

OVERCOMING THE LINGUAL CHALLENGE - PART 1

Written by **Asif Chatoo**



In the first part of a two-part article, Asif Chatoo describes the challenges presented by treatment with lingual braces and explains how digital solutions are providing greater flexibility

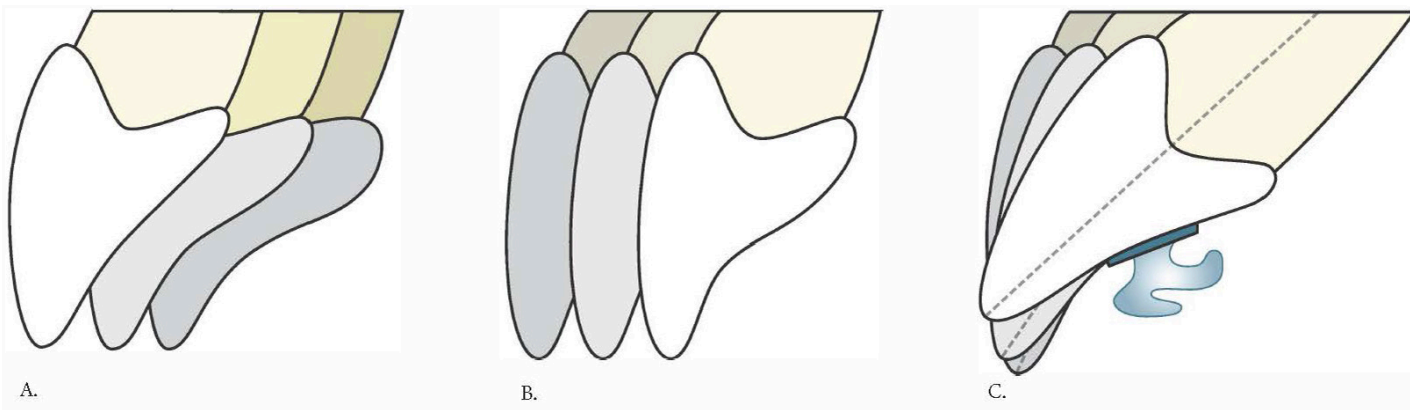


Figure 1: Representation of the comparison in the anatomical variation that may be found on the lingual surface (A) of the tooth compared to the more uniform labial surface (B)

There is a growing demand for aesthetic orthodontic treatment both to correct malocclusions and to complement restorative care. The main advantage of fixed lingual appliances is that they are discreet and are able to deliver the results we strive for and our patients expect.

Though it is now possible to provide treatment for most malocclusions using modern lingual systems, it should be noted that patients who seek to have treatment with lingual braces have expectations that are similar in quality but greater in extent when compared to those seeking labial orthodontics^{REF1}.

The management of lingual treatment has

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been greatly facilitated by digital technology. However, there are distinct challenges that the clinician should be aware of when providing treatment to a patient requesting lingual braces. The following considerations must be taken into account:

- Differential tooth surface anatomy
- Visualisation of the tooth surfaces
- Fractured brackets
- Sequential bonding
- Reduced inter-bracket span
- Dental health.

ANATOMICAL VARIATION OF THE LINGUAL SURFACE

There is greater anatomical variation of the lingual surface of the tooth compared to that found on the labial surface (Figure 1). As a consequence the direct placement of brackets on the lingual surface in an ideal position is more challenging. Furthermore, a difference in height of the bracket from the incisal edge of the tooth will have a more profound effect on the tooth movement

and final torque when compared to a similar variation of the bracket height from the incisal edge of the labial surface (Figure 2).

VISUALISING THE LINGUAL SURFACE

Direct visibility of the lingual surface is difficult, especially when trying to bond to the upper incisors. This means that the accurate direct bonding of brackets is more difficult. Figure 2 demonstrates that a difference in the position of the bracket on the tooth can have a profound effect on the subsequent tooth movement. For this reason, indirect bonding is the preferred option for many clinicians who regularly use lingual braces. There are many different systems and techniques available for indirect bonding available. Each has its own specific advantages and disadvantages but, most importantly, each aims to overcome the difficulties of bonding to the lingual surface of the tooth.

REBONDING OF THE FRACTURED BRACKET

A broken bracket is inconvenient during any

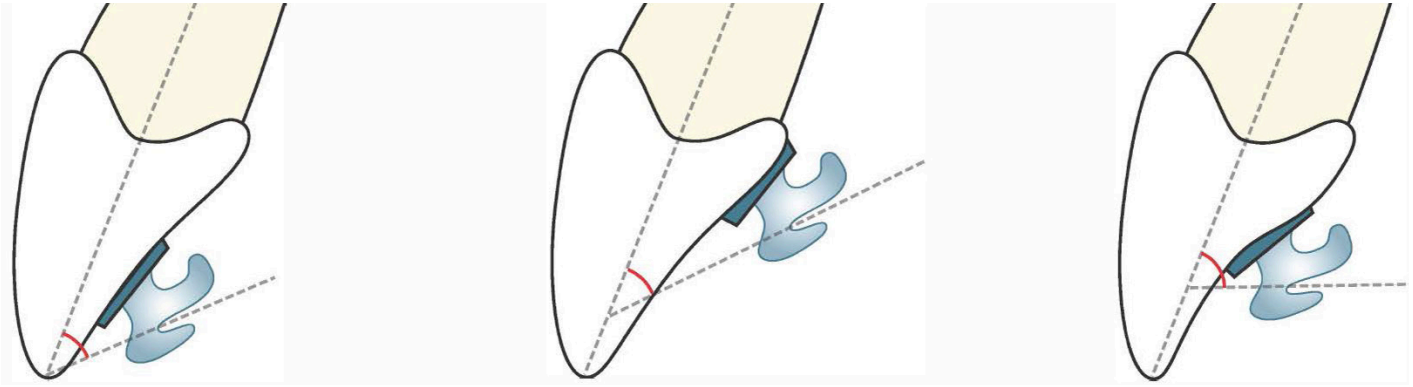


Figure 2: Diagrammatic representation of how a change in the height of the bracket will result in a difference in the effect of a force on the tooth on the lingual surface



