

Big Picture Podcast – Episode 15

The Chemistry of Braces (Chapter 8A)

Interview with Dr. Anoop Sondhi, D.D.S.

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Co-hosts John Suchocki, John Wright and Carolyn Wright interview Anoop Sondhi, D.D.S., inventor of the Sondhi Rapid-Set Indirect Bonding System, which has revolutionized the practice of orthodontics. If you've worn braces recently, then you've likely benefited from Dr. Sondhi's efforts. We begin with an overview of the chemistry behind his indirect bonding system. This is followed by a discussion of the challenges of developing and then promoting his invention. Duration: 19:47.

Carolyn: Welcome to the Big Picture podcast. My name is Carolyn Wright. I'm your host for today.

JW: And I'm John Wright. Your other co-host.

Carolyn: Today, we have the honor of interviewing Dr. Anoop Sondhi, orthodontists, as well as inventor of Sondhi Rapid Set Adhesion that has revolutionized the practice of orthodontics. In the olden days, orthodontic braces were bracket's, with bands that were cemented to each tooth. With Dr. Sondhi's approach and keen use of chemistry, the braces are now instead bonded to the outer surface of each tooth. Our dear friend of ours and mentor welcome, Dr. Sondhi.

Dr. Sondhi: It's a pleasure to be with you.

John: Thank you so much for joining us, Dr. Sondhi. What was your original interest?

Dr. Sondhi: Oh, a couple of things. My father had a dear friend who was an orthodontist and he was a very, very cool guy and I wanted to be like him and dad got me interested in the field and the interest never really abated. I like the science and I like the art portion of it. There is a certain visual element to what we do as orthodontists. I like very much being able to shape things for young people. I like to be able to correct things and help older patients who want that correction. And it is a combination of all those things that draws me to do what I do.

John: You find it a rewarding profession.

Dr. Sondhi: It is an extremely rewarding profession.

John: Uh, one thing that caught my attention and thought what you do is that you played a role in the development of an adhesive, not just the adhesive, but the procedure for braces that don't wrap as bands around each tooth, but braces that attach to the surface.

Dr. Sondhi: Mark COLVIN Yes, there has been a change over time where we used to put what word formerly referred to as railroad tracks, which were the metal bands that went around the teeth. That has since been replaced by braces that are attached directly to the outside surfaces of the teeth. It's the way that you attach the brackets to the teeth that is referred to as bonding. Now, this is bonding as in a mechanical mind. It's not it's not what in chemistry you might think of as a covalent man, for example.

John: Covalent non-ironic,

Dr. Sondhi: Yeah,

John: Not metallic,

Dr. Sondhi: Yeah.

John: But

Dr. Sondhi: It's

John: Just

Dr. Sondhi: A physical

John: Physical.

Dr. Sondhi: Bond.

John: Okay.

Dr. Sondhi: The reason I tell you that is that you can bond the braces to the tooth. The procedure called direct bonding, which is liberty to puts a resin on the bracket and then place it on the tooth. The version that I developed was called indirect bonding, whereby I can set the braces exactly the way I want them to end up on a patient's teeth on a model. And then we developed a procedure to transfer that through a transfer tray from the model onto the patient's teeth. That made the process much more accurate and much more efficient. But we had to develop a resin that was also designed for that purpose. The working time required is very different when you're trying to put 14 brackets on at the same time as opposed to just one.

John: Uh, so you have all those brackets going on to the patient's teeth like lower teeth

Dr. Sondhi: Yes.

John: All

Dr. Sondhi: All at

John: At

Dr. Sondhi: Once.

John: One time.

Dr. Sondhi: That

John: That's.

Dr. Sondhi: Is correct.

John: When you say indirect, that means it's attached to the tooth indirectly.

Dr. Sondhi: No, it is transferred to the tooth indirectly.

John: So you attach it

Dr. Sondhi: Onto a model

John: To

Dr. Sondhi: To

John: A

Dr. Sondhi: A

John: Model

Dr. Sondhi: Mom yesterday

John: And then from

Dr. Sondhi: From.

John: That it's going to fit the shape of that patient's teeth and a hand in glove.

Dr. Sondhi: Correct.

John: Ok.

Dr. Sondhi: And then the resin that is used to attach those braces to the teeth had to have properties that were consistent with that procedure. And that is the reason that we developed in that I

John: You mean

Dr. Sondhi: Had

John: Like

Dr. Sondhi: A pet

John: That,

Dr. Sondhi: Dog

John: Like the

Dr. Sondhi: That.

