and partially another phase. It could be austenite and martensite. It could also be martensite and R-phase. It could be R plus A .

So it is two phases, the point was, I was trying to describe it as two phases.

Q. Well, if the nickel titanium is partially martensitic, won't it behave like it is martensitic?

MR. GINSBERG: Objection to the form of the question.

A. That really depends on so many factors, how much martensite, what the other phase is present.

And when you say behave, I don't know if you are talking about mechanical behavior or thermal behavior. So it is a difficult question to answer.

Q. If you have a piece of nickel titanium alloy and you can permanently deform it, would you conclude that it's at least partially martensitic?

A. As I said before, in my

opinion, I don't think you can infer properties from structure or structures from properties in these systems until you have evidence of each.

As I said, the way I think it would typically be done is you would manipulate whatever variable and measure the phases present and measure the properties, and then once you had that standardized calibration between structure and properties, then you could take an unknown and infer either structure or properties from the other.

Q. If you heat an entire piece of nickel titanium, should the atomic arrangements be the same throughout that shank, that piece?

MR. GINSBERG: Objection to the form of the question.

A. So it would depend upon what temperature range you are going through. If it went through a transition, I would expect that by definition would mean the crystal structure would change.

Q. If you have a heat-treat piece of nickel titanium alloy and you do the DSC curve and you know it's not in that transformation phase, it is either above the Af temperature or below the Ms temperature --

MR. GINSBERG: Objection to the form.

Q. Would that crystal structure be uniform throughout --

MR. GINSBERG: Objection to the form of the question.

Q. -- the alloy?

A. It is a little complex when you start asking those temperatures. I mean, I'm not the one to do this, but there were several issues in there and I wasn't able to keep track.

MR. GINSBERG: Can I have the question back, too, because I lost track.

MS. BRENNER-LEIFER: That's because you kept interrupting my question.

MR. GINSBERG: You are pausing, and I apologize that you think I'm

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interrupting --

MS. BRENNER-LEIFER: You know, you should just let me finish talking. You need to be more patient and let me get my question out.

MR. GINSBERG: Well, the witness begins answering when you are pausing. If you are finished asking your question, I try to wait until you are done, but sometimes there is long pauses, so I apologize if I'm interrupting, but when the witness starts answering, I want to make sure that I get the appropriate objection on the record.

Could I have the question back, please.

(The record was read.)

A. If I can interrupt, what do you mean by "heat-treated"? This is one aspect. So that's one aspect.

THE WITNESS: You can continue.

(The record was read.)

A. That is another thing. I'm not sure what you mean by "that transformation

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phase."

THE WITNESS: Thank you, if you can continue.

(The record was read.)

A. So I think you meant to say below the --

MR. GINSBERG: Well, you don't have to correct the question. I object to the form of the question.

A. On the one hand you asked above the Af, so I will just, if you don't mind me, above the Af it is going to be all austenite.

Below the Ms it is going to be a combination of martensite plus austenite or possibly R-phase if that is present. Below the Mf it is going to be all martensite.

And if I can add to that, I'm using Mf and Ms and the phrase "all martensite," inferring that the reaction is complete. I was just trying to help you out with those relative temperatures. I didn't mean to infer that at Mf it is

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100 percent martensite. That's the temperature determined by the ASTM method, but as we have been talking, there is regions of the curve beyond those points.

I guess I would just add that it is all austenite when the austenite transition is complete and it is all martensite when the martensite transition is complete.

Q. And my question just went to when you are saying it is complete throughout the whole piece of nickel titanium that you are holding.

A. I'm sorry, there is multiple parts there.

Correct, if you are below the end of the curve then it is 100 percent martensite. If you are below the end of the curve where that martensite transition ends, then it is 100 percent martensite throughout the piece.

(Goldberg Exhibit 8 marked for identification.)

Q. Dr. Goldberg, I have marked as

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Exhibit 8 a reference you referred to in your report as Walia. It is in the Journal of Endodontics. It is dated 1988.

Have you reviewed this reference?

A. Yes.

Q. And this reference is -- it says "In this article we report the first use of an entirely new metallurgical system, Nitinol nickel-titanium orthodontic wire alloy for the fabrication of endodontic files."

A. I'm sorry, can you show me where you are reading?

Q. Sure. On page 346.

A. Okay.

Q. On the second column, the first full paragraph, right in the middle.

A. Okay, yes.

Q. "In this article, we report the first use of an entirely new metallurgical system" --

A. Second column, you said?

MR. GINSBERG: I'm not

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following either.

A. Oh, the middle of the column, okay, okay. I'm sorry.

Q. Okay. I will start again.

"In this article" -- are you following me?

A. Yes.

Q. "In this article, we report the first use of an entirely new metallurgical system, Nitinol nickel-titanium orthodontic wire alloy for the fabrication of endodontic files."

A. Yes.

Q. And is it your recollection this is about the time when nickel titanium began being in use for endodontic files?

A. Yes.

Q. Approximately?

A. Yes.

Q. And on pages 346 and 347 it describes the materials and methods used, correct?

A. I will have to take a scan of

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that.

(Witness perusing document.)

A. Okay. I have reviewed that.

Q. And in this report, Walia, et al, are comparing Nitinol and stainless steel wires, right?

A. Yes. I'm sorry, I think these are actually in the form of files. Let me just see here.

(Witness perusing document.)

Q. You are right, they fabricate files.

A. Yes.

Q. Does Walia perform any heat treatment on these files?

A. He doesn't describe any that he has used, no. But I would just say that he refers to ways that it could be heat-treated.

Q. Where are you referring to, please?

A. Page 351, the first column, I'm in the middle, starting, the sentence begins over on the right side of the

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column.

It begins "Moreover, it is possible to alter the superelastic force delivery of the the Japanese NiTi wire alloy" -- the one that they are testing -- "and perhaps other new wires by means of an appropriate heat treatment," reference 18. "It would be worthwhile to evaluate root canal files fabricated from some other recently introduced nickel-titaniums," etc., is the second reference there.

So while he doesn't do the heat-treating, he is recognizing the benefits and referring to the method, reference 18.

Q. Well, he says it's possible to alter superelastic force delivery of the Japanese NiTi wire alloy, right?

A. Right.

Q. And that is not specifically what he's testing?

A. I don't know that. And the reason I don't know for sure is because

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Unitek, I'm familiar with the company, and they would generally get their wires from another company, and I think at this point in time everybody was getting their NiTi alloys from Japan.

Q. Well, the first sentence of Materials and Methods says he is getting from Unitek in California.

A. Correct. I would have to read through it carefully, but I think what he is saying here is that my understanding at that point in time and probably to date to some extent many of these NiTi wires were coming, the blanks that were used, were coming from Japan.

So I think he is just referring -- let me just go back and read the beginning of that paragraph that I referred us to.

(Witness perusing document.)

Q. Dr. Goldberg, would you look at that sentence you are reading again on page 351. There is a reference 18.

A. Yes.

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Q. If you look at the references at the bottom of the right-hand column, it refers to Miura. And the name of that reference is "The Superelastic Property of the Japanese NiTi Wire Alloy Wire for Use in Orthodontics."

A. Yes.

Q. Isn't Walia merely getting that information from the Miura cite?

MR. GINSBERG: Objection to the form of the question.

A. I don't know where they are getting their information, but just go back to the original question, and I'm sorry if I diverted from that, you are asking me if Walia teaches or does -- you asked me if Walia does any heat treatments, and my response is he doesn't here, but he recognizes that desirable properties might be achievable with heat treatments, and he reports to reference 18 as a way that that might be done.

Q. Right. But he is saying that you can heat-treat the wire, right?

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MR. GINSBERG: Objection.

A. Correct. But all files start out as wires.

Q. But he is not suggesting you heat-treat the file?

MR. GINSBERG: Objection to the form of the question.

A. I don't read it that way. I mean, I read it as he is reporting on nickel titanium endodontic files, showing their properties, and recognizing that those properties could be altered just as the nickel titanium properties were altered in reference 18.

Q. Well, the next sentence after that reference 18 says "It would be worthwhile to evaluate root canal files fabricated from some of these recently introduced nickel titanium alloys."

So isn't he suggesting that you could make a file from a Japanese NiTi wire that was heat-treated?

MR. GINSBERG: Objection to the form of the question.

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A. I'm sorry, can you repeat that? I thought you were asking me about the next sentence.

Q. They go together, I think.

A. Okay. So --

Q. He is talking about files fabricated from some of these recently introduced nickel titanium alloys.

A. Oh, I see what you are saying.

Well, I don't know if they are actually available. He mentions beta titanium and then he goes on to stainless steel and Nitinol.

So I think the stainless steel and the Nitinol and the beta titanium, the Nitinol he is referring to here is referring to an orthodontic application.

So, I mean, my interpretation is he has measured these file properties using this nickel titanium and he is saying that there may be ways to alter the properties, just as done in other dental uses of nickel titanium, and in addition to that he is saying there are other

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alloys that might be of interest to be considered.

Q. But he doesn't explicitly suggest heat-treating the file?

MR. GINSBERG: Objection to the form of the question.

A. That's the way I read it, that he is specifically saying -- I mean, this whole paper is about the properties of the files, and he tested these particular files and he is noting that other nickel titanium alloys such as those used in orthodontics can have their properties varied by the appropriate heat treatment.

So he is saying that might be another thing we might want to consider, heat-treating these to get different types of properties.

Q. But he doesn't say that? I don't see where -- point out to me -- please, Dr. Goldberg --

MS. BRENNER-LEIFER: And I don't need your snarky comments.

MR. GINSBERG: I didn't make

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any comment.

MS. BRENNER-LEIFER: Yes, you did. I don't need these, like (indicating).

Q. You know, Dr. Goldberg, this is very important, okay?

A. Yes, I appreciate it.

Q. And I don't see where he is saying heat-treat the file. I want you to be very specific with which sentence does he say that.

A. First, to be fair, often you can infer things without specifically saying the exact words. I think we all have that experience.

Q. Okay. Well --

MR. GINSBERG: Please don't interrupt the witness when he is answering your question.

A. Let me read through this paragraph again, and I will try to explain where I'm getting my interpretation or my conclusion that he is recommending the heat treatment.

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(Witness perusing document.)

A. So I'm just kind of paraphrasing, the first sentence, he says this represents only a first approach in an entirely new field of endodontic research. He is saying other nickel titanium alloys have been recently described, and he references 18, and manufacturers have introduced several new brands for which superelastic behavior and other outstanding mechanical properties are claimed.

Moreover -- so he is saying this is a new field, isn't this interesting, other fields are using nickel titanium, and he is saying moreover, it is possible to alter the superelastic force behavior of NiTi wires by means of appropriate heat treatment.

So to me he is saying we are just beginning, we are just getting started, this is the beginning of a new phase, here are these alloys, and gee, there are different alloys, there are

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heat-treating possibilities, let's see what they do in other fields and let's use that information to see where we can go ahead since this is the first approach in an entirely new field.

To me that's the inferral in that whole paragraph, he is saying here we have shown this, this is the first approach, and as we would do in any paper at this point, what should come next, what else should be done, and that's what that paragraph is suggesting.

So to me I interpret that as suggesting other alloys, heat treatments, here is some references, gee, won't it be interesting to study those.

Just for your information, reference 19 is my article.

(Goldberg Exhibit 9 marked for identification.)

Q. Dr. Goldberg, I have handed you what has been marked as Goldberg 9. It is the Miura reference that was referenced in the Walia article.

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A. Okay.

Q. Would you take a minute to refresh your recollection about this article so I can ask you questions.

A. Sure.

(Witness perusing document.)

A. Okay.

Q. Dr. Goldberg, this Miura reference pertains to orthodontic wires, correct?

A. Correct.

Q. Specifically the Japanese NiTi wire?

A. Yes.

Q. And it doesn't relate at all to endodontic files, right?

MR. GINSBERG: Objection.

Q. Those are not discussed, are they?

MR. GINSBERG: Objection to the form of the question.

A. Endodontic files are not discussed. But I would add that we are at this reference because it was referred to

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in the Walia paper.

Q. Superelastic -- excuse me, superelasticity is a desirable property for orthodontic wires?

A. It is a desirable property.

Q. It helps the teeth move?

A. Yes.

Q. Because the force of the wire pulls the tooth?

A. Correct. I'm sorry, if I could just add, all metals, even the stainless steel that they are comparing it to, apply forces. The benefit of the superelasticity is that it is applying a lower force and a more constant force.

Q. If you look at page 2 and 3 of the reference, when they are looking at the examination of the mechanical property of the wire, specifically on page 3 in the first column Miura says "the approved ADA standard method is a cantilever type of test"?

A. Yes.

Q. I'm sorry, I should have backed

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up.

On page 2, at the bottom of the second column, he starts talking about the bending tests.

A. Okay.

Q. Miura says they did not use the ADA standard test, they designed their own test.

A. Okay. Let me just read that a second.

Q. It is in the --

A. Yeah, starting at "bending test"?

Q. Right.

(Witness perusing document.)

Q. Miura uses a three-point bending test.

A. I'm sorry, if I can just read those two paragraphs. I will try to do it quickly.

(Witness perusing document.)

A. Okay.

Q. So the bending test they use is specific for orthodontic wires, correct?

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MR. GINSBERG: Objection to form.

A. Which test are you talking about? The three-point --

Q. The bending test that they use that is also shown in Figure 2.

A. Yes, it is designed to simulate an orthodontic situation. I would add -- I'm sorry, but I'm just trying to clarify, so three-point bending tests are commonly used in many areas. They are modifying a three-point bending test by adding orthodontic brackets to try to simulate what the performance of these wires would be in clinical usage. So it's unique to what they want to demonstrate here.

But I would say that many laboratories use three-point bending and many laboratories even use this type of arrangement where the bracket is attached and the wire is put through to simulate clinical situations.

So I just want to clarify, when you said unique or different, it is

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different from the ADA method, which at that time was a cantilever method, but many labs would use similar, if not the same, clinical simulations.

Q. And this three-point bend test is different than the ISO standard for endodontic files?

MR. GINSBERG: Objection to the form of the question.

A. Yes, it is a different test setup.

Q. If you turn to page 4, they describe how the heat treatment is performed.

A. Yes.

Q. Do you see that section?

A. Yes.

Q. And the heat treatment was performed by immersion of the wire in a nitrate salt bath?

A. Yes.

Q. Is that a common way of heat treatment?

MR. GINSBERG: Objection to the

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form.

A. I don't even know in general and I don't know specifically for nickel titaniums if that's the common method.

Q. You don't know what the common methods for heat treatment of nickel titanium are?

MR. GINSBERG: Objection to the form of the question.

A. No, because those -- no.

Q. And then at the end of the first paragraph, in the second column, on page 4, they say the bending tests were conducted at a temperature of 37 degrees.

