

# Lingual Orthodontics: History, Misconceptions and Clarification

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## A b s t r a c t

Many frank misconceptions still exist surrounding the efficacy and clinical nature of lingual orthodontics, which were first introduced over 25 years ago in Japan and the United States. Despite early difficulties in the development of the technique, it has become a valid clinical option for patients in many parts of the world. Specific problems, for example concerning patient comfort and biomechanics, have been systematically solved over time. Continuing modification of clinical methods significantly increases options for clinicians and patients, especially adults who may be reluctant to accept traditional labial orthodontic appliances.

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Since the earliest fixed lingual orthodontic appliances appeared in the mid- to late 1970s,<sup>1–4</sup> they have been subject to significant vicissitudes.<sup>5–8</sup> Beginning in 1979, an initial wave of popularity occurred when the first mass-manufactured lingual brackets were released in the United States. At that time, the media and public had been made aware, rather suddenly, of a new technique that would allow straightening of teeth, *without* the requirement for traditional labial “outside braces” (Figs. 1 and 2). No matter how vigorously esthetic labial brackets (e.g., plastic, polycarbonate, vinyl and ceramic brackets) or other moderately effective alternatives (e.g., Invisalign [Align Technology Inc., Santa Clara, Calif.] have been promoted over the years, many adults do not seek orthodontic treatment because of the perceived embarrassment of wearing braces.<sup>9</sup>

The earliest consistently documented work on lingual appliances began around 1975,<sup>10,11</sup> when 2 orthodontists working independently in Japan and the United States started developing their own systems to place braces on the *inside* surfaces of the teeth. The early prototypes were based on modified, traditional “outside” braces. Much credit has been given to the late Dr. Craven Kurz of California, who with co-workers developed the early Kurz/Ormco lingual bracket system. However, over the same period, significant development was made by Professor Kinya Fujita, of

Kanagawa Dental University in Japan, who continues to make great advances in this clinical discipline.

## Why Lingual Orthodontics Developed Slowly in North America

Clinical protocols had not been fully elucidated in those early days, resulting in many clinicians feeling impelled to begin lingual orthodontic cases without being fully prepared. Orthodontists found that the new lingual technique required much more rigorous attention to detail, as well as a fundamentally different approach to treatment planning and biomechanics. Postural challenges associated with potential back pain and related discomfort may have discouraged many operators — although these difficulties were overcome with practice and enhanced efficiency of clinical technique — resulting in the abandonment of many early lingual orthodontic treatments, which were completed with labial appliances.<sup>10</sup> An early generation of frustrated clinicians came to believe that accurate, efficient lingual orthodontic treatment was an inherent paradox — much like earlier views that achieving manned flight was impossible.

Many negative perspectives continue to be propagated, particularly in North America. Thus, much of the long-term development of lingual orthodontic therapy has occurred in other parts of the world, including Japan and Italy,<sup>11</sup> France,<sup>7,12</sup> Korea,<sup>13,14</sup> Germany,<sup>15</sup> Singapore and



**Figure 1:** The visual appeal of concealed lingual orthodontic appliances is obvious, especially compared with an earlier fully banded labial orthodontic appliance (Fig. 2). Even modern bonded clear labial brackets hold limited esthetic appeal for many people.



**Figure 2:** Fully banded labial orthodontic appliance.



**Figure 3:** A clinical view of the Ormco 7 lingual apparatus, an American design. Note the complete absence of attachments on the labial and buccal surfaces.



**Figure 4:** Indirect lingual bonding is accomplished using transfer trays to orient the brackets on the teeth. One latest method, developed in Korea, uses an individual resin tray for each tooth to ensure maximum efficiency for initial bonding and re-bonding when necessary.



**Figure 5:** This adult patient presented with a Class II, division 2 malocclusion. Note the almost complete anterior overbite.



**Figure 6:** With fixed appliances bonded, the lower incisal edges are contacting the upper lingual brackets. There is no contact between the upper incisal edges and the lower brackets.

Australia,<sup>8,16</sup> Turkey,<sup>17</sup> Israel<sup>10,11,18</sup> and South Africa, although there are a few dedicated practitioners in the United States.

### The Current State of Clinical Applications

Ormco lingual brackets (Fig. 3) are currently in their seventh iteration (hence, Ormco Generation 7 brackets [Sybron Dental Specialties, Orange, Calif.]). They have been in use since about 1990 and continue to be widely used throughout the world. No substantive modifications to the design have been released since the early 1990s. They are compact and relatively simple for patients to wear, although they are not the only design available.

Objections to the concept of lingual orthodontic treatment are still occasionally raised, often by non-practitioners of the technique. For example, there is a perception that the length of treatment with lingual appliances is excessive compared with that for labial appliances. Students of orthodontic history may recall analogous debates beginning in the 1930s between the radical non-extraction lobby led by Dr. Edward Angle and the group under Dr. Charles Tweed, which advocated judicious selection of extraction patterns.<sup>19</sup> Despite the acrimony of the time, the latter faction's work led directly to the development of standard

edgewise mechanics, which in turn laid the groundwork for the modern straightwire appliance. In other quarters, the efficacy and nature of functional appliances has also been, and occasionally continues to be, hotly debated.

Despite early resistance, "new" techniques such as these have eventually become proven and have moved from the margin to the mainstream. There seem to be only rare instances in which candid admissions have been made exposing the convenience of the standby "old excuse that treatment time would be considerably longer."<sup>20</sup> While pundits may attempt to deflect patient interest in many a new clinical method in this fashion, there is no objective evidence to suggest that lingual orthodontic treatment should take any longer for a given case than labial orthodontic treatment.

