What do the teeth say?


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As students, we are all taught to listen to reputable teachers and read the right literature. Then as clinicians, we need to listen to our patients and their parents. But do we ever listen to the teeth we are moving? Do we ever get the messages that the teeth are trying so hard to tell us?

One who did was Dr P. Raymond Begg. He began as a humble sheep farmer and graduated with the B.D.Sc. (Bachelor of Dental Science) degree of Melbourne and the L.D.S. (License in Dental Surgery) Diploma of Victoria, Australia. He attended the prestigious Angle School of Orthodontia in 1924 and 1925, where he became one of Edward H. Angle's favorite pupils. He had seen the abandonment of the narrow occlusally accessed ribbon arch bracket in favor of the edgewise bracket with its horizontal slot and labial access. This alleviated the difficulty of contouring the ribbon archwires to the malocclusion and then progressing them, with annealing and heat treatment, at each subsequent visit. Angle[1] boldly claimed that his invention was "the latest and best" and openly said that it would make it possible for even "very poor orthodontists" to treat patients.[2] This enabled edgewise archwires to be preformed to ideal shapes before treatment, with individual teeth progressively ligated and aligned until full engagement was achieved, usually with expansion. The edgewise format also provided improved rotational and second-order tip control.

However, Begg noted that relapse occurred in most of Angle's expanded patients, who were almost invariably treated without extractions; if extractions were necessary, the subsequent translation of the teeth was fundamentally hampered by the imposition of bodily root control. Begg was not alone in listening to the teeth. Dr Charles H. Tweed used to teach his students that "anchorage preparation," by positioning mandibular molar and premolar apices mesially, provided excellent resistance to Class II intermaxillary traction (Personal communication from Dr Raleigh T. Williams to R. C. Parkhouse; November 9, 1993), and Angle himself came to recognize this. It was an acknowledgment that attempting to move a tooth apex first generates maximum resistance. Begg[2] recalled that by 1929, some orthodontists were already angulating brackets to eliminate second-order bends.

Begg therefore reverted to a modified (inverted) version of the narrow ribbon arch bracket of his own design, accessed gingivally, with the archwire retained loosely with small brass pins. Inevitably, some rotational control was lost with the thin, high-tensile stainless steel archwires used at the start of treatment, but because the bracket itself had no root torque capability, it gave the teeth freedom to "talk" by tipping. He quickly understood that his "light-wire technique" made it possible to move individual teeth, or even groups of teeth, with extremely light forces that had been previously unimagined. With his specially manufactured ultrahigh-tensile fine wires, he could also generate anchorage resistance in the mandibular first molars by inducing gentle mesial root movement. This frequently proved sufficient to balance reductions of large overjets by means of light Class II intermaxillary elastics without recourse to headgear.

A further bonus was the dramatic ease with which deep overbites could be reduced when the teeth were allowed to tip. Also, anterior bite opening could proceed right from the start of treatment, irrespective of canine angulations, which with edgewise slots tend to deflect the archwires incisally.

Inevitably, tipped teeth require subsequent uprighting and torquing, which Begg decided to tackle with light auxiliary springs and torquing spurs against heavier main archwires, in which he was later much aided in developments by H. D. Kesling and his son, Peter C. Kesling (coauthor of this article). However, without rectangular archwires, molar control needed a watchful eye. Also, the brackets were not self-limiting and carried no preangulations.

After Begg published "Differential force in orthodontic treatment" in 1956[3] and demonstrated the results during

Am J Orthod Dentofacial Orthop 2015;147:S191-4
0889-5406/$36.00

http://dx.doi.org/10.1016/j.ajodo.2015.02.013

courses given at the Kesling & Rocke Orthodontic Center, Westville, Indiana, the orthodontic world was compelled to take notice. The boundaries of what orthodontics could achieve were significantly expanded and generally within shorter treatment times than were then thought possible—and all achieved without headgear.