Do you see that?

A. Well, it says "the test was conducted at a temperature." Is that where you are reading?

Q. Yeah.

A. Okay.

Q. And they are talking about the bending test, correct?

A. Correct.

Q. Again, because that simulates

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the mouth?

A. Correct.

Q. And that's also different from the ISO standard?

A. The ISO standard for the endodontic files, correct, that's different, different temperature.

Q. The ISO standard for the endodontic files is performed at what temperature?

A. It is done in a lab, so room temperature I believe is what it calls for.

Q. Which would be somewhere around 20 degrees?

A. I would typically use 25 degrees. I think that's what Sinclair uses. So I think that's what I had been using.

Q. Would you look at Figure 3.

A. Yes.

Q. Figure 3 is a load deflection curve produced by the three-point bending test.

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A. Yes.

Q. And the solid line is the Japanese NiTi. Do you see that?

A. Yes.

Q. And Figure 4 is the same test using five different diameters of the Japanese NiTi alloy wires, right?

A. Yes.

Q. And the 0.016 inches is one of them; do you see that?

A. Yes.

Q. And just ballpark estimating, at 2 millimeters the tip of the curve goes somewhere maybe 700?

A. I'm sorry, are you looking at Figure 3 or 4?

Q. 4.

A. Okay. And at 2 millimeters, the tip of which curve?

Q. The 0.016 curve.

A. The tip of 0.016, yeah, that looks like, yeah, maybe about 700 grams.

Q. Now, if you look at Figures 5, 6 and 7, they are varying the heat

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application on the 0.016 inch Japanese NiTi alloy wire, right?

A. Well, they are varying the temperature, as you go to Figure 5, 6, 7, and within each of those they are varying the time.

Q. And at 400 degrees -- 400 degrees did not have a significant effect on the load deflection curve, did it?

MR. GINSBERG: Objection to the form of the question. It is vague.

A. Let me just see how they characterize it and then I will respond to that.

(Witness perusing document.)

A. They characterize it as only a small amount of heat-treatment effect was noted. So they characterize the change as small.

Q. And if you look at Figure 6, it had the heat treatment at 500 degrees had a greater effect on the load deflection curve, correct?

A. Correct.

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Q. And if you heated it for longer periods of time, the wire increased in stiffness?

MR. GINSBERG: Objection to form.

Q. Am I reading that correctly?

A. No, it is decreasing in stiffness.

Q. Because it takes lesser load to deflect at that 2 millimeters?

A. Yes. I would add that I would probably be focused more on, in addition to the peak, that the entire curve is getting flatter. They are moving down. So it is not just the peak.

Q. Are you referring to the peak as the point at 2 millimeters?

A. Yes. So I'm agreeing it is moving down, but I'm saying that most readers would probably look at the entire curve and not just the peak.

Q. And the top part of the curve is when you are applying the load and the bottom part is when you are releasing it,

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correct?

A. Correct.

Q. And then in Figure 7 you see the greatest effect on the load deflection curve, correct?

A. Correct.

Q. And this would have -- these wires have become even less stiff?

MR. GINSBERG: Objection to the form of the question.

A. Just in comparing these two, so just so you understand what I'm looking at, what I'm looking at is the slopes of the curves, not just the peaks, and comparing 6 to 7 I don't see that the position of the curves changed too much. Like the maximum, even at 2 millimeters, is 500 and then the curves decrease. So I would say the stiffnesses are comparable.

To me what is most notable about Figure 7 is, as the author reports, it is the loss of the spring-back properties, meaning it is not going back to its original shape. You notice in

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Figure 6 everything goes back towards the origin, but in Figure 7, that's not the case, and he is noting that by saying it is losing its spring-back properties.

Q. So would you agree that Miura shows that the effect of the heat treatment depends on the temperature and the length of time that you apply the heat?

A. I'm sorry, say that again. I'm sorry, I was looking at the figure.

MS. BRENNER-LEIFER: Can you read it back.

(The record was read.)

A. Yes, he is showing change in properties such as stiffness and the amount of permanent deformation that are a result of different time and temperature processes.

Q. If you look at Figure 8 on page 6 --

A. If I can just have a moment to read the legend and --

Q. Sure, please do.

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(Witness perusing document.)

A. I will just say, maybe it is in the text, but in the legend when he says range of superelasticity is indicated on the graph, it is not clear to me how he is indicating that.

I assume it is one of these either cross-hatched vertical lines or dots, but he doesn't describe that.

Q. Well, it is not clear to me either. I just don't think it is clear.

MR. GINSBERG: Objection.

Q. But do you -- the way I read Figure 8, and I just want you to agree or maybe clarify that I'm reading it correctly, he has three different diameter wires and he labels them light, medium and heavy, and I'm not really sure what that means.

MR. GINSBERG: Objection. You don't know what she means.

Q. I'm just asking, do you agree -- do you know what that means?

A. I do not know what that means.

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Q. And then he has force ranges for each of those, but he doesn't explain how he got there.

A. I would have to look, but I'm pretty sure that's the results of the bending tests. I would anticipate that. I'm glad to go read that section where he discusses Figure 8.

Q. Great. Please do that.

A. Except I'm not seeing Figure 8 referred to anywhere in the text. If somebody can help me find where he is discussing Figure 8. Oh, the very end.

(Witness perusing document.)

A. No, wait a minute, wait a minute.

(Witness perusing document.)

A. Okay, I can give you my interpretation of what's going on here.

Q. Great.

A. So Figure 8 and Figure 9 relate to a second study in effect. So they did the three-point bending, which is depicted in Figure 2, and the results are shown in

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the figures we've been discussing such as 5, 6 and 7.

Then what he says is okay, these results look interesting, we are now going to try this clinically. So what they do in the second paragraph under Clinical Applications for this Study, meaning now a separate study, they take these wires, 16-inch -- 16,000s, 18,000s and 22,000s, and they form them into what they refer to as an ideal arch. So that is a shape of an arch that is typical to the shape of your mouth or the teeth and lining in your mouth.

I'm not quite sure what it means when they say each size of wire was fabricated at three force levels, light, medium and heavy. So even here he doesn't describe what that means.

But the point they are trying to make is then they go on and show these cases, and let's take a look just at Figure 9A, and do you see that that tooth in Figure 9A seems a little high relative

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to the plane of occlusion, where the biting surfaces touch, but in Figure B that tooth has now been moved down and is aligned more with the adjacent and opposing teeth --

Q. I had a tooth exactly like that when I was 14.

A. There you go. Well, you in all likelihood had that done with nitinol.

So what they are showing is, hey, not only do we have these laboratory tests that show favorable results, but we made arches, put them into a patient, and look, it moved the teeth.

I still don't know what heavy, medium and light mean. But that's what they are trying to determine. Heavy, medium and light would typically mean the amount of force that is imparted in an orthodontic wire, but, again, without further clarification, I would just be speculating. But that's the gut intent of Figures 8 and 9.

Q. So what Miura is interested in

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doing is making orthodontic wires where he can adjust the amount of force --

MR. GINSBERG: Objection to form.

Q. -- that might be used on the tooth?

A. Correct. What he -- let me start that again.

What is happening at this point, this is 1986, is these new wires are just being developed in Japan. So he is anticipating that, hey, this might be useful, let me look at the properties. He looks at the bending properties and he says, gee, I can vary other things, stiffness, the amount of spring-back, the amount of permanent deformation that I get in these samples by varying the time or temperatures that I subject these to.

So he shows this matrix of mechanical properties, stiffness, deflection, permanent deformation, as a result of different time and temperature treatments, and he says, gee, for our use

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in orthodontics, these particular combinations looks useful, I'm going to make it into an arch and demonstrate that it is effective for orthodontics.

So that's what he is doing. He is showing that it is useful, showing you can manipulate the properties, and this Figure 8 that you asked about, I'm guessing that's really just a clinical version, that's a clinical representation of the bending curves. In other words, a clinician would more typically maybe just want to know, gee, how many grams are being applied with which wire.

So that's the type -- that presentation of the data looks like that to me. So he is saying here is this new alloy, here is how we vary the properties, here is the heat treatments that are necessary to get different characteristics, and for this particular application, I think whatever he used to make heavy, medium and light, he did, and he is demonstrating clinically it is

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effective.

MS. BRENNER-LEIFER: The videographer needs to change the tape, so let's go off the record.

THE VIDEOGRAPHER: This ends tape number four. We are off the record at 12:41.

(Luncheon recess: 12:41 p.m.)

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AFTERNOON SESSION

1:31 p.m.

A. JON GOLDBERG, Ph.D., resumed.

(Goldberg Exhibit 10 marked for identification.)

THE VIDEOGRAPHER: This begins tape number five in the deposition of Dr. Jon Goldberg. We are on the record at 1:31.

CONTINUED EXAMINATION

BY MS. BRENNER-LEIFER:

Q. Good afternoon, Dr. Goldberg.

A. Good afternoon.

Q. I have handed you what has been marked as Goldberg Exhibit 10. It is an article by Gregoire Kuhn which is relied upon in your expert report entitled Fatigue and Mechanical Properties of Nickel Titanium Endodontic Instruments.

Would you just spend a minute reviewing this reference so I can ask you questions about it.

A. Sure, thank you.

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(Witness perusing document.)

A. Okay, thank you.

Q. Dr. Goldberg, this paper relates to -- primarily to fatigue testing of endodontic files, correct?

MR. GINSBERG: Objection to the form of the question.

A. I wouldn't characterize it that way. There is a considerable amount of DSC measurements and the fatigue I believe relates to the used files and then towards the end they are showing the effect of temperature treatments on new files. I wouldn't characterize it as primarily fatigue. In fact, I guess the fatigue is the used files because I don't see a description of fatigue testing per se.

Q. Well, I was referring to the first page of the article, in the second column, the paragraph preceding the heading Materials and Methods, Kuhn writes "The aim of this work is to show fatigue characteristics of superelastic NiTi, and subsequently the effect of the process

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history on fracture life."

Do you see that?

A. I do.

Q. So do you disagree that that is the aim of this paper?

MR. GINSBERG: Objection to the form of the question.

A. I would say that is the title. That's what they are saying in the aim.

Before you even mentioned that, I was just looking at the data and I think the only data -- I'm assuming that fatigue means used files and there is really not too much on the used files it looks like, just Figure 5.

Q. And the first paragraph of his article in the first sentence Kuhn writes "In endodontic treatments the risk with traditional files (stainless steel) is plastic deformation and fracture."

That means breaking files, is that what it means?

MR. GINSBERG: Objection to the form.

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A. Well, fracture would mean breaking.

Q. And plastic deformation is what?

A. Would be permanently deformed.

Q. Permanent deformation?

A. Yes.

Q. If you look at page 17 --

MR. GINSBERG: Do you mean 717?

MS. BRENNER-LEIFER: Yes, thanks.

Q. Page 717, in the second column under Bending Tests, Kuhn writes "To perform bending tests we used a bending machine" -- "a bending testing machine," but he doesn't describe the testing machine he uses. Do you agree with that?

A. Yes.

Q. And in the first column on that page under the heading Thermal Treatments, he describes it, heat treatments that were used as being heat treatments in salt baths, do you see that?

A. Yes.

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Q. Do you have a problem with him using salt baths for heat treatment?

MR. GINSBERG: I object to the form of the question.

A. As I said, I'm not that familiar with -- this came up with something else, nitriding baths or something. So I'm not that familiar, but I know salt baths could be used. I really wouldn't have an opinion if it is good or bad.

Q. So are you familiar with the process of heat treatment in salt baths?

A. No.

Q. So are you also familiar with whether a water quench is common after heat treatment in a salt bath?

A. That really depends on what you are trying to achieve, which systems you are using. I mean, that's part of the process and if an author is doing that, then I accept it on face value that there is a reason that they are doing that.

Q. But you don't think he did it

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in a wrong way?

A. I couldn't have an opinion because I'm not sure what he is trying to do. I mean, in all honesty, I would read this, I would see this is the method that they are testing, okay, this is the thermal treatments that they are providing and then they are going to evaluate the samples after that.

Q. And in the next section under Methodologies, he is describing the DSC testing.

A. Yes, I see that.

Q. Do you see the end of the first full paragraph, Kuhn says that the start and finish temperatures of each phase transformation were determined from tangent lines where the DSC curve deviates from the adjacent baselines?

A. Yes.

Q. And that's what we saw as the method being used in the ASTM standard, correct?

A. Yes. But I see that and then I

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was looking for this when I was looking through, I don't see any of those tangent lines and he doesn't say it is the ASTM method, but ASTM method does use tangents, but I don't see any baselines or any tangents in here.

In fact, I see him referring to temperatures on the curve but I just assumed that that was done with this tangent method. So, I mean, that's -- most papers, if they are using ASTM, would say ASTM F177 or whatever it would be.

Q. And going back to the paragraph on bend testing, the last two sentences of the second paragraph, Kuhn writes "We obtained information." Are you following me?

A. Yes.

Q. "We obtained information about the elastic behavior (flexibility) of files and about heat treatments in clinical use. The results are discussed only in a qualitative analysis and not a quantitative analysis because of the shape

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of the instruments (range and machining design) which prevents any calculation."

Do you see that?

A. Yes.

Q. So Kuhn specifically says his analysis is qualitative and not quantitative, right?

MR. GINSBERG: Objection to the form of the question.

A. I would have to disagree because this would not be -- I mean, what he is doing, the data he is representing in Figures 5 -- all the figures, that's the data. So I could take a look at this and, for example, in Figure 5 I could say that, and I don't know if I'm exactly right here, but say at 8 millimeters on that bottom curve that's the solid line, I could draw a line across and say at 8 millimeters the measure on the Y axis is three newtons.

So while he may be describing it qualitatively, I mean, the data is definitely quantitative. I mean, even the

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DSC curves, I mean, he gives those temperatures.

Q. But Kuhn himself says that his analysis is qualitative?

MR. GINSBERG: Objection to the form of the question.

A. Yes, he says that at the beginning. Let me just see if I can find any other examples.

(Witness perusing document.)

A. Well, I would agree that the characterizations I am seeing are qualitative. But, again, I would state that the figures are quite quantitative.

Q. Well, he doesn't give any error analysis in any of these tests, does he?

A. No.

Q. So you don't know what the degree of error is in these test results, do you?

A. I don't. But I assume that the trends are legitimate because he is making that qualitative comparison.

So, for example, in Figure 6,

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he is saying the curves go up or go down. So I assume that he knows, or even though it is qualitative he is saying they are different. I don't think you need an error analysis just to indicate a trend.

In other words, I assume what he is saying is there is not so much variability here that we see no difference, he is saying the opposite, that there is enough variability regardless of the error bars to be able to identify that trend.