### Is Treatment Quality Comparable to Labial Orthodontics?

Literature review fails to reveal any objectively quantified evidence that lingual orthodontic mechanics are inherently slower or less precise in achieving dental alignment.<sup>18,21</sup> Anecdotal reports, possibly influenced by individual bias, are not new. For example, when the first usable ceramic brackets were released during the early 1980s, it was suggested that it



**Figure 7:** An occlusal view (later in treatment) demonstrates the shape of the upper lingual brackets, which act effectively as a bite plane against the lower incisors.



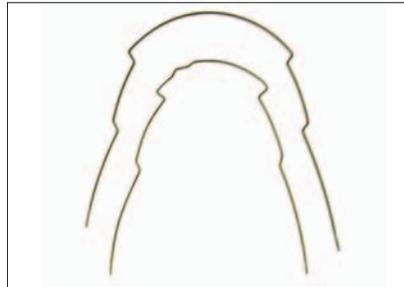
**Figure 8:** Only archwire mechanics were used to close the buccal segments in this combined lingual-upper, labial-lower case. No acrylic bite planes, interarch elastics, or other auxiliaries were required.



**Figure 9:** The Begg technique was developed in Australia and is almost unknown in North America. Here labial Begg appliances have been modified to the lingual aspect.



**Figure 10:** The most current Fujita bracket system is most commonly used in Japan and Korea; it allows the possibility of combining straightwire mechanics with elements of the Begg technique and other approaches.



**Figure 11:** Special archforms are often employed and can be more complex than those for labial appliances.



**Figure 12:** The Stealth bracket is a new design. Other prototypes are being developed with self-ligation in mind.

was “impossible” to direct-bond ceramic brackets accurately owing to their intrinsic transparency and the reflection of light that purportedly obscured landmark recognition.<sup>22</sup>

Despite some early trepidation, the direct bonding of ceramic brackets quickly became accepted practice. As a further note, because the advent of early ceramic brackets (e.g., the Starfire ceramic system [Sybron Dental Specialties], among others) coincided roughly with the arrival of early lingual appliances, many clinicians at that juncture turned away from primordial lingual appliances in favour of labial ceramic brackets, notwithstanding short-lived objections such as that cited above.

Precision of bracket placement (and, therefore, final clinical results) has been addressed primarily by the use of indirect lingual bonding (Fig. 4). The laboratory protocols for fabrication of transfer trays have been a standard feature of most lingual orthodontic styles of practice since the beginnings of the discipline. Direct bonding is possible, but rarely implemented.

Another commonly held misconception centres around the assumed problem of bracket interference in cases of deep overbite.<sup>17</sup> The earliest lingual bracket designs incorporated a built-in bite plane within the body of the upper anterior brackets.<sup>10,11,23</sup> The clinical case shown

(Figs. 5–8) demonstrates the initial “propping open” effect elicited by the presence of lingual upper appliances against lower incisors, with subsequent posterior bite closure. Curiously, critics of this aspect of the lingual appliance seem to overlook the impingement inherent in similar cases between lower labial brackets and the incisal edges of the upper anterior teeth.

### The Patient’s Perspective

Early objections regarding the comfort of lingual appliances have been overcome with time and the establishment of clinical approaches that generally do not exist in labial orthodontics. For example, the use of removable silicone pads, soft thermoplastic splints and other devices has been developed to the point of routine use, where needed, to accommodate speech and eating patterns in new patients with lingual appliances.<sup>12,24</sup>

Bearing in mind that many people tend to exhibit the maxillary canine to canine most prominently when smiling, it is possible to offer combination treatment in the form of lingual upper appliances and lower labial appliances. Such an approach achieves the desired result, along with more accessible patient fees. It is not unusual in this case for the fee to be roughly 1.5 times the usual labial orthodontic

fee, versus roughly twice the fee for a full bimaxillary lingual orthodontic set-up. Fees vary considerably, however, depending on the complexity of the individual case.

### Innovations and Future Directions

Numerous orthodontists are continuing to adapt other lingual orthodontic systems to simplify some of the earlier methods used in “invisible” orthodontic treatment. Some of these are based on techniques that originated largely outside North America.

During the 1990s, working with colleagues in Australia and South Africa, I built on an Australian bracket design<sup>4,8</sup> to streamline the treatment process. The design (Fig. 9) is known as the Begg technique after its originator, the late Dr. P. Raymond Begg of Australia, and is used more commonly in parts of Europe, Australia, New Zealand, Southeast Asia, China and Japan. The laboratory set-up was simplified compared with the Generation 7 appliances, but clinical manipulation still required rather intricate procedures. The advantage for patients was more accessible fees for their lingual orthodontic treatment.

Another system I have used more recently is one originally pioneered by Professor Kinya Fujita of Japan (Figs. 10 and 11). Like most other lingual systems, it allows the use of complex archwire designs completely different from traditional labial braces, allowing notable flexibility and varied mechanics to suit any clinical situation.<sup>13,14,25</sup> For example, tandem archwires and vertical slot auxiliaries may be used. Current versions of the Fujita system are the result of over 25 years of design evolution and continue to address issues of patient comfort and biomechanical efficiency.

Still another highly promising, and more recent, lingual orthodontic technique has been developed by American Orthodontics Inc. (Sheboygan, Wis.). Stealth brackets (Fig. 12) combine elements of other orthodontic systems, such as vertical and horizontal slots, to allow edgewise archwires or archwire auxiliaries or both.

Many other orthodontists and I are still in the process of improving and evaluating lingual orthodontic methods. This work maintains the long-standing convention of continuous lingual research and development continued by orthodontists and other colleagues worldwide. ♦

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