Tooth wear, the Dahl principle, the Inman Aligner and a real option for interceptive dentistry

Dr. Tif Qureshi discusses a different way of looking at preventative occlusal treatment through alignment and bonding

Figure 1. Patient A before treatment showing inter-canine collapse and crowding.

Figure 2. Immediately after alignment and bonding.

Figure 3. Six years with retention post-treatment.

Figure 4. Patient B before treatment.

Figure 5. Following alignment and increase of inter-canine width.

Figure 6. Patient C in occlusion with deep bite. Note the posterior contacts.

Figure 7. Patient in occlusion with Dahl composite added to lower anterior teeth. Note posterior contacts in contact at 3 months.

Figure 8. Occlusial view before.

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In my opinion, simple anterior orthodontics has been overlooked for many years as potentially one of the most important and useful areas in dentistry. This can be highlighted by the suggestion that many dentists simply do not identify or recognize that the increased crowding in the anterior region over time can lead to, or is linked to, a collapse of lower inter-canine width that can then lead to loss of canine guidance and the development of group function with the potential issues that can sometimes cause. This loss of guidance can happen in a relatively short period of time as the canines lose their protective function once they tip inwards. It is likely a combination of factors lead to this but there seems to be very little data collected, however this is a phenomenon that is clearly visible when examining many patients every single day. If we think forward when looking at a case such as that featured in Figure 1, several problems could start to potentially develop over time.

Firstly, the crowding could worsen, leading to increased risk of periodontal disease. The likelihood of differential tooth wear is also increased as the teeth crowd further. Areas already worn down are more likely to wear faster because of the softer nature of the sub-surface enamel. Exposed dentine is also likely to stain more as open tubules are likely to allow inorganic material to penetrate the enamel over time, commonly causing intrinsic staining. If the canines continue to tip inwards, there will be a loss of canine guidance that might well cause the transition to group function which could become traumatic if not monitored (and possibly treated). Many patients left untreated eventually need large amounts of work, up to and including full mouth dentistry. So if patients are in situations where a lower crowding is starting or has started, surely it makes sense to align the lower teeth, upright the canines and then apply retention to ensure this is less likely to relapse (Figures 2 - 5, Figures 4 and 5 show another case).

When aligning and with an alignment as a resultant increase of inter-canine width.

If the edges are already worn, it is also possible to restore the tips to seal the exposed dentine and improve aesthetics. In cases with more extensive wear, this can be combined with the Dahl principle where space can be reclaimed by opening the anterior bite, desensitizing the posterior teeth and allowing the posterior teeth to over erupt and the anterior to intrude a little.

The Dahl principle

Modified Lucia jigs have been used as deprogrammers to reverse the mandible find centric relation (CR). Direct composites can also be used as an anterior deprogrammer. Resin compositions - because of their resilience and ease of use and wear in small thicknesses - represent an ideal material to restore the palatal surfaces to the worn lower anterior incisal and canine edges too.

Dahl (1973) suggested creating space to treat localised anterior tooth wear by separating the posterior teeth using an anterior bite plane for 4-6 months. A combination of passive eruption of the posterior teeth and intrusion of the anterior teeth allows the re-establishment of posterior occlusion while holding the anterior space. Dahl actually uses, they can wear but to separate the posterior teeth, but we can now achieve the desired outcome with adhesive anterior direct composite. By identifying the difference between maximum inter-incisal position and CR, using pressure to gently guide the mandible, the position of the direct composite can be set slightly posterior to maximum interincisal position. This will create anterior contact on the incisal edge build-ups and possibly create premature contacts on the posterior teeth. These premature contacts can be equilibrated to improve the occlusal contact, but the residual space will eventually close through passive eruption over a few months. I have used this principle for over 15 years on over 500 patients.

During the “cosmetic boom” years, virtually every single veneer case I placed on the upper teeth had composite tip build-ups on six to eight lower anterior teeth to treat any wear and re-establish guidance before fitting the upper ceramics. I used up to 2.5mm of composite anteriorly and this seemed to cause a combination of extrinsic and possibly intrusional anterior teeth. I rarely ever placed ceramic directly on the anterior teeth to improve aesthetics and function with non-invasive composite. Dahl's principle is not to use it on anterior teeth to treat any wear needed to be allowed to allow the teeth to align. Space calculations can be carried out by using von Dranek's technique, manually or using a digital space calculator, such as Spacesize. These space calculations are an excellent way for clinicians to visualize how much actual crowding there is and exactly where the teeth need to go as this becomes a perfect prescription for the lab setup.

