Three-dimensional “technologies are going to become the standard of care”

Interview with Dr Sean K. Carlson

By Nathalie Schüller, DTI

Dr Sean K. Carlson is Associate Professor of Orthodontics at the University of the Pacific’s Arthur A. Dugoni School of Dentistry in San Francisco and maintains a private practice in Mill Valley, both in California in the US. Carlson is also a senior investigator in the Craniofacial Research Instrumentation Laboratory at the dental school. He lectures nationally and internationally and teaches at the Instrumentation Laboratory at the University of the Pacific’s Arthur A. Dugoni School of Dentistry. He lectures nationally and internationally on a variety of clinical and theoretical subjects, with a focus on 3D imaging in orthodontics. His primary focus is on using computer technology to improve the way we study, teach and practise orthodontics. During the Spring Meeting of the European Aligner Society, which took place in Venice in Italy from 29 to 30 March, Carlson shared some of his thoughts on making the change to 3D technology in orthodontics, the use of clear aligners and treating sleep apnoea.

Why did you choose to specialise in orthodontics? Did your need for creativity have anything to do with your choice?

Of course! Orthodontics is incredibly creative, and I think, depending on the type of orthodontist you become, you can express that creativity in ways that are difficult in other careers. I’ve always liked the idea of healthcare; I am very altruistic in nature and like to help people; so all fitted very well in choosing orthodontics. It is a very clean profession in healthcare; your patients are not truly sick, but you are helping them with your engineering skills and spatial relationships. It was very much interested me; so it all came perfectly into place with my personality traits and I’ve never found anything more interesting.

What do you mean when you say that depending on the type of orthodontist you practise you can express your creativity better?

I think there are both creative and non-creative orthodontists. Some people follow the rules, follow what was done before and never think for themselves and in doing so, just repeat what’s been done. That’s fine but is not going to push the specialty forward. If you are going to be creative, your job is to find the next level, find the horizon, and not everybody wants to do that because it is challenging.

You spoke about altruism being important to you. How can we apply it in orthodontics?

Giving back is essential and I think you should do it at every opportunity you can, but I think value in delivering service is important. Doctors tend to think that caring is about providing free treatment. That’s not fair. Human relationships are about exchange. If you are expected to give with nothing in return, people won’t value what they are receiving. I have no problem with the cost of something, if it has value to you, I think the cost is worth it. That does not mean you should ignore people that are less fortunate, so I love programmes that help patients who can’t afford the treatments.

Dr Melissa Shotell in her presentation stated that only 20 per cent of dentists use CAD/CAM technology and Dr Adriano Marotta Araujo that only 10 to 20 per cent use aligners. Three-dimensional technology is at the core of your treatments, possibly your teaching and research too. Why do you think so many dentists do not use these amazing technologies, and how could we change that?

There are two major reasons people don’t use them: cost and experience or the lack thereof. They either don’t want to pay for it, which brings us back to our discussion about service with orthodontics. Even if the technology is great, such as a 3D CAM/ CAM camera or a CBCT device, if you think it is overpriced, you will find any excuse not to use it. So, the challenge with these new types of technologies is that people don’t understand the value until they have paid the cost to own them. Once you get into new technologies and you realise you can’t live without them, then the price does not matter, but getting people to that point is very hard.

The other reason is the learning curve of these new technologies. You either do it using CAD/CAM to produce crowns using 3D milling machines or using impression-free imaging, if a CBCT, for instance, is hard to use them is difficult; you need practice and it’s hard work. Many orthodontists or careers are not comfortable; we have a very good reputation, we have a very good name, and I think we are just using the excuse to avoid pushing through the pain, and it stifles our progress. But there are always going to be doctors who understand that pushing through that pain ceiling to come to a better is a constant pursuit in daily practice. And if you do that, you adopt these new technologies very quickly and end up being on the leading edge of technology.

These technologies are going to become the standard of care; there is no question about it. It is just going to take a generation or two to happen.

Since you teach as well, you’d be able to say whether I’m correct in surmising that the next generation does not plan to have a practice without 3D technologies, right?

There is no question that my students understand these types of technologies ten times better than a seasoned orthodontist who is 50 years old and has a really hard time adapting to new technologies because he or she, like the rest of us, is really comfortable and doesn’t want to feel pain. The young doctors understand this and are very eager. The challenge for them is cost because they are fearful of not being able to afford things. I think that the young students who understand that this technology is necessary will thrive, but the students who are focused on the cost issue will end up stalling their practice growth and be five years behind the ones who use it. So, a lot is about fear. The main answer to your question is that people are scared and it is a hard nature; we don’t like change, whether it is where you live, or in your relationship or career. Anything that is unknown is scary and hard. By nature, human beings can’t like pain, so that’s what’s keeping people behind.

There are nowadays many companies on the market, and competition will drive the price down, don’t you think?