Q. Could you turn to page 719, and the left-hand column, about halfway through the page, before Discussion, there is a paragraph that begins "Figure 6."

A. Yes.

Q. "Figure 6 (A and B) demonstrate that the annealing conditions strongly affect the stress-strain behavior. For heat treatments below recrystallization temperature (Figure 6A), the specimens generally show an increased flexibility."

Let's look at 6A. In this

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bending curve he takes a profile, the profile file with a diameter 0.04, the Conicity 0.04 Diameter 20. I believe that's what it states in Table 1.

A. Yes.

Q. Are you following me?

A. Yes.

Q. And he has one that's un-heat-treated which is the solid line, another that is heat-treated for 400 degrees, and another one that is heat-treated at 510 degrees, each for ten minutes. Do you see that?

A. Yes.

Q. And when it is heat-treated at 400 degrees, the file that is heat-treated for 400 degrees is the one on the lowest curve, right?

A. Correct.

Q. And the 510 degrees is the middle curve?

A. Correct.

Q. And the untreated is the solid curve at the top, right?

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A. I see that.

Q. So the one that was treated at 510 degrees actually is less flexible than the one that was treated at 400 degrees, right?

A. Yes.

Q. And let's now turn to -- back to page 719, that same paragraph we were reading.

A. Yes.

Q. He continues, "On the other hand, results show that after annealing at a temperature above recrystallization, the stiffness of the instruments increases."

Now, if you turn back to Figure 6B you see that there is still heat treatment, but rather than become flexible they are more stiff?

MR. GINSBERG: Objection to form.

Q. Is that correct?

A. Yes.

Q. And the stiffest file is the one that was treated at 700 degrees,

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right?

A. I see that.

Q. So it seems that what Kuhn is showing in Figure 6A and 6B is that if you heat-treat a file the stiffness and flexibility are highly dependent on the temperature?

MR. GINSBERG: Objection to form.

A. Yes, among other things that can be garnered from those curves, for example, the peak value, the amount of permanent deformation. I mean, there is other information. He is focused on the stiffness, but all these curves show many things, like, as I said, the maximum moment, for example, which would be the peak, at the very tip of the curve.

Q. And it seems somewhat complex whether when you heat-treat it, it is going to be more or less stiff --

MR. GINSBERG: Objection to the form.

Q. -- based on 6A or 6B, correct?

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MR. GINSBERG: Objection to the form.

A. I'm sorry, can you repeat the question?

MS. BRENNER-LEIFER: Could you read back my question.

(The record was read.)

A. I guess the complexity is a matter of definition. You know, in a general sense, I would just say this shows that a number of mechanical properties can be affected by the heat treatment, that those properties are affected one way when the temperature is 510 or 400 and are affected another way if they are 600 or 700. Personally I wouldn't consider these curves complex to interpret.

Q. I don't mean the curves themselves to be complex to interpret. I just mean the trend is somewhat complicated in terms of whether you -- all of these are heat-treated.

A. Right.

Q. All of these files are

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heat-treated, right?
A. Right.
Q. And they are all heat-treated at least 400 degrees?
A. Correct.
Q. And despite the fact that they are all heat-treated at at least 400 degrees, some of them are more flexible and some of them are less flexible?
A. That's correct. And he explains that by differentiating one of these as above the recrystallization, the other is below. So he is trying to explain there is a rationale why they may be different.
Q. And what is the recrystallization temperature?
A. Well, he doesn't say, but I'm assuming that it is going to be somewhere between 510 and 600.
Q. Now, is that recrystallization temperature something that is standard for nickel titanium or it depends on the specific alloy?

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A. It depends on the alloy and the previous treatment, processing of the sample.
Q. So it is something you would have to figure out empirically by testing the alloy?
MR. GINSBERG: Objection to the form of the question.
A. I think you would. I think you would have to look at the given alloy. I mean, what is complex is the metallurgy is complex and the steps in the processing is complex, so how it is cast, how the wires are made, how much cold reduction, all of those, what the dislocation density is, what the grain size.
I don't want to belabor the point but I want to point out that metallurgy is complex. So I would anticipate that the recrystallization temperature would not always be the same. It would depend upon those processing parameters.
Q. Are these bending curves for

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these temperatures something that you think you would be able to predict?
A. Predict on what basis? Given what that I would then predict them?
Q. Well, just from general principles for nickel titanium, are these -- is this predictable behavior or is this behavior that you just have to learn by studying specifically?
MR. GINSBERG: Objection to the form of the question.
A. My opinion would be, and I think this is similar to what we have talked about in the morning, because it is so complex, in my opinion, it is difficult to look at the structure and predict the properties. So I would need to look at the properties and know the structure and then I could demonstrate the correlation.
Q. So it is not a very predictable art?
MR. GINSBERG: Objection to the form of the question.
A. No, I'm not saying that at all.

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In fact, what makes all materials a science and not an art is we do this calibration. We look at all the structures. We measure the properties of importance. That gives us knowledge as to how to manipulate the properties, in this case time and temperature of heat-treating, to get the desired properties.
Q. What do you mean, we do this calibration?
A. I will use an example. Steel cable --
Q. Let's just stick to NiTi. Because if you give me another example, I will have to bring you back to NiTi.
A. Gotcha. I apologize for that. Let's take NiTi. So let's say I was interested in increasing the stiffness. So from previous literature, I would look at the previous literature, everywhere I could find information on NiTi and I would see, okay, the property I wanted to change is stiffness and I would look and see what

people -- where people have studied stiffness, what they have done to vary the stiffness and what their explanation was.

So they might have done a heat treatment. They saw an increase in stiffness and they explained that by saying that the grain size grew. So that gives me a clue that I can manipulate that property, here is the temperature range that I should work in, and the underlying mechanism is this grain size. So then I would start and look at a particular grain size, heat-treat that material, see the new grain size, and then measure the property, the stiffness, and armed with that I would then go backwards and say okay, I want a stiffness of X, I see what happens with these different heat treatments, it makes sense because I see the grain size is moving in this direction, therefore I'm going to pick this temperature, that should give me the property and I anticipate that this will be the grain size.

That's the way we did it when we developed our titanium alloys.

Q. When you say "we," who is "we"?

A. Myself and my collaborator, Charles Burstone.

Q. And when you say "our titanium alloys," which titanium alloys are you referring to specifically?

A. The beta titanium alloys that were reference 19 in that previous article you were looking at.

Q. Dr. Goldberg, just to confirm, you agree that Dr. Kuhn does not specify the bend test he is using in this paper, right?

A. Correct.

Q. And he does not say that the bend test used for Figure 6A and Figure 6B was the ISO 3630-1 standard?

A. Correct, it does not say that.

Q. And he does not say that these files permanently deform more than 10 degrees under the ISO 3630-1 standard bending test, right?

A. If I can just elaborate on that, I mean, he does show permanent deformation but he doesn't make the specific comment, similar to what we are saying. He makes qualitative comments, but the figures show the quantitative results.

Q. Where does he say that these files show permanent deformation?

A. As I said, he doesn't say that specifically, but I look at the figures and I can see that information.

Q. Where do you see that in the information?

A. In Figure 6A.

Q. Where in Figure 6A?

A. So if you take a look at the control, do you see that the control returns all the way back to 00?

Q. Yes.

A. Now take a look at the very bottom line, the one that is 400 degrees C, with thatches and dots. Do you see that it doesn't come all the way back, in

fact, it hits the axis somewhere between maybe 1 and a half and 2?

Q. No, I don't see that.

A. Do you want me to point it out to you?

Q. Are you talking about the 400?

A. The 400, yes.

Q. No, on mine it goes back between about -- I see the line continuing all the way almost to 0.5.

A. Oh, okay. My eyes must be going out. So anywhere, somewhere other than zero, the line hits the axis.

Q. Half a millimeter? I mean, this is very hard to read. But I see that line going to at least half a millimeter, below half a millimeter.

A. So let's say it's -- we will compromise and say it is 1 millimeter, or I guess we could blow this up or something. But the point is, it is not zero. So that shows me that that heat treatment lowers the stiffness, lowers the maximum moment, and increases the

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permanent deformation.

Q. How can you increase permanent deformation?

A. Well, because the sample that is the control has no permanent deformation. It clearly comes back to zero. The one we are discussing does not come all the way back to zero. You say it is half. Maybe I say it is 1 and a half. But it is clearly something other than zero.

Q. Okay. So we have one file that was bent?

A. Right.

Q. There is no degree of error shown here, because there was only one file tested?

A. Correct.

Q. And the bending test is not specified?

A. Correct.

Q. And without any of that information on the basis of one test you feel comfortable that this demonstrates

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that you bend this file -- I mean, you heat-treat this file to 400 degrees and you are definitely getting permanent deformation?

A. Yes, because Kuhn qualitatively says he is seeing a change in these. He is not saying there is no change.

Q. But he doesn't say --

MR. GINSBERG: You just cut off the witness.

Q. -- qualitatively anything about permanent deformation?

A. I'm sorry --

MR. GINSBERG: Please don't cut off the witness when he is answering a question.

A. Maybe we should start again because I lost my train of thought here.

Q. Kuhn didn't say qualitatively anything about permanent deformation, did he?

A. Not in the text, correct.

Q. And Kuhn says he is only making qualitative analysis, not quantitative

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analysis, correct?

A. That's what he says in his text. But, again, the data is the data and, as you can see, it is quite quantitative.

Q. Quite quantitative, what does that mean?

A. Well, he could have simply had millimeters and -- he could have had these numbers from zero to 9 and zero to 3.5 -- let me see if I could say this.

He could have just had displacement and force and no scale bars. That would have been qualitative. Then you would just see the trends but you don't know the actual values. What he is reporting is quantitatively the results and then discussing it qualitatively. But the data is still there.

Q. Well, let's go back to what he says on paragraph 717.

A. I'm sorry, I remember what I was going to say before if this would be helpful.

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Q. Okay.

A. So the reason that even though it is one file and one test and the method is not described, he has got a control. It is the hard black line. So that equalizes everything.

So same conditions, same test, same whatever, he is telling me qualitatively these curves are different and I can see quantitatively that there are. There is an increased -- there is a decreased stiffness. There is a decreased maximum moment, that's the Newton scale, so the peaks are lower, and I can see and, as you said, maybe it is 0.5, maybe it is 1.5 -- excuse me, let me get a drink.

MR. GINSBERG: Watch your mic. I will get it for you.

THE WITNESS: I'm sorry.

A. So when I look at these, what I see is increased stiffness, decreased maximum moment, increasing permanent deformation.

Q. Could we go back to page 717.

A. Sure.
Q. The last sentence in that paragraph under Bending Test, Kuhn writes "The results are discussed only in a qualitative analysis and not a quantitative analysis because of the shape of the instruments, range in machining design, which prevents any calculation."
A. Correct.
Q. What do you think he means by that?
MR. GINSBERG: Objection to form.
A. I can't say what he was thinking, but I read this as saying because the geometries are complex, so, in other words, when we typically would do a testing, you know, we would have a uniform cross-section, so that you could calculate the effect of the area. That becomes difficult with a file because of its odd shape.
But even though -- so what he is saying is he is not calculating stress,

he is not calculating strain, he is not calculating the common material properties that we would calculate, but would need a known cross-sectional area to measure.
So what we do in this situation, this is what I consider more of a clinical simulation, we don't measure the stress or the strain because the area is so complex, so this would be like anytime else, we would compare two products to show an endodontist the effects of the two.
So he is showing me the data. Clearly the data is quantitative. What he can't calculate is the force per unit area, so he is just showing the absolute values, but those are quantitative values. He may discuss them in a qualitative sense, but the fact that he says they are different says to me that quantitatively he has made that determination.
Q. Figure 6A, you are putting a big conclusion on Figure 6A, right?
MR. GINSBERG: Objection to the

form of the question.
A. I wouldn't characterize it as a big conclusion. As I said earlier, these are not complex curves and we would run tests like this typically to measure the stiffness, the maximum moment, and if there was any permanent deformation. That would be the three parameters we would routinely use in this type of curve.
Q. But you admitted earlier that your eyes weren't so good and you couldn't read that line very well.
A. Right. I will accept your eyes. We will say 0.5.
Q. What if my eyes said it went all the way back to zero, would you accept it then?
A. I wouldn't.
MR. GINSBERG: Objection to the form.
Q. Why?
A. Because to me it looks like it is coming down somewhere between 1 and a half and 2, maybe it is 1 and a half. You

feel it is a half. But it is not zero. The black line is zero. And I would just say that's not a small value. Even if we take 1 and they deflected 8, 1 out of 8 is whatever percent that is, you know, 12 percent, 15 percent, whatever that number.
Q. And what if we blew up that diagram really big and you saw that it went back to zero, then what would you conclude?
MR. GINSBERG: Objection to the form of the question.
A. Well, if we would do that I would have to see the curve.
Q. If we blew that diagram, Figure 6A, up really big and it went all the way back to zero, would your conclusion change?
MR. GINSBERG: Objection to form.
A. Again, because I would have to see the control as well. This is the reason that he can't make it quantitatively. What he is doing is he is

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comparing the two. So in that blowup we would just have to see what the control looked like, what each of those looked like.

Q. Well, the control is right there. I'm just saying if you took this Figure 6A and you blew it up really big and you saw that that bottom line went all the way to zero, would your conclusion change about permanent deformation?

A. I would -- I would have to see it. I would just say it sure looks to me like it is hitting that curve at 1 and a half, so it is definitely hitting it by 1, and even by your eyes at a half. I think it is tracing along the bottom of that. I would have to see the blowup to make that conclusion -- to make a conclusion.

Q. But I just want to understand that your conclusion about permanent deformation depends on where that bottom line intersects that zero mark, right?

A. Correct.

Q. And if it doesn't intersect at

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zero then you consider anything that doesn't intersect at zero millimeters to be permanent deformation?

MR. GINSBERG: Objection to the form of the question.

A. Can you repeat that?

Q. Well, you said it doesn't matter if it is 0.5 millimeters or 1.5 millimeters, it is still permanent deformation?

A. Correct.

Q. So is it your opinion that anything other than zero is permanent deformation?

A. Yes.

Q. And if it is 0.5 millimeters, can you extrapolate for how that file would perform in this ASTM -- I'm sorry, in this ISO 3630-1 standard?

A. So it is difficult. First of all, we don't know the method here, so we are comparing two different methods. It is very difficult to take the results from one method and predict what it will be in

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another.

But what I could do, this is what I guess I could do something like this, and this is definitely arm waving, let's just for the sake of this discussion of comparing it to ISO, the ISO method, let's just say it is coming down at 1. You said a half. I said 1 and a half. Let's just for an example say it came down at 1.