John: Timing it should set within so many seconds.

Dr. Sondhi: The timing, the viscosity it needed to flow a little more easily into some crevices. So it was a combination of the timing and the viscosity.

John: Once it's on the teeth, is there opportunity to tweak it? The positions a little bit? Or is it just worked so well on the model that it is pretty much on?

Dr. Sondhi: There is no need for having to tweak anything on the off chance that a bracket would be applied incorrectly. It is not a difficult matter to remove the bracket and repeat the procedure.

John: Can you talk about how it actually sticks?

Dr. Sondhi: Yes, if you look at the enameled surface on a tooth, it looks like a really smooth surface, but it is actually at a microscopic level. A series of enamored rods.

John: Rods facing out or vertical

Dr. Sondhi: Vertical

John: Or up.

Dr. Sondhi: Day, are you? If you are looking at the front surface of the tooth, you're looking at the top of the rods.

John: Oh, so if you had a bunch of straws, plastic straws in your holding in your hand and then you'd look through those straws like through window.

Dr. Sondhi: That's

John: That's

Dr. Sondhi: A

John: A

Dr. Sondhi: Very

John: Very

Dr. Sondhi: Good

John: Good analogy.

Dr. Sondhi: Analogy.

John: So. So they're coming out. They're coming out

Dr. Sondhi: They're

John: Toward

Dr. Sondhi: Coming

John: You.

Dr. Sondhi: At you

John: Oh,

Dr. Sondhi: Now.

John: No.

Dr. Sondhi: In between those straws with the visual that you just gave me are

John: Are.

Dr. Sondhi: In between the enameled rods is some further enamel material, but it is of a different degree of calcification than the enamel that's inside the rods.

John: Calcification, you mean the amount of calcium hydroxide appetite

Dr. Sondhi: Correct.

John: That's in

Dr. Sondhi: Correct.

John: There?

Dr. Sondhi: Because the bone is primarily calcium phosphate and so forth. So

John: So.

Dr. Sondhi: Because of the difference in the calcium content of the enamel rod,

John: The

Dr. Sondhi: The enamel

John: Enameled,

Dr. Sondhi: That's

John: The

Dr. Sondhi: In

John: Matrix

Dr. Sondhi: The matrix between

John: Between

Dr. Sondhi: The

John: The

Dr. Sondhi: Rods.

John: Lines. Yeah, that

Dr. Sondhi: If

John: Holds

Dr. Sondhi: The

John: The

Dr. Sondhi: Rods

John: Rods

Dr. Sondhi: Together

John: Together

Dr. Sondhi: Also

John: Also.

Dr. Sondhi: Correct.

John: Yeah.

Dr. Sondhi: If you then apply a 37 percent phosphoric acid solution

John: Phosphoric

Dr. Sondhi: For

John: Acid.

Dr. Sondhi: Yessir just for a few seconds, it

John: It

Dr. Sondhi: Will

John: Will.

Dr. Sondhi: Etch the enamel

John: Now surfeit.

Dr. Sondhi: Surface. And because the difference in the calcium content of the enameled rods and the matrix material, it will etch unevenly.

John: So wait, let me guess. In between the rods, it gets etched more.

Dr. Sondhi: You

John: You are

Dr. Sondhi: Are correct,

John: Right.

Dr. Sondhi: Sir. So now we have all these rods with the little divots, if you will, between them, which creates enough roughness it and it's a roughness at a very, very high microscopic level that the resin then fills those in and creates the mechanical bond to hold the braces onto the tooth.

John: Mechanical bond, so it's so Velcro, like Velcro is mechanical. You've got all the surface area, all these little hooks holding onto the nooks and crannies. So it's a there's a mechanical.

Dr. Sondhi: There is there is a certain similarity, there is unlike Velcroed, though, there are no moving parts.

John: But once it's adhered, I'm envisioning a glue that's just filling all these nooks and crannies, so has all the surface area of contact

Dr. Sondhi: Also correct

John: That is

Dr. Sondhi: That.

John: That strong enough to hold it against the forces needed to push the teeth?

Dr. Sondhi: It

John: It is.