Yes, that is one answer but not the...
real answer. Bringing costs down is not the way to solve fear. An example is CBCT. When I got into it, almost 15 years ago, it was very expensive and there was no education available—it was like diving off a cliff. My first CBCT machine cost over US$200,000 and that was a lot of money! You can now get a machine for much less, so yes, the cost will always come down as technology advances, but seeing something that offers so many new possibilities, that insight, as happened for me when I first saw what CBCT could do, meant I could not go back; I had to have it. The value overcame the cost, I could not practise consciously and not have that because I knew it was out there and how it could improve the treatments and care I was giving my patients.

Aligners are not suitable for every-one. Can you tell me when you do not see them as a treatment possibility, and if you use them as part of a hybrid treatment plan?

My practice treats children exclusively—a conscious decision I took four years ago when I decided to commit to what I was really good at and really loved, which is building faces and young bites that are healthy and will last a lifetime. My practice treats children exclusively—a conscious decision I took 12 years ago, it was very expensive and there was no education available—it was like diving off a cliff. I do a lot of developmental treatments and care I was giving my patients. The value overcame the cost; I could not go back; I had to have it. I could not practise consciously and not have that because I knew it was out there and how it could improve the treatments and care I was giving my patients.

I do a lot of developmental treatments, a lot of two-phase treatments. Therefore, I have very small inter-ventions, often in children aged 7 to 10, in which we develop facial bones, correct jaw width and allow the dentition to erupt quite straight. Cleaning that up with conventional fixed appliances to get a perfect occlusion is what we do in our second phase, which usually happens around 12 years old. Conceptually, you can do that with any appliances, so it does not matter if one uses lingual or labial appliances or aligners, it is just about knowing what your goal is and how to get there, and making sure to evaluate your results to get to a result that is good and stable. Therefore, as long as you are paying attention, you can use anything. Personally, I do not use aligner therapy a lot simply because what works well in my prac-tice is conventional labial appliances, which are on for very short periods. For my practice model, it is very efficient and the only reason I do it that way. I think someone can have a practice exactly like mine and do it with aligners completely, it is just not what I developed. If I wanted to switch my practice to aligners, thought that it is that much better than what I am doing, I would push through the pain we talked about before and do it. But I don't yet see someone getting results that are remark-ably superior to what I am doing, results that I cannot achieve with the way I work. Okay, but do you use them in par-ticular cases or in combination with conventional fixed appliance-s? Do you see that one day they will replace conventional appli-cances?

Much depends on the area where you live and the demand for it. In my area, a very wealthy community with much depends on the area where you live and the demand for it. In my area, a very wealthy community with a lot of discretionary income and high education, and because I treat children, the demand for aligners is not as high. Will conventional fixed appliances ever go away completely? Maybe, but I think that because there are still certain challenges with aligners, conventional brackets are slightly better at certain things. I just don't think it is going to be an all or nothing game; it just depends on the type of practice you have.

In your presentation, you spoke about a 91 per cent decrease in the apnoea-hypopnoea index with maxillary expansion and removal of adenoids and tonsils. Is it a possible solution to snooring for both children and adults?

If you identify and can remove those tissues, it is beneficial. I think that, at least in the US, adenoids and tonsils are largely overlooked now compared with the 1970s. I believe in the late 1970s or early 1980s, a study had come out stating that recurrent infection was not a reason to remove adenoids and tonsils, so doctors de-cided not to do it anymore and insurance didn't cover it so readily. What they did not know at the time was that all these breathing issues were also related to obstruction in the sleep area. If you identify and can remove those tissues, it is beneficial. I think that, at least in the US, adenoids and tonsils are largely overlooked now compared with the 1970s. I believe in the late 1970s or early 1980s, a study had come out stating that recurrent infection was not a reason to remove adenoids and tonsils, so doctors de-cided not to do it anymore and insurance didn't cover it so readily. What they did not know at the time was that all these breathing issues were also related to obstruction in the sleep area.

Does expansion or adenoid and tonsil removal cure sleep apnoea? No, it is a very complex disease. We do a lot of early expansions in my practice, called rapid palatal expansion, which is a natural distraction of the maxilla, to improve the width of the maxillary bones, and this is now also done more commonly on adults, using temporary anchorage devices to produce larger maxillae. There are many studies in the lit-erature that show an increase in up-per airway volume with maxillary expansion, so physically, you create a larger airway space. That does not necessarily correlate with curing sleep apnoea. For some patients with a structural issue, it improves their sleeping quality tremendously and sometimes you can eliminate intra-oral appliances.

If you can benefit many patients and understand that you won’t cure or benefit all patients, then I think it is an important thing to do. I think what is happening, at least in the US, is that people are trying to make it an all or nothing argument. They either want to know that it definitely works and cures everybody, or it definitely does not work. The problem is that, it is never that easy. Biology, health-care and medicine are never that easy. Getting a study to tell you one way or another is not how research works, you are never going to get the answer from one study, but people want black and white.