So whatever 1 divided by 8 is, and I guess I should know this, it is 15 percent, 20 percent, some number. So I would expect, just arm waving, same percent change in a different test. So in that ISO test you deflected 40 degrees. So I don't know what the percentage is --

Q. I'm sorry, 45?

A. 45, okay. So you deflected 45 degrees. So here I'm saying, all right, why don't we say the number is 15 percent, and I'm just not sure what it is, so I would expect 15 percent of 45, whatever that number is, to be an estimate of the

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deformation you would get there.

So I'm kind of making a percentage but really doing a very loose prediction of saying that percentage would be indicative of what you would see in another test.

Q. But I'm a little bit confused, because we see on this same diagram it goes up to 8 millimeters.

A. Correct.

Q. For instance, for the un-heat-treated one, the top line --

A. So can I --

Q. Whether you deflected 4 millimeters and 8 millimeters is a huge difference on the force?

A. Right.

MR. GINSBERG: Objection to the form.

Q. It is not linear?

A. Yes, I agree. And it is going to be a different test in the ISO. But just so we have a basis for discussion, could someone divide 1 by 8 and see what

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that number is.

MR. GINSBERG: I think it is 12 and a half.

Q. Yeah, half of a quarter.

A. Right, okay, thank you. You must have been good in math.

Q. No, I think he was good at math.

A. So let's say it is 12 and a half percent. So what I am saying is it deflected 8 millimeters and permanently deformed 12 and a half percent. I'm making, admittedly, a very arm waving, if I deflect a similar file, and this is a bending test, so I kind of think it is going to be not too different from ISO, if I deflected 45 degrees, what is 12 and a half percent of 45?

Q. Okay, we can do that math later.

A. So whatever it is would be my general prediction of what I would get there. And I say that because the same type file, they are both bending, and I'm

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seeing 12 and a half percent permanent deformation here. So if you are forcing me to make the prediction, I'm taking that same percent and transferring it over to the ISO and saying 45 percent of the deflection, 45 degrees, that's how I would determine what permanent deformation I would see.

I would just add I would definitely do the test.

Q. See, I will tell you, that confuses me because if I -- this is not a straight line here. These are all curves.

A. I'm sorry, but the axis is linear. It is a straight line. The curve is not straight.

Q. I'm talking the curve. The curve --

A. That's right, but that's not what we are talking about. We are talking about on that linear scale of zero to 8, we are not talking about any forces here, no Newtons. We are talking about how much does it recover.

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Q. I understand that. My question is this: If I was using this same bending test, we don't know what it is, if he is only bending this, say, looking at the bottom curve, he only bends it 4 millimeters, he might not get any permanent deformation, right?

MR. GINSBERG: Objection to the form of the question.

A. I couldn't predict that. I mean, I assume -- there is nothing I can assume. I anticipate it being less, but I don't know if it would be zero. I would assume that that permanent deformation -- this is getting difficult to assume. Yes, if it was 4 millimeters, I would expect a different amount of permanent deformation.

Q. But you wouldn't expect 15 percent?

MR. GINSBERG: Objection to form.

A. It might be. I mean, that would be my best guess, that it wouldn't be at 1 and a half, it would then be 12

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percent, 12 and a half percent of 4. That would be my guess. But I would -- really you should do the test.

Q. So is permanent deformation normally expressed as like a percentage of your deflection?

MR. GINSBERG: Objection to form.

A. In basic materials testing, yes, that's the way that it is normally done, as a percentage.

In these bending tests, what is more common is you deflect it a certain amount either in degrees and -- again, this is the clinical simulation, so you would deflect it the way that a clinician might deflect it, and then you would measure how stiff is it, what is the maximum moment, how much does it recover, and you might report that either in degrees or in millimeters relative to how much it was deflected. That's why the ISO method defines, you know, how much to -- how much to deflect it.

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Q. So if you do a test where you are deflecting 90 degrees instead of 45 degrees, would you expect the same material to have the same percentage --

A. Yes.

Q. -- of recovery?

A. Yes.

Q. I want to make sure I answered the question clearly -- that I asked the question clearly.

A. Okay.

Q. If you put the sample in two different bend testing, one was 45 degrees and one was 90 degrees, you would expect the same percentage of permanent deformation?

A. Again, it is complex. It depends upon many parameters. But as a first estimate, yes.

Q. Well, what other parameters does it depend on?

A. Dimensions of sample, what's going on within the material. I mean, just as you see the stiffness here, I'm

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not sure you could have predicted that change in stiffness with those temperatures. So you would just have to see what it was.

If you would have asked me, I would have said the same thing about the stiffness. I'm not sure I can predict that. That's why they do the test.

Q. And just so the record is clear, when you said you couldn't predict this, that you were pointing to Figure 6A?

A. Correct. I mean, I feel that the reason they did the study is that he didn't know what these results would have been, so they did the annealing, or did the heat treatment at 400 and 510 degrees for 10 minutes and did the bend test and looked at the results.

Q. Could you turn to page 720, please.

A. Sure.

Q. I'm looking at the last paragraph on the second column.

A. Okay.

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Q. Kuhn writes "Some suggestions." Do you see that?

A. Yes.

Q. "Some suggestions could be proposed to improve the lifetime of endodontic files. These include applying thermal treatments at approximately 400 C (recovery) before machining to decrease the work hardening of the alloy, choosing machining conditions adapted to this NiTi shape memory alloy, and electropolishing by the manufacturer to reduce the machining damage on the file surface."

Do you see that?

A. Yes.

Q. So Kuhn suggests applying a thermal treatment before machining, right?

MR. GINSBERG: Objection to form.

A. I was going to say even before you asked your question, I'm not sure what he means by "recovery" in parentheses.

Q. I'm not either. But would you answer my question?

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A. Could you ask it again?

MS. BRENNER-LEIFER: Would you please read back my question.

(The record was read.)

MR. GINSBERG: Are you asking in the entire article or this paragraph? Objection to form.

A. In this specific line, given that I don't know what "recovery" means, if we ignore "recovery," I would say it is 500 degrees before machining. But I don't know what "recovery" means so that could alter my answer, and that opinion is based on reading that line.

MS. BRENNER-LEIFER: Our videographer needs to change the tapes and this is a good time to take a break.

THE VIDEOGRAPHER: This ends tape number five. We are off the record at 2:26.

(Recess taken.)

THE VIDEOGRAPHER: This begins tape number six in the deposition of Dr. Jon Goldberg. We are on the record at

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2:49.

BY MS. BRENNER-LEIFER:

Q. Could you go back to the Kuhn reference, Goldberg 10.

A. I'm sorry, and what page?

Q. Goldberg Exhibit 10, page 718.

A. Yes.

Q. At the last paragraph on that page, it talks about bending tests.

A. Uh-huh.

Q. Now, we don't know how they do these bending tests, we only have very limited information, right?

MR. GINSBERG: Objection to form.

A. Right.

Q. So Dr. Kuhn says "At first, and until 3 millimeters of strain, only the tip of the instrument is bent. Then, between 3 and 6 millimeters, the curvature is in the middle of the file. Finally, above 6 millimeters, the part that has the maximum cross-sectional area near the handle becomes deformed in turn."

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So do you understand Dr. Kuhn to be saying as the file is being bent in this machine, where in that file is the curve happening?

A. Yes.

Q. And then the next paragraph he says "As can be seen from the curves, the samples deformed at room temperature recover their original state, indicating that the transformation temperature is close to room temperature." Do you see that?

A. Yes.

Q. How does that indicate that the transformation temperature is close to room temperature? Do you understand that?

A. No.

Q. And do you know what he means by "the samples deformed at room temperature recover their original state," do you know what he means by that?

A. Yes. It the going back to zero but I'm not sure -- yeah, it looks like he is referring to Figure 5. So if I look at

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Figure 5 and I see that.

Q. He doesn't refer to Figure 5.

A. Well, I was just trying to figure out where he was looking and the next closest reference is to Figure 5 and he is saying --

Q. Well, let's go back --

MR. GINSBERG: He is not finished with his answer. Were you finished?

THE WITNESS: No.

A. What I am saying is I don't know which data he is referring to there so I was just trying to figure that out.

Q. Well, he doesn't refer to Figure 5 in the first paragraph, right?

A. Correct.

Q. You understand he is referring to all of the tests?

A. I don't know. It says bending tests, so I was trying to figure out which of the bending tests.

Q. So he could be referring to Figures 5 and 6, right?

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MR. GINSBERG: Objection to form.

A. I don't know. I mean, he makes that general comment and I'm looking just trying to figure out, but it's not clear.

Q. Thank you.

(Goldberg Exhibit 11 marked for identification.)

Q. I'm going to ask you a few questions about this patent, the McSpadden patent. Before we do that, where did you find all these prior art references?

A. Some I found, some were provided by the attorneys.

Q. Which ones were provided by the attorneys?

A. I don't exactly recall, quite frankly, and there was a lot of articles -- there was just a lot of articles we were going through. So I know some we didn't use, some they suggested and we didn't use, some they suggested and we did use, some I found, we used or may not have used. So it is just hard for me

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to remember which ones. But I definitely know that I identified some of the articles.

Q. And how did you go about finding articles?

A. So I was asked to give opinions about the patents, the '773 and the '341, so I did searches. I would typically use either PubMed or SciFinder search engines and put in key terms on the issues that I was interested in studying.

Q. And what key terms?

A. Well, I don't remember exactly which ones, but I would have used nickel titanium or NiTi, something like that, mechanical properties, heat treatment, bending characteristics, endodontic applications, orthodontic applications.

Some of this I just knew because in our work with the beta titanium alloys we typically compared to other wires such as stainless steel and nickel titaniums. So I was familiar with Brantley, I know Bill Brantley and I know

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his lab. So I probably like just went on and did a search for Brantley and looked for which ones of his articles would have been relevant.

Q. Could you spell Brantley?

A. B-r-a-n-t-l-e-y.

Q. And he is an expert in this field?

MR. GINSBERG: Objection to the form.

A. Yeah, he has a lot of experience. He has done most of the testing. Many of the articles that we have here are from his lab.

Q. You consider him authoritative?

MR. GINSBERG: Objection to form.

A. I think he has got to be knowledgeable in this area, very knowledgeable. He has done most of the work.

Q. Is beta titanium superelastic?

A. No.

Q. It has orthodontic

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applications?

A. Yes.

Q. What do you use it for?

A. So in orthodontics there is two broad classes of the device for the braces. There is what is called the attachment, so the brackets that gets attached to the teeth.

Q. I remember.

A. You remember, okay, yeah, you remember. So you may remember that you went it once in a while and you said that it hurt. What hurt was they were moving an old wire or readjusting a wire and putting in a new wire.

What the orthodontist is trying to do is apply particular forces. So the orthodontist, to do that, wants the wire to, first of all, be a particular shape. So they may bend it into a shape that they want. And there is three standard wires that are used, stainless steel, beta titanium and nickel titanium. So it is used to adjust -- to straighten teeth.

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Q. What are the advantages of beta titanium?

A. Sure. So teeth move more effectively if lower forces are applied. The force that the device imparts is a result of the geometry, such as its cross-section, and the material properties, particularly its modulus of elasticity.

So in our work we identified the need to have -- we knew lower forces were desirable. We knew stainless steel had a certain level of force. And we were looking for material that could apply a lower force.

I will just say, because I know the story, others had attempted that but were not commercially successful because the difference, while statistically improved, was not clinically significant. So the beta titanium is clinically significant in that it has a stiffness of about half of what stainless steel is, so that's what made it a success. And it is

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now one of the standard screen wires.
Q. What about alpha titanium, is that superelastic?
A. I don't believe so.
Q. Is alpha titanium used in orthodontic applications?
A. I don't believe so.
Q. Let's look at Exhibit 11 now, which is U.S. Patent Publication Number U.S. 2002/0137008. Inventor's name is McSpadden. We can call this the McSpadden patent. Is that okay?
A. I'm fine with that.
Q. Do you want to take a few minutes to refresh your recollection about this reference before I ask you questions?
A. Yes, thank you.
(Witness perusing document.)
A. Okay. I'm sorry for taking so long, but the patents are a little more involved. I have scanned through it, but obviously it is complex, so I will wait for your questions.
Q. I was just looking at the

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abstract of the patent which gives a summary of what this patent is about. And the abstract refers to a superelastic alloy material selected to have a relatively high loading plateau greater than about 500 megapascal, is that what that is?
A. Yes.
Q. What is a high loading plateau?
MR. GINSBERG: Objection to form.
A. I'm not sure how they are using it here. I would anticipate -- I'm not sure how they are using it. In orthodontic applications, that would be like the plateau region of a superelastic alloy when you are deflecting it.
Q. What does that mean?
A. So on the stress-strain curve or the bending curve the material would increase, and, again, this depends on the test method and then there would be a horizontal plateau region in the stress-strain curve. That is what I --

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that is how it is used in orthodontics.
I haven't, you know, so I'm anticipating what the use is here, but I would have -- if you could point me to the figures that they are getting this from, but I assume that's what that means.
Q. Well, I can't point to a figure that they are getting it from. I'm just reading the abstract and asking you what your understanding of high loading plateau is. So that's it. You answered my question.
At the end of the abstract they say "The resulting file is also stiffer than comparable files fabricated from conventional NiTi alloys." And he seems interested in having a high loading plateau because it allows for the formation of precision ground flutes in cutting edges.
Do you see that on the abstract?
A. Yes.
Q. And would you turn to the last

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page of the patent, please. If you look at the first claim, the claim is to an endodontic instrument fabricated from an alloy of nickel and titanium where the nickel titanium alloy is selected to have a loading plateau greater than about 500 megapascal.
Do you see that?
A. Yes.
Q. So that seems to be the point of his patent; do you agree with me?
MR. GINSBERG: Objection to the form of the question.
A. Well, that's the point of the claim, but there is the whole specification.
Q. Right. But that's what he is interested in for his invention?
MR. GINSBERG: Objection to the form of the question.
A. I mean, there is multiple claims, so that's one point he is trying to make, and that's what he is focused on on the abstracts. He is looking at

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manipulating the characteristics and these are the ones that he has mentioned as important to him.

Q. Machining and loading?

A. Correct.

Q. I'm sorry, the terms --

A. Correct. And he is changing -- if this is what I said it was, the plateau region, so he is interested in manipulating the stress-strain curve is the way I would think about it.

Q. And do you understand why a stiffer file would be machined better?

A. I didn't, until I just glanced through this. Oh, why it would be machined better? No. I would just assume that a harder material can be more accurately ground. I don't know. It just kind of seems intuitive, not a professional opinion.

(Goldberg Exhibit 12 marked for identification.)