Dr. Sondhi: Is strong enough not only to withstand the forces required to move heat. But this is strong enough to let the patient then function in a day to day basis, they eat and use frequently eat stuff. We even tell them not to eat

John: There's

Dr. Sondhi: This,

John: A lot of

Dr. Sondhi: Of

John: Force

Dr. Sondhi: Course.

John: The jock can apply.

Dr. Sondhi: And the reason is strong enough to tolerate that. There has to be a point where the resin can fail and that can happen. If a patient really abuse it. For example, if somebody starts crunching on ice cubes, you know,

John: Grunts

Dr. Sondhi: It's like crunchy

John: You know,

Dr. Sondhi: Rocks.

John: And

Dr. Sondhi: And the

John: The

Dr. Sondhi: Reason

John: Reason

Dr. Sondhi: That

John: That

Dr. Sondhi: That

John: That.

Dr. Sondhi: Happens is, frankly, the day comes that we have to remove the braces. So we

John: My

Dr. Sondhi: Need

John: Next

Dr. Sondhi: To be

John: Question,

Dr. Sondhi: Able to make it fail

John: If

Dr. Sondhi: Anyway.

John: I

Dr. Sondhi: I

John: Could

Dr. Sondhi: Give Elizabeth

John: Live the rest of

Dr. Sondhi: My

John: My life

Dr. Sondhi: Life

John: With

Dr. Sondhi: With these.

John: His

Dr. Sondhi: I

John: Eyes

Dr. Sondhi: Right.

John: Making

Dr. Sondhi: Making sure

John: Transparent.

Dr. Sondhi: That,

John: But

Dr. Sondhi: Ok.

John: Ok,

Dr. Sondhi: So

John: So they

Dr. Sondhi: They

John: Have

Dr. Sondhi: Have to

John: To come

Dr. Sondhi: Come

John: Off.

Dr. Sondhi: Off. And that happens by exceeding the bond strength that we expected to have during day to day activity.

John: You

Dr. Sondhi: Take

John: Take

Dr. Sondhi: A

John: A pair

Dr. Sondhi: Pair

John: Of

Dr. Sondhi: Of

John: Pliers

Dr. Sondhi: Pliers.

John: And pull.

Dr. Sondhi: We do indeed. We don't actually pull. There's a special pair

John: Blah, blah.

Dr. Sondhi: Pliers that

John: The twist

Dr. Sondhi: Gets between

John: Between

Dr. Sondhi: The

John: The

Dr. Sondhi: Bracket

John: Brown

Dr. Sondhi: And

John: And.

Dr. Sondhi: The tooth and bricks that an want.

John: It's

Dr. Sondhi: It's a

John: A

Dr. Sondhi: Solid.

John: Solid that's

Dr. Sondhi: That's correct.

John: A

Dr. Sondhi: A brittle

John: Brittle, a

Dr. Sondhi: Solid

John: Solid.

Dr. Sondhi: Also. Correct.

John: And do

Dr. Sondhi: Do you

John: You whack

Dr. Sondhi: Like it

John: It

Dr. Sondhi: A

John: A little

Dr. Sondhi: Little bit?

John: Bit and

Dr. Sondhi: Nope.

John: Then.

Carolyn: A

JW: A

Carolyn: Gentle

JW: Gentle squeeze

Carolyn: Squeeze

JW: On

Carolyn: On

JW: The

Carolyn: The

JW: Bracket

Carolyn: Bracket. And

JW: And it

Carolyn: It

JW: Just

Carolyn: Was projected

JW: Gently releases

Carolyn: Releases

JW: From

Carolyn: From

JW: The

Carolyn: The

JW: Tooth.

Carolyn: Tooth.

Dr. Sondhi: If I can explain it this way, the weakest part of the bond is its ability to tolerate a sheer force,

John: It's the sideways.

Dr. Sondhi: Right? So we have an instrument that gets under the BRACHT and provides that sheer force. Remarkable. Very gently.

Carolyn: It

Dr. Sondhi: It

Carolyn: Doesn't

Dr. Sondhi: Doesn't hurt.

Carolyn: Hurt.

John: But when was this developed?

Dr. Sondhi: The reason that I developed was developed in nineteen ninety nine.

John: So would you classify yourself as a chemist?

Dr. Sondhi: No, I'm an orthodontist. I worked with chemists with the R&D department of 3M. 3M is a company that has extensive experience with different types of resins and glues.

John: It he said those are the people who make Post-its

Dr. Sondhi: They make

John: Range

Dr. Sondhi: Everything from

John: From.