Inevitably, feathers were ruffled as vested interests and professional reputations became threatened. Although much of Begg's thinking went directly against the grain of Angle's edgewise teaching (particularly his use of extractions), some basic reappraisal was urgently needed in the edgewise fraternity. The quest was on for lighter forces and shorter treatment times. This was to be aided in part by the coming of multistrand wires and, later, nickel-titanium alloy, and even by the introduction of a limited amount of tipping.

Much criticism was aimed at the Begg technique, some of it no doubt motivated by commercial interests and the challenge to established methods. Keen competition between the 2 sides doubtless stimulated orthodontic standards during the 1970s in which, with hindsight, edgewise technology was destined to win by virtue of its majority and the combined interests of its several manufacturers. Clinically, the Begg appliance proved more difficult to control, requiring thorough training in the technique. To experts in the edgewise technique, it required courage to overturn long-standing clinical habits and embrace entirely new thinking. Even so, many did.

A further blow came in the late 1970s when Andrews[4,5] introduced the straight-wire appliance, which was simple to handle, with the potential to produce an "inbuilt" detail finish scarcely possible with the Begg technique. Many Begg converts moved to it. However, although the Begg bracket had now become unfashionable, the technique had made its mark and remained indispensable to those of us who had succeeded in mastering it. Despite its difficulties, the Begg appliance could still treat maximum severity malocclusions, which were frequently beyond the scope of straight-wire appliances.[6]

The best of both worlds would be to combine the ease of movement of the free-sliding Begg bracket, enabling tooth tipping with ultralight forces, with the precision finishing that the straight-wire concept could now demonstrate.

The breakthrough began in 1986, when Peter C. Kesling introduced the Kesling slot (Fig).[7-9] This comprised a single wing, programmed torque-in-base edgewise bracket, from which the opposite corners of the archwire slot had been cut away to permit crown tipping in the desired direction. The angle of the cutaways prevented excessive tipping, and the extent of the cutaways, each overlapping slightly across the midline, ingeniously enabled the 0.022-in vertical dimension to increase as the tooth tipped during translation to a possible maximum of 0.028 in. This created a unique 100% interbracket distance. The aim was to enable Begg's principles to be carried out in a more familiar bracket with easier archwire insertion, by using elastomeric ligatures instead of brass pins. Christened "Tip-Edge" (because it was literally a tipping edgewise bracket) by TP Orthodontics (LaPorte, Ind), the technique showed immediate promise. Side-Winder springs replaced the previous uprighting springs to correct second-order angulations during the final phase of treatment. These were self-limited by the uncut surfaces of the Kesling edgewise slot.

Meanwhile, Dr Richard C. Parkhouse (coauthor of this article), with experience of both Begg and Andrews straight-wire techniques, was working to exploit the rectangular wire potential in the Tip-Edge toward a precision finish.[10] The improved control available with rectangular molar tubes was an obvious benefit. However, it was also found that the increased vertical archwire space, occurring when the teeth were even slightly tipped, could be used to advantage. At the start of uprighting, a stainless steel archwire of almost full slot thickness (0.0215 × 0.028 in) could readily be accepted in the bracket without binding or discomfort. This offered a magnificent stability platform.

It was also found, as expected, that the Side-Winder springs acting in the second-order plane would induce third-order torque concurrently when used in conjunction with a rectangular archwire. As the increased vertical dimension in the tipped archwire slot effectively reduced back to 0.022 in during second-order uprighting by the Side-Winder spring, the uncut edgewise surfaces of the archwire slot were torquing the bracket to the archwire in the third order.

By this method, all bracketed teeth were tipped and torqued with light forces by the auxiliaries, whereas the stout rectangular wires remained essentially passive. This was vigorously contested in a letter to the editor[11-15] as impossible but was verified mathematically.[16] Even with a completely inflexible archwire, the principle would still work.

In fact, there is a parallel with torque uptake in conventional brackets. Before nickel-titanium wires, it was edgewise practice to step up stainless steel rectangular archwire sizes in increments, each increasing torque uptake (reducing torque play) until the vertical slot dimension was almost completely filled. Tip-Edge turns this on its head, reducing the vertical slot size down to the full-sized rectangular archwire, during which the archwire itself needs no adjustment.