Q. Dr. Goldberg, we have just handed you what has been marked as

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Goldberg Exhibit 11. It is the --

A. I'm sorry, mine is marked 12.

Q. Okay, 12, my apologies. Exhibit 12 is a reference by a gentleman, the last name K-h-i-e-r. Do you know how to pronounce it?

A. I would pronounce it Khier, but I'm not great at pronunciation.

Q. I was going to go with Khier but then I thought you were going to correct me. So let's go with Khier.

A. Okay.

Q. Do you want to take a minute to review this reference before I ask you any questions?

A. Yes, thank you.

(Witness perusing document.)

A. Okay, thank you, I appreciate the time.

Q. Now, this Khier reference pertains to orthodontic wires, right?

A. Correct.

Q. There is no reference to files, correct?

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A. Correct.

Q. And the orthodontic wires were heated in air, right?

A. I don't know. If you can point me to that description.

Q. I'm sure I can. Page 311, column 2, last paragraph.

A. Yes. Actually, they were not heated in air. They were heated in a vacuum.

Q. Sealed and evacuated, is that where you are getting that?

A. Yes.

Q. And if you look at column 1 on page 311, they used an ADA cantilever test for bend testing; is that right?

A. Yes.

Q. And they bent the specimens at room temperature?

A. Yes.

Q. Which they define as 22 degrees Celsius plus or minus 2 degrees Celsius?

A. Yes.

Q. Do you consider 22 degrees

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Celsius room temperature?

A. Well, as we've seen, there is a range of temperatures that people consider room temperature. So here they are considering 22 degrees.

Q. You wouldn't disagree with that, right?

A. Well, as I said, there is a range. Dr. Sinclair uses 25. So it is at least that range.

Q. Is there a set temperature for an average dental office?

A. Gee, I don't know that. I don't know the answer to that.

Q. So the bend testing was not performed according to the ISO 3630-1, right?

A. Actually, that version of the ADA test is like the ISO test.

Q. Well, here they are bending to 80 degrees.

A. Yes, yes.

Q. First column under the temperature.

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A. Yes, correct.
Q. 80 degrees?
A. Uh-huh.
Q. So it is similar but it is not the same?
A. The mechanics are the same. You hold it at one end and deflect the other. That's what I meant by the same. So the span length will be different. The amount of degrees would be different. But it is -- the ISO test is a cantilever test.
Q. So they are similar in that they are cantilever tests?
A. Correct.
Q. But there are some differences?
A. Yes.
Q. Such as the degree of bend and maybe some other particulars too?
A. Yes. I would have to compare it. I'm just familiar with the general loading parameters.
Q. Now, there are a lot of figures in this reference. I'm going to give you

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a pen because I think it might be helpful to you. You don't have to use it, but I found it helpful in my own analysis.
A. Okay.
Q. Maybe you won't need it. Do you say it Nitinol or Nitinol?
A. Nitinol.
Q. Nitinol. That's what I thought. Nitinol SE wires in Figure 1.
A. I'm sorry, Figure 1, okay.
Q. That's supposed to be a superelastic wire, right?
A. Yes.
Q. And Figure 2 is the Sentinol wires?
A. Yes.
Q. And those are also superelastic wires?
A. Yes. I'm basing that on that's how the authors characterized them. The ones they are saying are superelastic are Nitinol SE, Sentinol and NiTi.
Q. And the NiTi wires are in Figure 3, right?

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A. Yes.
Q. Now, we are looking at Figure 4 which is Nitinol wire, but not Nitinol SE -- and they describe this as non-superelastic wire, right?
A. Yes.
Q. And Figure 5 is Titanal wires?
A. Your guess is as good as mine there.
Q. You mean the pronunciation?
A. The pronunciation, yes.
Q. And that's also described as a non-superelastic wire, right?
A. Let me just look. Yes, Nitinol, Titanal and the Orthonol alloys are not superelastic, according to page 311.
Q. And Figure 6 shows the Orthonol wires, right, and those are the --
A. Yes.
Q. -- non-superelastic?
And then Figure 7, 8 and 9 are testing on the superelastic wires that are heat-treated?

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A. Yes.
Q. And Figures 10, 11 and 12 are testing on Nitinol, Titanal and Orthonol which are not superelastic and they are heat-treated?
A. Correct.
Q. Now, would you look at Figure 1, please.
A. Okay.
Q. These are bending plots for Nitinol wires of different diameter, right?
A. Uh-huh.
Q. The 0.016 inch is the diameter of the wire, right?
A. Yes.
Q. And in this plot that is the plot with the circle, colored-in circle, and that's the lowest plot on that --
A. Correct.
Q. -- bending plot, right?
Which, correct me if I'm wrong, I'm trying to keep track of this stuff --
A. Okay.

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Q. -- means that it's the most flexible; is that right?

A. Can you repeat that question, while I'm looking at this?

Q. Which means that it is the most flexible, the wires that are tested here in Figure 1, right?

A. These are orthodontic wires, and in the orthodontic area we look carefully at both the loading portion of the curve and the unloading portion of the curve.

And as far as stiffness, what makes these superelastic -- and I'm not trying to complicate things, but it is complicated -- what makes them superelastic is that plateau is difficult to interpret flexibility. So some read it as how low that plateau is, others read it the slope of the plateau.

But to try to answer your question, the 16,000s have the lowest unloading plateau, and if I used unloading plateau, which is what we would typically

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use, I would say that that is the lowest stiffness wire.

Q. Now, with the Kuhn reference, we spent a lot of time looking at where that lower -- the unloading plateau intersected the X axis --

A. Yes, can I bring that out again so I have that in front of me when you are making that comment?

Q. Sure. I mostly wanted to direct you to the unloading plateau for the 0.016 inch wire in Figure 1 of Khier.

A. Yes.

Q. Now, that intersects somewhere -- if you had to extrapolate that line, you would agree it doesn't go back to zero, right?

A. Correct.

Q. What number would you say it goes back to?

A. I don't know, 17.

Q. Okay, I'm good with 17.

A. It starts, you know, maybe the actual test got started at about 5.

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Q. Explain to me how the test can start at 5.

A. Sure. Because it's sensitive that they were using this ADA method with torque meters, so those are handheld instruments, and I can tell you from experience, when you are beginning to take those measurements, at least that initial measurement when you are starting the test, as you can see on here, it may not all be 00. It is just that it is hard manually to always line up the zero bending moment with the zero angle.

That's why they are showing all that variation around the axis. It is just a result of this test, this manual device. That is probably why they didn't draw the initial lines all the way down to 00.

Q. Now, and when you are looking at Figure 2 and Figure 3, it looks like the 0.016 wire has the lowest curve for those figures, too?

A. Correct.

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Q. For the Sentinol wire, where would you say that 0.016-inch wire intersects on the Y -- I'm sorry, X axis when it is unloaded?

A. When it is unloading, around 15 degrees.

Q. And for Figure 3, where would you say the 0.016 inch NiTi superelastic wire intersects the X axis on the unloading curve?

A. 12 degrees.

Q. I think those are all excellent estimates.

A. Thank you.

Q. Now, let's look at the Figure 4 and 5 for a second. These are the non-superelastics and they are totally different-shaped curves.

Can you explain why those curves are so different for the non-superelastic curves?

A. Yeah. First of all, I don't know if I would use the term "totally." I'm not 100 percent what that means. I

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mean, because they have the same general shape.

The difference I think you are referring to is that the first three have kind of -- the slope level is off, whereas in these three it seems to be -- it is continually increasing. The other difference is at the unloading there is more permanent deformation in these wires.

Q. Because they are not superelastic, I guess?

MR. GINSBERG: Objection to the form of the question.

A. Yeah --

MR. GINSBERG: Well, wait for a question, Dr. Goldberg.

THE WITNESS: Okay.

Q. My question is, because they are not superelastic?

A. Well, there could be other reasons. Again, this is this issue of structure versus the results. Even on the superelastics, it looks like some of these are showing permanent deformation. These

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are showing more permanent deformation and it is because these are not superelastic.

So the superelasticity, as he has grouped the three, that would be the difference. That is one of the differences, the increased permanent deformation and the non-superelastic.

Q. Now let's look at Figure 6, 7 and 8.

A. Okay.

Q. I'm sorry, 7, 8 and 9.

A. 7 --

Q. 7, 8 and 9 are the superelastic wires that are heat-treated.

A. Heat-treated, right.

Q. So we just looked at the non-heat-treated superelastic wires, and we looked at specifically at the 0.016 inch wire.

A. Correct.

Q. Now, Figures 7, 8 and 9 are those same wires and comparing them to -- comparing the heat treatments?

A. Correct.

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Q. Unfortunately, they don't show the un-heat-treated in Figures 7, 8 and 9. I just want to point that out to you.

In Figure 7 they have the Nitinol SE superelastic wire and they have two heat treatments at 500 degrees, either 10 minutes or 120 minutes, and then two heat treatments at 600 degrees, either 10 or 120 minutes.

Are you following me?

A. Yes.

Q. Now, if you look at the first curve, the 500 degree treatment for 10 minutes.

A. Okay.

Q. And you look at that unloading curve, where would you estimate that intersects that X axis?

A. 8 degrees.

Q. And what about the 500 at 120 minutes?

A. I would say 9 degrees.

Q. And what about the 600 for 10 minutes?

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A. 17 degrees.

Q. And what about the 600 for 120 minutes?

A. 30 degrees.

Q. Now, let's compare that with Figure 1.

A. Figure 1, okay.

Q. Now, your estimate of where the untreated Nitinol SE superelastic wire intersected that X axis was 17 degrees, right?

A. Correct.

Q. Which is the same number you just gave me for the 600 degree at 10-minute treatment, right?

A. Right. But I would just caution, as I mentioned, it is much -- it is a little risky, in my opinion, taking that unheated in Figure 1 and comparing it over here.

I would almost always want to see it on the same curve because -- I would just make that caution.

Q. Because why?

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A. Well, because it can't always be assured that everything was the same. I mean, the ones that are done on each curve suggest to me, the way this would typically be done, is these are all done about the same time and they are showing the relative pattern.

While it is the same method, I can't be sure that I could pick that curve up from this group and move it over to this group. I mean, we could do that, but I would just caution that it's not on the same line.

Q. Right. Well, I mean, what they are comparing in this plot for Figure 7 are four different heat treatments?

A. Correct.

Q. You would have to -- I mean, they are not doing those all at the same time in the same oven, there are different temperatures and times, right?

A. Correct. What has been done here is to demonstrate the effect of the heat-treating. They are different

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temperatures and different times and they are showing you the trend and the results. So you can see how those curves kind of are following a pattern.

Q. And comparing it to Figure 1, some of those heat-treated wires had less permanent deformation than the untreated wire, right?

MR. GINSBERG: Objection to form, for the reasons stated.

A. That's what it appears. But here is my caution, and I don't know this to be the case, but remember I said there was some uncertainty around that initial region. And it looks like to me is they have really made an attempt in Figure 7 to have all the plots start at the same point, and if we extrapolate those back, it is going to be awfully close to 00.

So they are lining up those plots to make that comparison. If I was going to move the 1 from Figure 1 over, I would do the same thing. I would move it so that that initial point is around zero,

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because that's clearly what they are doing in Figure 7.

Q. So in Figure 1, do you see that initial point to be around zero?

A. No. I think you asked me that before and I said it was coming down at about 5 degrees. I have a little mark on here, so I think that's what you asked me.

Q. So if we shifted it 5 degrees --

A. To the left.

Q. -- then they would line up?

A. That's what I would do.

Q. So in Figure 1, if you shifted all 5 degrees, then it would come down at 12 degrees, the lower one? You would shift 17 to 12, right?

A. Correct.

Q. And then if you compared that to Figure 7, you would still see that some of these heated files had more permanent deformation than the unheated files, right?

MR. GINSBERG: Objection to

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form.

A. My conclusion there would be that heat-treating definitely affects it. The first couple, the ones that are 500 degrees, yes, that value is maybe 1 degree backwards, but I would say it's really similar to the control, but the pattern is what is important, at 600 degrees clearly we are seeing a shift towards the right.

So granted, if I made the correction I'm suggesting, one of those plots would be to the left of the origin of the control by a degree --

Q. I just want to make sure this is clear --

MR. GINSBERG: Please do not interrupt the witness. He was answering the question.

MS. BRENNER-LEIFER: I think he answered it.

MR. GINSBERG: He was still talking.

A. So I'm just trying to say that two of those heat treatments, I would

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really consider, you know, they are within a degree of what the control would be. But the 600 degrees clearly is to the right.

Q. Okay. Well, when we went through Figure 7, you gave me those X intersection points as 8, 9, 17 and 20.

A. 30.

Q. Yeah, 30. And you just told me that if we shifted Figure 1 5 degrees, it would be 12. So it is more than 1 degree, isn't it?

A. Correct. So let me see here. What were the values I gave you?

Q. When we went through Figure 7, you told me 8, 9, 17 and 30.

A. Correct, okay. So we are shifting everything I said, what, 5 degrees?

Q. Right. The number you gave me for Figure 1 was 17 degrees --

A. Right, so we are saying 12.

Q. And then you suggested we shift it --

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A. So it is 12.

Q. -- 5 degrees.

MR. GINSBERG: Objection to the form of the question. Please let her finish asking before you give your answer.

Q. So even shifting, as you suggested, and comparing that shifted plot where the untreated would hit at 12, both of the 500 degree heat treatments would be to the left of 12, one at 8, which is 4 degrees difference, and one at 9, which is 3 degrees difference, right?

MR. GINSBERG: Objection to the form of the question. You can answer.

A. Yes. You are subtracting, if I'm following you, 8 from 12 and 9 from 12.

Q. So even making your adjustments, the heat-treated wires at 500 degrees showed less permanent deformation than the untreated, right?

MR. GINSBERG: Objection to the form of the question.

A. Yes. By this plot, the 8 and 9

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is less than 12.

MS. BRENNER-LEIFER: We need to change the tape. So we will take a five-minute break.

THE VIDEOGRAPHER: This ends tape number 6. We are off the record at 3:44.

(Recess taken.)

THE VIDEOGRAPHER: This begins tape number seven in the deposition of Dr. Jon Goldberg. We are on the record at 3:56.

BY MS. BRENNER-LEIFER:

Q. I have a couple of more figures in this Khier reference I want to go through. It is similar to what we did with Figures 1 and 7. I want to look at Figures 8 and 9 and compare them to 2 and 3.