Dr. Sondhi: Postage to, you know, a number of products that you and I use that have some sort of adhesive component.

John: Scotch tape

Dr. Sondhi: So they had

John: Had.

Dr. Sondhi: The chemists in their R&D department who understood the properties that I needed in the clinic and were able to work with me to develop that resin.

John: Did you contact them or did they contact you?

Dr. Sondhi: I had been doing some consulting work for them. And so the conversation came up almost organically as a part of my work with them.

JW: You talked, Dr. Sandy, a bit about how the tooth is prepared to receive the bracket. But is there anything special that actually happens to the bracket material to prepare it to be attached to the tooth? In other words, is it rubbed against an abrasive or something to make it more coarse?

Dr. Sondhi: No. They bracket at the time of manufacturer will have one of two things in it. If it's a metal bracket, it will have a mesh back to it. So the mesh by definition provides a mechanical bond required for it to hear. If you see the newer pleader braces, those are generally ceramic braces.

John: Including

Dr. Sondhi: Literally made

John: Me.

Dr. Sondhi: With porcelain. And

John: And

Dr. Sondhi: In

John: In

Dr. Sondhi: Order

John: Order

Dr. Sondhi: For

John: For.

Dr. Sondhi: Them to attach to the resin, there is a prime layer off sailin that is put on the inside of the ceramic bracket. So the bond between the bracket and the resin, if it's a metal bracket, is a mechanical one. But if it is a ceramic bracket, it's actually a chemical bond because the method mithat relate, which is the foundation of the dental resin bonds to the siloing that is painted onto the underside of the bracket.

JW: Having worn braces just a few years ago, in my past, I remember those painful spacers you're tell me people don't have to wear those anymore. Wow. And people are wearing them braces for two and three years still. Or is it less?

Dr. Sondhi: It is way less than it used to be. Everything is so much more significantly efficient. A patient that might have been in braces for, shall we say, two years in the early years of my career when we were still using bands, that patient would today be in braces for maybe 12 tops, 14 months

John: I would say better

Dr. Sondhi: Living

John: Living history.

Dr. Sondhi: Here.

John: Sorry.

JW: New orthodontist that are in school learning the procedure, so is the indirect bonding method used almost exclusively now? Or is it one of two or three different procedures that an orthodontist has in his or her toolkit?

Dr. Sondhi: It varies a little bit, but most of the educational programs will teach both direct and indirect bonding. The doctors then tend to choose which they prefer when they end to practice. That said, there has been a steady increase in the number of people who want to use the indirect bonding procedure simply because it is more efficient and more accurate. It does require doing some extra laboratory work, and so some people don't want to do that, but for reasons that have to do with the advent of digital technology, where you can now literally simulate in a digital setup what the outcome of your alignment with braces will be. That is a steady move towards incorporating Indrek Bonnie, because it just works better with digital technology. We are also now just seeing the advent of 3D printing. There's only one company so far. The ad has started this, but others will move in this direction because they are going to make it possible to liberty

Carolyn: We

Dr. Sondhi: 3d

Carolyn: Used

Dr. Sondhi: Print your own braces in your own office.

Carolyn: Dr. Sandy, I know this technique is being used here in the United States pretty extensively. What about abroad? What about other countries?

Dr. Sondhi: All over the world. When I first developed this, I wrote an article that was published in the American Journal of Orthodontics, introducing everybody to the procedure and the reason that I had developed. The second thing is, of course, as your work becomes known, then other people want to learn by inviting you to speak at conferences, teach, continue education courses at universities and so forth. Then over the last 20 some years, I have taught courses in 64 different countries. There's been all over the world. The Third Avenue, of course, is through the videos. Now everything is accessible. Our videos are available on YouTube and so forth. So people learn these procedures in different ways. But yes, it is something that is used in a rather significant number of orthodontic offices around the world.

Carolyn: So back in the 1990s, when you started using this technique, did you find any resistance from your from your colleagues?

Dr. Sondhi: Oh, certainly we had to prove it. I had to publish case reports. We did studies to demonstrate the efficacy of the material. The bond strengthened the material. So we wrote several scientific articles. Basically, we also got lucky in that some people around the world, especially some orthodontic programs in the United States and also in Germany, used this material for a number of studies that were published. So it's over time its efficacy got established. But yes, there's always resistance to the beginning because people are used to doing things a certain way and they want to have a really persuasive reason before they would change

John: But

Dr. Sondhi: The.