The width of only one tooth needs to be measured to set up the program will use this for calibration. The dentist simply then places the tips on the teeth done by a single click that measures the mesial-distal width of each tooth being moved (known as the required space, or “the teeth”) and then the program allows a curve to be intuitively set up that follows the line of the ideal curve (known as the available space for the curve). The curve needs to be set to improve the landmark teeth - meaning teeth that are well placed occlusally and aesthetically. This will prevent the teeth from being flared out and ensure correct occlusal control. The program then does the sums and subtracts the required space from the available space. This figure is the amount of crowding present and hence the amount of space that might be needed. In my experience, most adults have some degree of differential wear. After alignment, I rarely grind teeth to level them off as this is clearly destructive and will only lead to reducing guidance and increasing posterior interferences over time. Instead, I nearly always build and open the bite anteriorly with composite and induce the Dahl effect. Those treating adults with orthodontics must be able to re-build the tooth structure or co-plan with a restorative dentist to ensure the patient's guidance is protected.

The patient wanted an Inman Aligner as she wanted her teeth to align quickly and also to be able to wear the appliance for periods at work. We also quoted for eight composite tips to improve the aesthetics, treat the deep bite and induce the Dahl effect to establish better ante-
The Treatment
Her Inman Aligner treatment took 10 weeks with three sessions of IPR, and a further 0.13mm of adjustment per tooth per appointment.

This staged IPR approach is far safer than performing all of it in one go, as often less IPR is needed than expected. It avoids excess space formation and the destruction of contact point anatomy, which is so often seen when IPR is done all at once. Anatomically respectful IPR should be performed by anyone creating space to move teeth.

The patient was also instructed to remove the aligner for at least four hours a day.

At seven weeks, the patient started whitening with Zoom! DayWhite (Philips Oral Healthcare) when not wearing the aligner. Whitening can be highly effective if the right instructions are given to the patient. Dry teeth will whiten better, so we not routinely tell patients to swallow, then suck air over their teeth before the tray is inserted.

This is something I have done for the last couple of years and it has made whitening far more predictable and the results have been consistently better.

A short-acting hydrogen peroxide gel that requires only 45-minute application each day is ideal. With sealed rubber trays, it does not matter if the teeth are still aligning. After eight weeks, they are usually 60-75% aligned. The tray will still fit at the end, but, of course, a new tray is made over the composites and wire retainer. Performing whitening in this way adds massive value and reduces chair time and, of course, can only be done with removable braces.

You cannot, and should not, use short-acting concentrated gels in rigid clear aligner trays as they are not sealed and the gel will contact the gum line. Lower percentage materials are indicated.

At 12 weeks, the composite tips were removed in one go. It is quite possible to have your technician construct a wax-up of the proposed outline. It is also quite possible to do this with articulated models and a wax-up. You can then use a putty stent to help you create an accurate outline.

Note how upper alignment has improved on its own by just aligning the lowers correctly.

Personally, I have always preferred to build free-hand. I try to visualize the original anatomy of the teeth before they were worn. The new initial contact position is posterior to maximum intercuspal position. Very minimal feather preps were used to literally just roughen the bonding surface. The teeth were then etched, bonded and an initial outline of the load bearing areas were built up with a nano-hybrid composite.

A dentine shade, then an incisal enamel shade, is layered over. The composite is then polished back with fine burs and smoothed with Soflex discs and Pogo rubbers.

Eight composites were placed in this way. They were built-up using different amounts but in a way that aligned the incisal outline and that opened the bite on the anterior teeth. It was important that their contacts are fairly even but with more load on the canine and premolar and a long centric contact on the incisors. At this point, the patient’s posterior teeth were discluded and a visible space was present.

The patient continued to wear her Inman Aligner and an impression was taken for a jig that would hold a stainless steel retainer to be fitted next time.

A bonded retainer was fitted to the lingual surface from canine to canine and the patient was instructed on the use of interdental brushes.

The results
The patient was seen after 5 weeks to ensure there were no premature posterior contacts. On return after a few months (Figure 6), it was noted that the posterior teeth were now in full contact again. Lateral excursio showed good predictable guidance and anterior guidance was also now completely discluding the posterior. Whether this has happened due to passive eruption, anterior intrusion or even some re-positioning of the condyle can be argued. The point is that the patient’s deep bite was reduced, her occlusal symptoms disappeared and the aesthetics had massively improved. She had improved canine and anterior guidance and, one year on, she has had no issues, chips or even stains.

A potentially difficult treatment plan turned into a simple non-invasive technique and the photographs show a pleasing result. The patient reported an improvement in symptoms. However, we always give the patient a bite guard to wear in case of periods of bruxism.

Conclusion
We have all read articles showing cases like this that eventually end up prepped heavily for ceramic restorations. Patient like this left untreated long term will become more worn and eventually might need full mouth or extensive treatments. While I certainly cannot profess the Dahl principle to be the answer to all occlusally compromised cases, I suspect that with the recent trend towards non-invasive treatments and rapidly rising litigation, this kind of less destructive solution might become more popular.

The key is to pick up on likely candidates early and treat them with alignment and bonding or just bonding to help prevent wear in later life. In my opinion, if patients knew the benefits and the problems they could save themselves from, there would be millions of potential candidates for this kind of treatment.