A. 8 and 9, okay.

Q. It is on page 314.

A. Okay.

Q. So let's do our estimate of where those unloading lines intersect the

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X axis, starting from --

A. I'm sorry, which figure are you on? 8?

Q. Let's start with 8.

A. Okay.

Q. So there is the 500 at 10 minutes, which is the one with the bigger dashed line.

A. I'm having a little trouble finding it. Okay. I think I have it.

Q. Do you want to give me an estimate where that --

A. The unloading curve?

Q. Uh-huh.

A. 11 degrees.

Q. Okay. And what about the 500 for 120 minutes?

A. I would say the same.

Q. Okay. And what about for the 600 at 10 minutes?

A. I would say 19.

Q. Okay. And what about the 600 for 120 minutes?

A. I don't know, 32.

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Q. Okay. Now, let's compare that to Figure 2 where you gave me unloading, X intercept at 12 degrees. That's what my notes show.

A. Okay.

Q. Do you feel the need to make any adjustment to that zero point?

A. Maybe 2 degrees.

Q. Which way?

A. To the left.

Q. So you want 12 to become 10?

A. Yes.

Q. Okay. So we are going to make the untreated 10 for points of comparison.

A. Okay.

Q. So the 500 degree heated wires at 10 and 120 minutes were -- you gave me 11 for both of those.

A. Yes.

Q. So would you agree that within the error in estimation we are doing here, that those are not -- it is hard to call those different?

MR. GINSBERG: Objection to the

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form of the question.

A. Again, I mean, those two values are close. We don't have a measure of standard deviation here. We have just been going saying not statistically, just what is the values.

So if that's the pattern, whatever I said over here -- what did I say, 10 -- one is 10, the other are 11. We haven't been talking about error.

Q. Right. So do you want to say that's not -- we don't see a significant difference there?

MR. GINSBERG: Objection to the form of the question, comparing two graphs.

A. So let me just say, again, we haven't been doing that. If you are asking me to give an opinion about, you know, when you say statistical, I hate to get picky, but I teach the statistics, so are you talking about a practical difference or if it is a statistical difference based on a number of samples?

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Q. I didn't ask you statistical.

A. Oh, okay.

Q. I didn't say that.

A. Fine. So then I would say they are different.

Q. You would say they are different?

A. Yes.

Q. Okay. And how would you consider them different?

MR. GINSBERG: Objection to the form of the question.

A. What we have been doing up to this point is just looking at whatever the values were and commenting if one number was higher or lower than the other. There have been no discussion of error. It is just based on these values, what are they.

And so I'm just looking now. This number, I'm sorry, I have to keep going back, was 10. So 11 is greater. I mean, clearly 30 is even greater, or 19, whatever numbers we had.

Q. Okay.

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A. So you are -- okay.

Q. Okay. So at 500 degrees heat treatment, we see maybe a slight increase in permanent deformation in that wire?

MR. GINSBERG: Objection to the form of the question.

A. We see an increase of 1 degree.

Q. Okay, 1 degree. But it could be a little bit different because we already made a 2 degree adjustment in your 10?

A. Correct.

MR. GINSBERG: Objection to the form of the question.

A. Yeah.

Q. And if we hadn't made that adjustment, then it would have been comparing 11 to 12?

A. It would have been comparing the uncorrected value to a corrected value.

Q. So if we do this estimated correction, then the heat treatment showed a 1 degree increase in permanent

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deformation, and if we -- do you agree with that?

A. Yes.

Q. And if we don't do the correction, then the 500 degree treated wire showed actually a 1 degree less in permanent deformation?

MR. GINSBERG: Objection to form.

A. Yes.

Q. And if you do the 600 degree treatments at 10 and 120 minutes, you see a more clear increase in permanent deformation; would you agree with that?

A. I would say we are seeing a larger difference.

Q. A larger difference, okay.

Now, let's look at Figure 9 and go through the same process.

For the 500 degree treatment --

A. I'm sorry, for Figure 9, and it is the NiTi we are doing now?

Q. Right.

A. 3 and 9?

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Q. Right.

A. Okay.

Q. So if we look at the 500 degrees Celsius for 10-minute treatment --

A. If I could just interrupt, because I have the drawing here, can you tell me what I gave as the value in Figure 3?

Q. Yeah. I think you gave 12.

A. It looks like it is almost 10 in my drawing.

Q. I have two numbers here. So we will go with 10.

A. Okay.

Q. So we will give 10.

A. Okay.

Q. So let's look at Figure 9 now. What is your estimate for the X intercept for the 500 degrees Celsius, 10-minute treatment?

A. Just doing what I have been doing, following the pattern, I would say 10.

Q. And what about the 500 degrees

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Celsius for 120 minutes?

A. 13.

Q. What about 600 degrees Celsius for 10 minutes?

A. 21.

Q. And what about 600 for 120 minutes?

A. 36.

Q. Now, when I look at Figure 3 -- oh, I know what -- actually, I think I know my problem for a figure, why I had two numbers here. So you just gave me the number 10 for Figure 3.

A. Well, you gave me that number.

Q. Right. Well, I thought you had told me before 12 and then you told me that you want to make it more like 10.

A. Okay.

MR. GINSBERG: Objection to the form.

Q. Now, do you think you need to correct that -- make a correction for that number?

A. No.

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Q. I mean, for Figure 3, to compare it to Figure 9.

A. Oh, a correction? Let me take a look.

(Witness perusing document.)

A. No.

Q. So comparing that number 10 untreated to the -- which is the same as the heat treatment at 500 degrees for 10 minutes.

MR. GINSBERG: Objection to the form of the question.

A. I'm sorry, but the number I wrote down -- let's see, correct, I'm sorry, 10.

Q. Okay.

A. I'm sorry, you're right.

Q. Okay.

A. No, time out. Hold on one second. I apologize, I was misreading. I'm fine with 10.

Q. Okay. The reason why I was confused is that my earlier notes, you said for Figure 2, when we were looking at

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Figure 2 before, the first time you told me 15, and then we had a conversation about adjusting the number for Figure 2, but I myself was looking at Figure 3.

So you told me 2 degrees, so I adjusted from 12 to 10 because that's what I was thinking. But when you said 2 degrees, were you thinking of adjusting Figure 2 from 15, 2 degrees, to 13?

MR. JESIC: Objection to form.

A. I would just say the only notes I have here are -- numbers I have are 10 and 12. I just don't recall.

Q. For Figure 2?

A. For Figure 2, yes.

Q. Okay. Well, why don't you look at that Y intercept -- I mean the X intercept again for the 0.016 inches for Figure 2.

A. Okay.

Q. And what is the number you estimate that for?

A. I have 12 written here. Maybe it is more like 13.

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Q. And then you told me you wanted to adjust it?

A. Right, 2 degrees.

Q. 2 degrees. So it would be 11?

A. 11.

Q. Okay. Which is the numbers that you gave me for the 500 degree heat treatments in Figure 8?

A. Correct.

Q. While you were making these adjustments and then looking at Figures 7, 8 and 9, you made adjustments to this Y axis based on where you thought it should hit the zero at the Y intercept for the top curve, right?

MR. GINSBERG: Objection to form.

A. At the 00 --

Q. For the loading curve?

A. For the loading curve.

Q. Now, when you look at Figure 7, for the loading curve, when you draw those curves, would they intercept at 00?

A. It looks like it to me, because

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of the shape of the curve.

Q. Okay. So we don't need to make an adjustment to Figure 7 based on where that loading curve would intercept.

A. Correct.

Q. What about Figure 8?

A. I would say those should be shifted to the right, maybe, let's see, that's 10, 2 or 3 degrees.

Q. And what about Figure 9?

A. Figure 9, I would say 4 degrees to the right.

Q. This is getting very complicated.

MR. GINSBERG: No question. You don't have to answer.

Q. All the shifting is getting very complicated and confusing.

MR. GINSBERG: Wait for a question, Dr. Goldberg.

Q. Let me see if we can get it straight, because we have done this a few times now.

If we shift Figure 8 numbers 2

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to 3 degrees to the right, or I guess bigger, right?

A. Right.

Q. So your 11's become 13's or 14's?

A. Uh-huh.

Q. The 19 becomes 21 or 22. And your 32 becomes 34. And similarly, if we shift your numbers in Figure 9, your 10 becomes 14?

A. Uh-huh.

Q. Your 13 becomes a 17. Your 21 becomes a 25. And your 36 becomes a 40. Right? Are you with me?

A. I'm sorry, what's the question?

Q. Are you with me?

A. I'm not 100 percent sure, because I've got an awfully marked-up page here.

Q. Okay. I think you are following me, though.

MR. GINSBERG: Objection to the form.

Q. I think we are on the same

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page, but I just want to make sure.

So going back to Figure 8, we said we were comparing the Figure 2 we shifted to 13 and we are comparing -- but then we are shifting the other one to 13 too. So it comes out the same.

A. No.

Q. We shifted them the same way, didn't we?

A. No.

Q. Okay. Which way did we shift it?

A. In Figure 2 we shifted it to the left 2 degrees. So it went from 12 or 13 down to 10 or 11.

Q. Okay. So we are comparing 11 for the untreated to 13 or 14 for the 500 at 10 degrees Celsius and the same number for 500 degrees at 120 minutes.

So the 500 degrees treatment, according to all of our estimations and adjustments, would show a small increase in permanent deformation?

MR. GINSBERG: Objection to the

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form of the question.

A. Well, if my numbers are the same that you are looking at, we are going from a 10 to an 11, so there is a 1 degree increase for the 500 degree C, 10 minutes.

Q. Okay. And a larger increase for the 600 degree treatments?

A. Yes.

Q. And for Figure 9 we see -- what would you say the degree increase in permanent deformation is for the 500 degree, 10-minute treatment as compared to the untreated?

A. Okay, so give me a second. I would say that's an increase from 10 to 14.

Q. So for both the Sentinol and the NiTi wires we see a 1 to 2 degree increase in permanent deformation if we do a 500 degree heat treatment for 10 minutes, right?

A. Yes.

Q. But then when we look at the Nitinol SE superelastic wire, we see -- we

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still see, with all our adjustments and estimates, a decrease in permanent deformation for the 500 degree, 10-minute heat treatment, right?

A. I don't have what the adjustment from Figure 1, I don't think we've done that.

Q. I thought we did a 5 degree adjustment for Figure 1. That was the first adjustment we did.

A. Okay. So let me just -- so therefore --

Q. We adjusted it from 17 to 12.

A. To 12, okay, I'm sorry. 17 down to 12, okay. Okay, thank you.

Q. So just to make sure that my question and answer was clear, that when we see the heat treatment at 500 degrees for the Nitinol SE wire, we see a decrease in permanent deformation from about 12 degrees to 8 degrees for the 10-minute treatment and 9 degrees for the 120-minute treatment?

A. Yes. If we do this process of

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carrying that curve to the other curves, correct.

Q. So trying to put all this stuff together, maybe we can make some conclusions.

A. Okay.

Q. First, the permanent -- effect of heat treatment on permanent deformation depends on the kind of wire, even if it is a superelastic wire, right?

A. Uh-huh.

Q. We saw that for the three different wires?

A. Yeah.

Q. It depends on the temperature?

A. Yes.

Q. And it depends on how long you heat-treat it, right?

A. I'm sorry, so the question?

Q. How long you treat it -- how long you heat-treat it?

A. Affects the change in the permanent deformation? I'm sorry, if you could just put it in the form of a

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question to me.
Q. I thought I had, but I will restate it.
A. Okay.
Q. The effect of heat treatment on permanent deformation for superelastic wires depends on, what I see, three things, one, the type of wire; do you agree?
A. Yes.
Q. Two, the temperature you heat-treat, right?
A. Yes.
Q. You agree with that?
A. Yes.
Q. And, three, the length of time of the heat treatment?
A. Yes.
Q. And for at least the nitinol wire, the heat treatment actually decreases the permanent deformation that's seen?
MR. GINSBERG: Objection to the form of the question.

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A. Yeah, the 500 degree does.
(Goldberg Exhibit 13 marked for identification.)
Q. Dr. Goldberg, I have given you what has been marked as Goldberg Exhibit 13, which is the Walak patent.
Do you want to take a minute to look this over before I ask you questions?
A. Yes, thank you again.
(Witness perusing document.)
A. Okay, again, I appreciate the time.
Q. Dr. Goldberg, this patent relates to heart stents and catheter guidewires, right?
A. Well, they are described as medical devices, and those are two of the examples they give.
Q. Do they describe any dental applications in this patent?
A. I don't believe so.
Q. And the ISO 3630-1 testing method pertains specifically to endodontic files, right?

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A. Correct. I'm sorry, I wasn't listening to that, I apologize, because it just caught my eye, under Other U.S. Documents, is Sagaye, which is another document that we used, and I don't recall what applications were in that one.
MS. BRENNER-LEIFER: Could you read back my question, please.
(The record was read.)
A. Yes.
Q. And because the Walak patent pertains to stents and guidewires, there is no bend testing according to the ISO 3630-1 method, right?
A. For stents? I'm sorry, I wasn't sure what you were asking.
Q. And because the Walak patent pertains to stents and guidewires, the Walak patent doesn't describe any bend testing according to the ISO 3630-1 method, right?
A. I'm going to answer that the Walak doesn't refer to the ISO bend test method.

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Q. And in the Walak patent, Walak is interested in selectively using heat treatment to affect a portion of the stent's properties, right?
A. Yes.
MR. GINSBERG: Objection to the form of the question.
(Goldberg Exhibit 14 marked for identification.)
Q. Dr. Goldberg, I have handed you Goldberg Exhibit 14, which is the Sagaye patent, S-a-g-a-y-e -- well, I'm not quite sure how you pronounce it, because my colleague just pointed out there is two spellings on here. It is either S-a-g-a-y-e or S-a-g-a-e.
In any case, can we call it the Sagaye patent?
A. That is fine with me.
Q. Do you want to take a minute to look this over before I ask you questions?
A. Yes, sure, thank you.
(Witness perusing document.)
A. Okay, thank you.

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Q. Ready?
A. Yes.
Q. The Sagaye patent also pertains to catheter guidewires, correct?
A. Yes.
Q. And it also doesn't have any dental applications described, correct?
A. That's correct.
Q. And Sagaye also treats just a portion of the guidewire, correct?
A. Correct.
Q. And Sagaye didn't test the guidewires according to the ISO 3630-1 method, correct?
A. Correct.
(Goldberg Exhibit 15 marked for identification.)
Q. Dr. Goldberg, we have marked as Exhibit 15 the Gil reference entitled "Relevant Aspects in the Clinical Applications of NiTi Shape Memory Alloys."
Do you want to take a minute to look this over?
A. Yes, thank you.