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Treatment of a moderate to severe Class II malocclusion using Invisalign® treatment with mandibular advancement—a case report

By Dr Donna Galante, USA

Introduction

Minimizing the use of elastics in Class II treatments not only addresses a patient compliance concern, it also addresses a treatment efficiency concern. The vertical force component of Class II elastics tends to extrude teeth, which redirects mandibular growth in a vertical direction and makes the A-P correction less efficient. Avoiding clockwise rotation of the mandible (i.e., downward and backward) helps to keep mandibular growth along a horizontal trajectory in order to maximize the sagittal change.

Case Report

Patient information:
- 14 years old
- Male
- Chief concern: overbite and crowding

Orthodontic diagnosis:
- Right side: Class II molar and canine (moderate)
- Left side: Class II molar and canine (severe)
- Overbite: severe deep bite
- Upper arch: moderate crowding, with retroclined incisors
- Lower arch: moderate crowding

Invisalign treatment with mandibular advancement utilizes integrated precision wings to advance the mandible without the use of interarch elastics. The precision wings in the lower aligners position the mandible forward by sliding against the precision wings in the upper aligners. At the same time, the active portions of the aligners straighten the teeth and coordinate the arches to remove interarch interferences and stabilize the sagittal changes. This approach maximizes the horizontal component of the mandibular advancement and minimizes unwanted vertical changes.

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Intraoral view of Invisalign treatment with mandibular advancement

5-month progress records (weekly aligner changes)

End of mandibular advancement phase (12 months, U: 23 + 26; L: 23 + 26; weekly aligner changes)

Final after an additional aligners phase of U: 25 + L: 25 aligners, changed weekly (10 months total)
**Ortho Tribune**

- Total treatment time: 22 months
- Mandibular advancement aligners: not used in this case (see discussion)
- Mandibular advancement aligners: U 23+26, L 23+26, changed weekly (22 months total)
- Additional aligners: U 23+26, L 23+26, changed weekly (10 months total)
- Retention: Invisalign retainers 16 hours a day for 6 months, then at night for life

**Discussion**

Removing anterior interferences was important for maximizing the correction of the sagittal dimension, and expansion of the upper arch was critical for preventing posterior crossbites from forming as the mandible came forward. When the upper arch is constricted, the posterior teeth are unable to interdigitate fully due to prematurity posterior contacts as the mandible advances. Widening the upper arch form removes these interferences so that the lower posterior teeth can finally seat against the upper teeth. By doing this, mandibular plane divergence is avoided, and the horizontal component of the sagittal correction is maximized. The deep bite is also improved when the mandible is advanced downward and forward.

In the additional aligner phase, the goal was to continue leveling the curve of Spee by intruding the lower incisors. Anterior interferences after Class II correction can lead to a mild posterior open bite. By intruding the incisors to remove these interferences, interdigitation of the posterior teeth is restored.

To help stabilize the A-P correction during additional aligner treatment, the patient wore Class II elastics (4oz., 5°/8° diameter) connected to precision cuts in the aligners near the upper canines and lower first molars. Elastics were worn for 10–12 hours a day (typically at night only), for 3 months.

The sagittal improvement and the amount of upper incisor torque achieved, were both good (AANB = -1° and A-PN = -4°, respectively). The final upper incisor position was essentially pleasing, but slightly under-torqued relative to orthodontic norms (U1-SN = 92.8°), theoretically pleasing, but slightly under-torqued (∆ANB = -3.5° and ∆U1-SN = +10.0°, respectively).

General superimposition (cranial base at sella) shows mostly downward maxillary growth, with the mandible moving downward and forward.

**Maxillary superimposition shows that positive upper incisor torque was achieved.**

Three key take away points:

1. The precision wings feature of Invisalign treatment with mandibular advancement product maximizes the horizontal component of mandibular advancement while minimizing the vertical dental component typically associated with the use of Class II elastics (which tend to extrude the anchor teeth). As a result, excellent vertical control during Class II correction can be expected.

2. Any retroclined upper incisors need to be set up with proper inclination (positive incisor torque) in order for the mandible to advance into a stable Class I relationship. This can be initiated early in a premandibular advancement phase of aligner treatment if needed. Excessive lower incisor proclination should be avoided, since anterior interferences will limit how far the mandible can come forward.

3. Transverse problems should also be addressed early with a premandibular advancement aligner phase. The crowns of the upper molars and premolars (and often times the canines) should be uprighted buccally to properly coordinate the arches while the lower arch is moving forward into a Class I relationship. If the clinical crowns are short, additional attachments can be added to the setup to improve aligner retention during arch development.