John: About how many years would you estimate it was, would you say that reluctance lasted? Was it like just a year? Five

Dr. Sondhi: Always

John: Years?

Dr. Sondhi: Closer to those of two to four years before we overcame that.

John: Mm hmm. And it was a lot of effort, evidence, testimonies

Dr. Sondhi: All

John: Of.

Dr. Sondhi: Of the all of the above. It was primarily publications and journals. You have to publish verifiable data in peer reviewed journals. And then I had to lecture and show the effectiveness and treatment. Orthodontics is a highly visual specialty. What orthodontists want more than anything else is to see your stuff on a screen so they can analyze it and they want to see consistently well treated cases to do in order to believe what you're telling them.

John: You talked about 3D printing earlier. Was that 3D printing of the braces themselves?

Dr. Sondhi: That's just starting. It is not a well-established procedure yet does I think I've mentioned there's only one company that has been touting that they have the ability to give you the software whereby you can design what type of braces you want to put on the patient's teeth and print them in your own office.

John: What material is being printed on?

Dr. Sondhi: Oh, primarily the same acrylic that's used for printing.

John: Acrylic,

Dr. Sondhi: Correct.

John: Correct? Okay.

Dr. Sondhi: Ok.

John: And that has the tensile strength to

Dr. Sondhi: So

John: Lately.

Dr. Sondhi: They claim

John: Yeah.

Dr. Sondhi: We don't know that yet.

John: Okay.

JW: Hence,

Dr. Sondhi: Hence

JW: The

Dr. Sondhi: The

JW: Resistance

Dr. Sondhi: Resistance,

JW: To

Dr. Sondhi: Hence

JW: Change

Dr. Sondhi: The Resistance

JW: The.

Dr. Sondhi: To Change Act.

John: Do you have other passions in your life, aside from the Daintree?

Dr. Sondhi: Yes, I do. I happen to be a pilot. I am very interested in aviation. And I have been flying for thirty six years now and I would say have been a very serious pilot. I haven't pursued it just as a weekend hobby. I have a commercial pilot's license. I'm certified

John: Certified

Dr. Sondhi: To

John: Flight.

Dr. Sondhi: Fly jets and I have an airline captain's rating.

John: Wow. What advice would you have for today's student?

Dr. Sondhi: You know, it is frequently said that if you find work that is enjoyable to you, then you won't feel like you're working very hard for the rest of your

John: Life

Dr. Sondhi: Life. And

John: Noticed.

Dr. Sondhi: That is true. I think it is critically important that, one, be passionate about what you are doing, because otherwise it gets harder and harder to get up in the morning and convince yourself to leave home and go to work. So you have to have a passion for what you are doing. But the reality of life being what it is, you have to be able to monetize that passion

John: You

Dr. Sondhi: And make

John: Make a

Dr. Sondhi: A living

John: Living.

Dr. Sondhi: And provide for family and do all of those things. But there is a particularly good reason to believe that if your passion for something is profound enough, then the monetizing becomes easy. And I say that simply because I have seen young people who chose a profession primarily because of their ability to monetize. And by the time they were, shall we say, 40 years old. That is no longer a satisfaction. So I think it would be unwise to approach life with rose tinted glasses. But if you had to choose between the two, stick with the passion, because monetizing a passion is a heck of a lot easier than being able to monetize that and have no passion left to go for it.

John: Dr. Sandy, thank you so much for joining us here at the Big Picture podcast.

Dr. Sondhi: It's

John: It's been.

Dr. Sondhi: Been my pleasure. We learned some things. Oh, that's

John: Great

Dr. Sondhi: Crazy.

John: Athlete, we.

JW: Pretty.

Dr. Sondhi: Oh.

John: Our theme music by Zach Jefferey. Musical Flourishes by Patrick Wright on jazz guitar, Scott Pazira on Bass and Carrington Clinton on Drums. Production Assistance from Greg Simmons and CPro Music. Our special thanks to Anoop Sondhi, inventor of the trademarked Sondhi Rapid Set indirect bonding system used by orthodontists worldwide. For show notes and more, please visit conceptualscience.com. A note of appreciation to all instructors using conceptual academy. Thank you for your support. And to the hardworking student. Thanks to you as well for your learning efforts, which we see as the path to making this world a better place. Good chemistry to you.