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(Witness perusing document.)
A. Okay, thank you.
Q. Does Gil discuss endodontic files?
A. No.
Q. Does he discuss permanent deformation of endo files?
A. No.
(Goldberg Exhibit 16 marked for identification.)
Q. Dr. Goldberg, we have handed you what has been marked as Exhibit 16, which is the Schafer reference.
Could you take a minute to look over this reference before I ask you questions.
A. Yes.
(Witness perusing document.)
A. Okay, I think I'm ready.
Q. The Schafer reference is directed to stainless steel endodontic instruments, right?
A. Yes.
Q. It doesn't discuss nickel

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titanium endodontic instruments?
A. No.
Q. And the Schafer reference also doesn't discuss heat-treating nickel titanium, right?
A. Correct.
(Goldberg Exhibit 17 marked for identification.)
Q. I will hand you what has been marked as Goldberg Exhibit 17. This is the Tepel reference.
Do you want to take a minute to look at this before I ask you questions?
A. Sure.
(Witness perusing document.)
A. Okay.
Q. Is the Tepel article comparing properties of stainless steel endodontic instruments to nickel titanium endodontic instruments?
A. Yes.
Q. Does he express a preference for stainless steel endodontic instruments?

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A. I have to read more carefully, but just looking at -- let me read the abstract again.
(Witness perusing document.)
A. You know, based on the last couple of sentences, I think he is saying, you know, the different ones have different parameters and you have to consider all of them. I'm not sure I see where he is expressing a preference for stainless steel.
Q. Let's go to -- before we get to this comparison, Tepel doesn't describe any heat treatments for superelastic nickel titanium files, does he?
A. Well, the first paragraph has that Walia reference where they do talk about heat-treating.
Q. I'm sorry, the first what?
A. So the first paragraph has the reference 6, which is the Walia reference.
Q. The first paragraph?
A. Yes, the first paragraph in Tepel has several references in giving

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background material, and reference 6 is the Walia reference, which is where they do talk about potential heat-treating of nickel titanium endodontic instruments.

So he is providing the background, and just, you know, I'm looking at the references as I'm reading, and so he is referring readers to that reference.

Q. Well, specifically he says "to minimize undesirable changes of the curved root canal, different root canal instruments with a greater flexibility have been developed during recent years."

And he cites to Walia for that proposition, right?

A. Correct.

Q. But Tepel himself does not discuss heat-treating endodontic instruments, correct?

A. No, not in this article.

Q. Could you turn to page 144, please.

Under the Discussion, he first

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discusses resistance to bending. Do you see that, the first two paragraphs --

A. Uh-huh.

Q. -- relate to resistance to bending?

A. Uh-huh.

Q. And in the second paragraph, he says "flexible stainless steel instruments, especially those with a modified non-cutting tip, performed better than nickel titanium or titanium aluminum instruments."

Do you see that?

A. Yes.

MR. GINSBERG: Objection to the form, to the extent that you are not reading the entire paragraph.

A. Well, I see that sentence.

Q. And then he says "resistance to bending allows conclusions about whether an instrument will follow the curved root canal."

Do you see that?

A. Yes.

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Q. And then he says "this parameter allows no prediction on whether undesirable changes to the curved root canal will appear."

Do you see that?

A. Yes.

Q. And then he concludes, "therefore, resistance to bending has only a limited clinical impact and this parameter alone is non-appropriate selection criteria for root canal treatments."

Do you see that?

A. Yes.

MR. GINSBERG: It is mischaracterizing the document. It doesn't say that.

Q. "Root canal instruments." Do you see that?

A. Yes, I see that.

Q. So he doesn't think that resistance to bending is an appropriate selection criterion for root canal instruments?

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A. Well, he is saying alone it is not, and I would just comment that there is considerable other literature that suggests that that is important that there be high flexibility.

MS. BRENNER-LEIFER: We need to change the tape, so we will take a five-minute break.

THE VIDEOGRAPHER: This ends tape number seven. We are off the record at 4:56.

(Recess taken.)

THE VIDEOGRAPHER: This begins tape number eight in the deposition of Dr. Jon Goldberg. We are on the record at 5:06.

BY MS. BRENNER-LEIFER:

Q. Dr. Goldberg, getting back to the Tepel reference, on page 144, the next parameter that Tepel discusses is resistance to fracture.

A. Okay.

Q. And he says "except for the nickel titanium instruments, visible

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non-elastic deformation occurred before fracture, which leads to an obvious unwinding of the twisted instruments."

Do you understand what he is talking about?

A. Can I read from the beginning of that paragraph, please?

Q. Sure.

(Witness perusing document.)

A. Okay.

Q. Could you explain what he is talking about, "visible non-elastic deformation occurred before fracture, which leads to an obvious unwinding of the twisted instruments"?

MR. GINSBERG: Objection to the form of the question.

A. Well, it looks to me like what they are doing is evaluating this property of whether the files fail, and, if they fail within the root canal, that would be a serious problem.

So what he is saying here is that all of the files other than the

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nickel titanium exhibited this -- exhibited deformation, permanent -- actually, non-elastic is permanent deformation before they fractured.

And then I guess once they fractured, the instrument which is being twisted, untwisted. And that happened for all of them except the nickel titanium.

Q. What does it mean when you say the instrument is untwisted?

A. So in clinical application you use either a hand or rotary instrument, and what you do is rotate the file and then that removes the root canal material.

So I believe what they are referring to here is the possibility that as you are doing that, it could fracture, and they are saying that all the wires except nickel titanium showed visible permanent deformation when that happened.

In other words, they were twisting and twisting, one end, say, the tip would get caught, and it would break, and so it would untwist because it is no

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longer connected to the hand that is doing the twisting up here. And that happened for all the files except the nickel titanium files.

Q. In the next paragraph, he says "Moreover," do you see that sentence?

A. One second. Okay, down towards the end of the paragraph?

Q. Right.

A. Uh-huh.

Q. He says "flexible stainless steel instruments with modified non-cutting tips caused less undesirable changes of the curved root canal shape due to instrumentation. Therefore, from a clinical point of view, flexible stainless steel instruments offer two major advantages."

Do you understand that to be an advantage?

MR. GINSBERG: Objection to the form of the question.

A. Not completely. If you don't mind, if I could just read that paragraph

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and think about that for a second.

Q. Yeah, please.

(Witness perusing document.)

A. I'm sorry, I really can't give you an opinion here because I'm not sure what modified non-cutting tips are. I'm just really unable to follow the logic through the paragraph.

Q. Okay. Would you turn the page to 145.

A. Yes.

Q. In the concluding paragraph here in the first column, he says "When the four parameters investigated in the current and the previous studies (13 and 18), namely, resistance to bending, resistance to fracture, cutting efficiency, and instrumentation of curved canals are evaluated with regard to their usefulness for the clinician, the conclusions can be drawn that resistance to bending is the least relevant parameter during clinical usage. Compared to this, resistance to fracture has a greater

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clinical importance, which, however, is qualified by the fact that for the instruments tested in this study, fractures should not be a complication if the instruments are used correctly. Hence, in our opinion, the most important parameters are cutting efficiency and instrumentation of curved canals. These two parameters allow the evaluation of root canal instruments from a clinical perspective, and therefore can serve as a useful complement to the already existing international standards."

Do you agree with his conclusion in that paragraph?

MR. GINSBERG: Objection to the form.

A. I would characterize this -- so here is how I would say this in lay terms, that as with many things, there is many parameters to consider. He is looking at all these together and saying you've got to consider all of them, and he is giving more weight to some than to the others,

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and the factors that he is coming up with that he thinks are more important, these two parameters, meaning I guess cutting efficiency and instrumentation of curved canals, he thinks are important and is suggesting that they be considered for inclusion in the international standards.

Q. And what are the international standards?

A. Well, I assume standards like ISO 3635.

I will just add, I'm looking underneath, and the reference beneath it is ISO 3630, so he must be referring to that standard and he is arguing that these test methods should be included.

Q. Back on 144, in the second paragraph.

A. 144, which column?

Q. Second column, first full paragraph, Differences.

A. Okay.

Q. And the next sentence that begins "In previous investigations."

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A. Yep.

Q. He says "flexible stainless steel instruments displayed higher cutting efficiencies than conventional stainless steel K files and reamers, especially higher than nickel titanium and titanium aluminum instruments."

Do you see that?

A. Yes.

Q. So he says from a cutting efficiency standpoint, he thinks the flexible stainless steel instruments are better than the nickel titanium instruments, right?

A. Well, he is saying they are more efficient. I'm not sure what that means. Maybe it means cutting better.

(Goldberg Exhibit 18 marked for identification.)

Q. Dr. Goldberg, we have marked as Goldberg 18 a chapter from a book entitled Endodontic Therapy, by Franklin S. Weine. It is the Sixth Edition. And I have handed you Chapter 5.

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Do you want to take a minute and look over this reference?

(Witness perusing document.)

A. I have paged through, but just to be fair in my characterization, to be reasonable, I'm not reading this, I'm just paging through to just take a look at the pages. It is 70 pages here.

Q. Dr. Goldberg, you cited portions of this reference in your expert report?

A. Yes.

Q. Specifically you cited pages 183, 184 and 209.

A. Okay.

Q. Is this a reference that you found or your counsel found?

A. I don't recall. I think it was the counsel.

Q. Did they provide you with the whole chapter?

A. I'm sorry?

Q. Have you seen this whole chapter before or just the portions that

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are cited here?
A. I have seen the whole chapter.
Q. You have seen the whole chapter?
A. Yes.
Q. And why did you not provide the whole chapter with your expert report?
A. Well, I provided the sections that I thought were relevant. But if I could see my expert report, that might help me answer.
Q. You have the expert report.
MR. GINSBERG: Objection. He has his expert report without the exhibits. It is an incomplete report.
Q. I told you which ones are cited, which ones were provided as exhibits to your expert report.
A. Okay.
(Witness perusing document.)
MR. GINSBERG: Can I just have the question back. I just lost it.
(The record was read.)
(Witness perusing document.)

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A. Okay, thank you.
Q. Can you answer the question now?
A. Yes. I provided the pages that I was referring to. I didn't know I was supposed to send in the chapter or the whole book. I mean, it is actually all from a very large book.
Q. Yeah, true. Would you turn to page 183, please.
A. Okay, I'm on 183.
Q. There is a section called Precurving of Files.
A. Uh-huh.
Q. And in the second column on that page, the second to last full paragraph says "it is best to enter canals only with files that have been precurved" --
A. I'm sorry, I'm not quite with you here.
Q. "For these reasons."
A. Page 183, second column?
Q. The paragraph beginning "For

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these reasons."
A. Gotcha, okay.
Q. -- "it is best to enter canals only with files that have been precurved."
Do you see that?
A. Yes.
Q. And then it describes methods of precurving at the bottom of that page.
"One is placing an extremely sharp curve near the tip of the instrument. This is used when the preoperative radiograph discloses a sharp apical dilaceration or when an obstruction is encountered" and describes how to estimate the degree of curvature, and then it says "The other precurve is gradual for the entire length of the flutes and is to be used in all other cases."
Do you see that at the end of the paragraph?
A. Yes.
Q. And then at the bottom column, it says "The curving may be imparted by drawing the instrument across a metal

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ruler, cotton pliers, or other sterile instrument," right?
A. Yes.
Q. It doesn't describe pre-heat-treating the file so that it is -- so that it can be bent, does it?
A. Not in this section.
Q. And then the section says that you have to resterilize the instrument after you -- after you curve it, before you use the instrument, right?
A. Yes.
Q. How are dental instruments sterilized before they are used?
A. Different ways. Heat is one. Ethylene oxide is another. I think it depends on the specialty. Probably each specialty has methods that are just more appropriate for how they work.
Q. Is ethylene oxide a solution?
A. I think it is a solution. I'm not sure.
Q. And when you say by heat, do you mean in an autoclave or a small oven?

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A. I would say in an autoclave would be most appropriate.

Q. And how long does that take?

A. I'm not sure.

Q. Could you turn to page 211, please. Do you see the heading that says Disadvantages of Flexible Files?

A. Yes.

Q. And in this section, the Weine reference says that there are certain disadvantages to flexible files; is that correct?

A. Yes.

Q. And in the second column, the Weine reference says that "The flexible file systems, while being excellent for maintaining curves, are very poor in penetrating to the tip of these channels."

A. I'm sorry, I'm not --

Q. I'm sorry --

A. I got you. It is in the middle of the paragraph. I'm sorry. Go ahead.

Q. I will restart.

The Weine reference says "The

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flexible file systems, while being excellent for maintaining curves, are very poor in penetrating to the tip of these channels often lined by sclerotic dentin deposits that make the walls very irregular."

A. I'm sorry, I was at the middle -- let's start again. But if you could just tell me where you are starting from.

Q. Sure. I'm in the second column, the first big paragraph. I will just start from the beginning.

"Three different functions must be performed by instruments for treating curved canals, and a single file system rarely performs all of these. They are (1) penetration, the ability to gain access to the tip of a narrow canal; (2) need for flaring and early flaring; and (3) maintaining the shape of the curve. The flexible file systems, while being excellent for maintaining curves, are very poor in penetrating to the tip of these

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channels often lined by sclerotic dentin deposits that make the walls very irregular."

Do you agree with that statement?

MR. GINSBERG: Objection to the form.

A. This is really more of a clinical. I understand what it is, but this almost looks like a clinical opinion.

So I just don't have enough experience actually -- I mean, I have never actually done it. So I don't know if I can give you an opinion there. I understand what they are saying. They are saying you need different types of instruments to achieve the different functions. So that makes sense to me.

Q. And he is saying that the flexible files are very poor in penetrating to the tip of these channels, right?

A. Yes.

Q. And then he says "When flexible

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files were used in an attempt to traverse such canals, many would buckle, just like a wet noodle, particularly when the small sizes, (nos. 08 and 10) were used."

Do you see that?

A. Yes.

Q. So he does -- he says that the flexible files are very poor in penetrating to the tip of the channels because they buckle?

A. Yes.

Q. And then he says "Clearly for this function" -- i.e., penetration -- "the older, unmodified tipped instruments are superior," right?

MR. GINSBERG: Objection, misreading the sentence.

A. No.

Q. Let me start again.

"Clearly, for this function, the older, unmodified tipped instruments are superior."

Do you see that?

A. Yes, I see that.

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Q. And when he is saying "for this function," he is referring to penetration, right?

A. Yes.

Q. So he is stating an opinion that the older, unmodified tipped instruments are superior to the flexible files for the function of penetrating?

A. Yes.

MS. BRENNER-LEIFER: It might be useful to take a three-minute break just so I can see if I have any other questions.

MR. GINSBERG: Okay. I think we have about seven minutes left.

MS. BRENNER-LEIFER: Okay.

THE VIDEOGRAPHER: We are off the record at 5:36.

(Recess taken.)

THE VIDEOGRAPHER: We are back on the record at 5:41.

MS. BRENNER-LEIFER: Counsel, do you still maintain your position that this deposition transcript needs to be

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designated highly confidential? Because I did not ask him about the confidential document that was marked as an exhibit.

MR. GINSBERG: I do maintain that. I will have to review the transcript. I don't recall offhand. I believe manufacturing parameters were disclosed, but I will have to look at it. And certainly there is confidential exhibits that were introduced.

MS. BRENNER-LEIFER: Well, aside from one exhibit, there is only one exhibit that was confidential.

MR. GINSBERG: We will review the transcript.

MS. BRENNER-LEIFER: Okay. I have no further questions for you, Dr. Goldberg. Thank you very much.

THE WITNESS: Thank you very much.

MR. GINSBERG: I just have a few questions for you, Dr. Goldberg.

EXAMINATION BY MR. GINSBERG:

Q. Can you take a look at Goldberg

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Exhibit 16, please. I think that was the Schafer reference.

I believe Ms. Brenner-Leifer asked you whether the Schafer article discusses nickel titanium endodontic files. Do you recall that?

A. Yes.

Q. Can I refer you to the first page of this document and the second column.

A. Okay.

Q. You see the sentence that begins, in the first full paragraph, "This increasing flexibility is achieved either by different design features of the instruments or by the use of nickel titanium alloys." Do you see that?

A. Yes.

Q. Does this refresh your recollection as to whether or not the Schafer article discloses nickel titanium endodontic instruments?

MS. BRENNER-LEIFER: Objection, leading.

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A. Yes.

Q. And how does it refresh your recollection?

A. Well, I can see right in the introduction they are describing nickel titanium alloys.

Q. Thank you.

Can we turn to Goldberg Exhibit 3, that's your supplemental expert report. I would like to direct your attention to paragraph 7.

Is paragraph 7 your definition of what you believe a person of ordinary skill in the art is?

A. Yes.

Q. Is the definition of person of ordinary skill in the art that's disclosed in paragraph 7 of Goldberg Exhibit 3 the definition you had in mind when you prepared your expert report dated September 11th, 2014?

MS. BRENNER-LEIFER: Objection, leading.

A. Yes.

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Q. Can we turn to Goldberg Exhibit 10. That's the Kuhn reference.

A. Okay.

Q. I believe Ms. Brenner-Leifer spent some time on the first page, page 716, and specifically the sentence in the second column, it is the second full paragraph, that says "The aim of this work is to show fatigue characteristics of superelastic NiTi."

Do you see that?

A. No. The second full paragraph?

Q. Yeah, full paragraph.

A. Oh, the second. I see it, yes.

Q. Do you see that?

A. Yes.

Q. Does the Kuhn article describe disclosing a superelastic nickel titanium file?

MS. BRENNER-LEIFER: Objection, leading.

A. Yes.

Q. Does the Kuhn article disclose subjecting such file to heat treatment

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which results in permanent deformation?

MS. BRENNER-LEIFER: Objection, leading.

A. Yes.

Q. Could you take a look at paragraph 718.

A. I'm sorry, you mean page 718?

Q. I do mean page 718. Thank you, Dr. Goldberg. And I would like to direct your attention to the paragraphs under Bending Tests.

A. Yes.

Q. Do you recall Ms. Brenner-Leifer asked you some questions about the second paragraph that begins "As can be seen from the curves, the samples deformed at room temperature recovered their original state"; do you see that?

A. Yes.

Q. Now, in Figure 6A, did the curves disclosed recover their original state?

A. The heat-treated ones do not.

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The unused ones do.

MS. BRENNER-LEIFER: Objection, leading.

Q. Now, in that paragraph, when it says, going back to the paragraph under Bending Test, "As can be seen from the curves, the samples deformed at room temperature recovered their original state."

I could refer you to paragraph 5 -- I'm sorry, to Figure 5.

A. Figure 5, okay.

Q. Do those curves recover their original state?

MS. BRENNER-LEIFER: Objection, leading.

A. Yes.

Q. Does that review inform your understanding of what that paragraph under the Bending Test heading refers to when it talks about the samples deformed at room temperature recover their original state?

A. Yes, I believe it refers to Figure 5.

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Q. Thank you.

Could we take a look at Goldberg Exhibit 11, which I believe is the McSpadden reference. Can I direct your attention to paragraph 52.

A. Okay.

Q. And specifically I want to direct your attention to the last sentence of that paragraph that begins, and I will just read it to you, "If desired, the formed endodontic file (i.e., subsequent to machining) may be further heat-treated and/or annealed in order to achieve the desired degree of superelasticity or other material properties and/or to set a desired file shape (straight, precurved or pretwisted)."

Do you see that?

A. Yes.

Q. How would heat-treating a superelastic NiTi file allow you to set a desired file shape?

MS. BRENNER-LEIFER: Objection, beyond the scope of direct. Objection,

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leading.

Q. You can answer.

A. It would allow the file to more easily permanently deform, and that's what you need to be able to bend and put in a shape.

(Goldberg Exhibit 19 marked for identification.)

Q. Dr. Goldberg, let me hand you what has been marked Goldberg Exhibit 19.

Do you recall you were asked some questions about Figure 6A of the Kuhn article, which is Goldberg Exhibit 10?

A. Yes.

Q. And I believe when Ms. Brenner-Leifer asked you where the profile file that was heat-treated at 400 degrees, something to the effect that showed permanent deformation, I believe you mentioned at the 1.5 millimeter mark?

MS. BRENNER-LEIFER: Objection to form.

A. Yes.

Q. Looking at the blown-up

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picture, does that help you identify where it hits the X axis?

A. Yeah. It is actually 1.8.

MR. GINSBERG: I have no further questions.

EXAMINATION BY MS. BRENNER-LEIFER:

Q. Dr. Goldberg, looking at Exhibit 19, in that bottom curve for the 400 degree heat treatment, do you see how that line extends to the left of 1.8 and there is a longer line going from 1.6, there is a point, there is a line from 1.4 to 1.2, there is another point indicating part of the line at 1 and there is another line extending all the way down to 0.6 and there is another residual point at 0.3?

MR. GINSBERG: Objection to the --

Q. Do you see that?

A. Yes.

Q. That is all part of the same line, right?

A. Yes.

Q. And they all are approaching

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zero, right?

A. No. They approach zero at 1.8. When you do this test, you are looking at the force and the deflection, and this would be in any of these sort of tests, it gets down to zero, you might stop the test there or you might continue it even though it is zero.

So I would interpret all those little bumps that you are seeing is that it is at zero, but they are just continuing to make readings along the way.

Q. But the millimeter --

MR. GINSBERG: Please let the witness finish answering before you interrupt him.

MS. BRENNER-LEIFER: He answered me.

MR. GINSBERG: He was continuing his answer.

A. The relevant point is where it hits zero, and that's at 1.8 in this blowup. So they are continuing to collect data. It is different millimeters, 1.6,

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1.4, 1.2, but it is all at zero.

Q. Right. When it's deflected at 1 millimeter, you are just releasing the force, right?

A. You are releasing the force from 8 millimeters.

Q. Right. And it is continuing to deflect lower than 1.8 millimeters, right? That line is showing that it is deflecting to below 1.8 millimeters, right? It is recovering its shape below 1.8 millimeters?

A. No, the test is continuing, but there is zero force, meaning it is deformed.

Q. No. The force here on the X axis --

A. Is zero.

Q. No. I'm looking at the X axis, X, that's the bottom.

A. Right, that's not force. That's millimeters.

Q. I know. That's the degree of deformation, right?

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A. Correct.
Q. And that deformation is going to continue going down, right?
A. It has reached zero at 1.8 and it stays zero all the --
Q. It is zero --
A. Zero --
Q. Zero Newtons?
A. Zero Newtons, correct.
Q. When there is no force applied?
A. Right. That means it is permanently bent at that point.
Q. There is no force applied anymore?
A. Right, because it is bent.
Q. And then the number is at 1.8 millimeters and then it is continued to be undeflected, right? That's why the line continues down lower?
A. No.
Q. That doesn't make any sense, that it continues down lower.
MR. GINSBERG: You are now being argumentative, and I would ask you

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to rephrase your question. I object to the form.
Q. Can you explain that to me, please?
A. I would be glad to.
So when you are doing these tests, it can be either driven by force or driven by the deflection.
So what's happening here -- if I can use, you know, my finger -- they deflected 8 and then they keep on bringing it back. At 1.8 there is zero force, meaning this is not pushing, meaning it's still out here, but they continued the test. So the values then become 1.60 Newtons, 1.40 Newtons.
Q. Right. As --
MR. GINSBERG: Please don't interrupt the witness as he is answering.
A. As the tests continue. But it is not the sample pushing against it. It is that you keep on running the test.
Q. Right. So the wire continues to unbend?

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A. No.
Q. You just did this (indicating).
A. No.
Q. We just saw your finger do this (indicating). That's the --
MR. GINSBERG: You are now being argumentative. You don't like the answers that you are getting and you are trying to trip up the witness. We are going to play this in court.
MS. BRENNER-LEIFER: Your objection is form.
MR. GINSBERG: I object to form and this is an inappropriate line of questioning.
MS. BRENNER-LEIFER: I am allowed to ask questions following up.
MR. GINSBERG: Not the way you are asking it.
A. I can say it again. The wire is bent to 8 and it keeps on coming back. But I'm now moving the dials on the machine and I'm reading -- I'm driving this by the number of degrees -- the

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millimeters deflection.
At 1.8, I'm at 1.8, but there is zero force, meaning the wire is not pushing. I keep on moving the instrument, 1.4, 1.6, it stays there because the wire is now in this permanently deformed position. It can't push anymore. It is just that I'm running this test down to 00.
Q. And isn't that wire continuing to move?
A. No. It is permanently deformed at 1.8.
Q. Then why are there marks below 1.8?
A. Because those are showing that there was no force -- they keep on monitoring back, turning back the millimeters, 1.6, 1.4, and they are recording zero, zero, zero, zero, zero, meaning no force, meaning the wire is not pushing anymore.
Q. But the wire is in that position, right?

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A. It is in this permanently bent position at 1.8. It stays there.
Q. There is a mark, aren't they not taking a measurement at 1.4?
A. They are, sure. Let's take 1.4.
Q. They are taking a measurement at 1.4?
A. Right.
Q. And that means --
A. It means there is zero force.
Q. And 1.4 means the wire is 1.4 millimeters deflected?
A. No, the wire stays back here.
Q. Then I don't understand what that measurement is of.
A. Well --
MR. GINSBERG: The witness just --
MS. BRENNER-LEIFER: You know what, I'm asking questions. You don't like my questions, that's too bad. You opened the box and showed him this, and I'm entitled to ask the questions. I will

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get to the answer -- I will continue to ask my questions until I understand it to my satisfaction.
Q. Now, these are fair questions.
Dr. Goldberg, explain to me how you can get a point measured at 1.4 millimeters deflection when you are saying there is not 1.4 millimeters deflection.
MR. GINSBERG: Objection to form. Asked and answered.
A. Let me try to explain, if I can, again. So I'm controlling the deflection on the machine with the device.
Q. I understand, you are controlling the force that pushes the wire.
A. No.
MR. GINSBERG: Stop interrupting the witness.
A. I'm controlling the deflection and I'm reading whatever force is there. So I turn it up to 8 and I measure the force in Newtons. I keep on turning it down, down, down, and I see the number

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going lower and lower and lower because the wire is pushing against what was holding it back and deflected it in the first place.
At 1.8 it is zero. So I'm holding it at 1.8 and there is zero force. What that means is the next increment that I take, there is zero force because the sample has stopped recovering. It stopped recovering. So I may run this machine all the way down to zero and take readings at 1.4, 0.8, 0.5, 0.3, but the force is zero because the wire is not pushing on it anymore. It stays in the position that it was at 1.8.
Q. Okay. I don't understand how it can stay in position 1.8 when you just told me it was moved to 1.4.
A. No, the wire wasn't, the instrument was.
Q. Wasn't the instrument moving it to 1.4?
A. No, it can't anymore because the wire is now bent. It bent -- going up

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it makes a lot of sense, yes, you are pushing it up. So here you are pushing the wire up. Now I'm controlling with my left hand the instrument coming down. It is coming down, coming down, coming down. The wire is bent at this point.
I keep on bringing the instrument back, and I can read 1.4, 1.6, 1.8, and it is always zero, zero, zero, because there is no force anymore, because the wire is no longer against the animal.
MS. BRENNER-LEIFER: You know, I can tell that you like his answers because you are nodding, but you are not testifying right now.
MR. GINSBERG: The witness is looking at you. I'm not even saying anything.
MS. BRENNER-LEIFER: I know. You are nodding to approve of his testimony, and I think that's wonderful for you, but it is inappropriate in a deposition to nod your head when the witness is testifying to indicate that you

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like his answers.
MR. GINSBERG: Look, I understand you don't like the answers here and you are very upset, but you should try to calm down and ask questions.
MS. BRENNER-LEIFER: You know, I'm not too upset. What I'm upset about is your inappropriate conduct during the deposition, because you know you are not supposed to be nodding your head when the witness says the right answer and shaking your head when you don't like the answer or you don't like the question. That is inappropriate.
MR. GINSBERG: Your conduct throughout today --
MS. BRENNER-LEIFER: And I really wish we had a camera on you, because you would be thrown out.
MR. GINSBERG: Your conduct today, you know, even in breaks, in speaking -- I don't need to put that on the record. All I could say is --
MS. BRENNER-LEIFER: No, you

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don't need to put anything on the record, because there is not a person in this room who hasn't seen your head bobble all day.
MR. GINSBERG: That is absolutely false.
MS. BRENNER-LEIFER: It is bobbling right now.
I'm done with my questions. Thank you.
THE WITNESS: Thank you.
THE VIDEOGRAPHER: This concludes today's proceedings. Total number of tapes used was eight. We are off the record at 6:02 p.m.
(Time Noted: 6:02 p.m.)

_____
A. JON GOLDBERG, Ph.D.

_____
Subscribed and sworn to before me this _____ day of _____, 2014.

_____
Notary Public

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EXHIBITS

DIRECTIONS NOT TO ANSWER

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(NONE)	

REQUESTS

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(NONE)	

CERTIFICATION

I, TODD DeSIMONE, a Notary Public for and within the State of New York, do hereby certify:

That the witness whose testimony as herein set forth, was duly sworn by me; and that the within transcript is a true record of the testimony given by said witness.

I further certify that I am not related to any of the parties to this action by blood or marriage, and that I am in no way interested in the outcome of this matter.

IN WITNESS WHEREOF, I have hereunto set my hand this 2nd day of October, 2014.

____
TODD DESIMONE

* * *

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CASE NAME: DENTSPLY v. US ENDODONTICS
DATE OF DEPOSITION: 9/30/14
WITNESS' NAME: A. JON GOLDBERG, Ph.D.

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A. JON GOLDBERG, Ph.D.

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OF____________,2014.

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