Figure 3a: Pre-treatment lower arch. When crowding is present there is a need to sequentially bond the teeth to ensure that the brackets are placed in the most ideal position



Figure 3b: At the initial bond up it is not possible to place all the brackets in an ideal position on all the teeth. In this case the lower left central incisor is to be removed to create space to derotate and align the lower canine teeth



Figure 3c: The lower incisors are aligned and composite buttons placed in the canines to help derotate the teeth to allow for brackets to be bonded in an ideal position



Figure 3d: Brackets are placed on the lower canine teeth. The fact that the teeth have been derotated makes it easier to place the brackets in a more ideal position

type of fixed orthodontic treatment. This is especially true in lingual treatment. The accurate repositioning of a lingual bracket is essential as the tooth is more susceptible to undesirable movement if there is even a slight difference in the bracket position for the reasons previously outlined.

Indirect bonding with transfer trays not only allows for the accurate placement of brackets at bond up but also facilitate the accurate repositioning of the bracket should they debond.

The incidence of debonding can be reduced if patients are instructed on how to look after their braces and if the treating clinician correctly assesses the occlusion so that the bracket positioning is correct and less inclined to trauma on biting.

SEQUENTIAL BONDING IS REQUIRED

In most cases, it is possible to place labial brackets on all the teeth at the start of treatment. This is not necessarily true when treating patients with lingual appliances. In

many instances, where there are rotations and crowding of the labial segments, sequential bonding of the teeth is required. This means that space must be created to aid the derotation of teeth to allow all the brackets to be placed. This may lead to the initial alignment phase of treatment taking longer to allow for all the teeth to be incorporated into the brace (Figure 3).

REDUCED INTER-BRACKET SPAN

The circumference of the lingual surfaces ▶

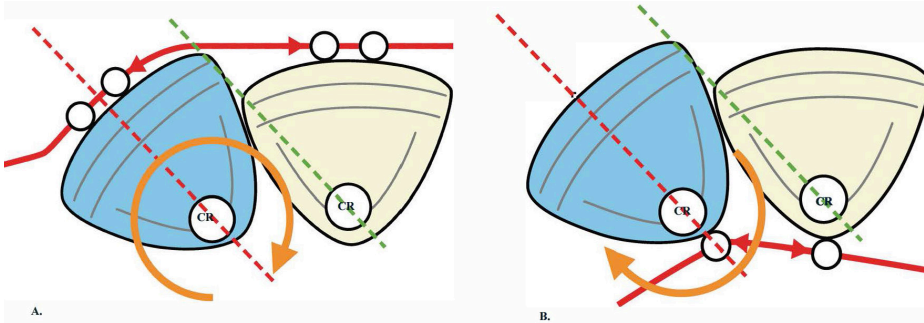


Figure 4: The inter-bracket distance when working on the labial side of the tooth (A) is greater than when working on the lingual side (B). This leads to an increased stiffness of the same diameter arch wire in lingual orthodontics with a rotational moment that is less than with conventional labial braces

of the teeth is reduced in comparison to the labial surface. The significance of this is that when the teeth are bonded with brackets there is a corresponding reduction in the inter bracket distance on the lingual surface. If we consider that the stiffness of any wire is inversely proportional to the cube of its length then, as the inter-bracket distance decreases, the stiffness of the wire will increase.

The ratio of the inter-bracket distance between the lingual and labial surfaces is 1:1.55 for the maxilla and 1:1.39 for the mandible. This leads to an increase in the stiffness of the same wire between the labial to lingual surface by a factor of 3.72 for the maxilla and 2.68 for the mandible^{REF2}. The implication of these factors means that the process for initial alignment may take longer when working from the lingual side as you are unable to fully engage the wire earlier on in treatment.

DENTAL HEALTH

Periodontal tissues: It has been shown that during treatment, fixed appliances cause an increase in plaque and bleeding indices, when compared to removable aligners^{REF3}. However, these changes are totally reversible with no long-term damage to the periodontal tissue or change in the presence of periodontal pathogens^{REF4}.

Enamel demineralisation: The incidence of enamel demineralisation, following fixed orthodontic treatment with labial and lingual appliances, has been shown to be 4.8 times higher on the buccal surface than on the lingual surface^{REF5}. This implies there may be an advantage to using lingual braces, when considering the type of appliance used to treat a malocclusion.

It is very important that all patients undergoing treatment with fixed appliances should have careful instruction on brushing and be monitored throughout treatment with regular visits to the hygienist.

SUCCESSING WITH LINGUAL BRACES

A carefully planned and methodical approach to treatment enables the practitioner to

overcome all the inherent challenges of the lingual technique.

A diagnostic laboratory-based set up, planned with the end point in mind has been a key principle in planning for a successful treatment outcome in lingual orthodontics. Coupled with a diagnostic set up, the use of indirect bonding to the lingual surfaces overcomes the difficulty in bonding and ideal bracket positioning on the lingual surfaces.

Digital technology has allowed for greater sophistication of the lingual appliances. With digital bracket positioning, CAD/CAM designed brackets and robotically bent wires, the appliances are more customised. They can deliver the tooth movements that we plan for and with the kind of precision our patients expect^{REF6}. A retrospective study of treated cases with customised lingual appliances have shown discrepancies of less than 1mm in linear movements and 4° in angular measurements between the predicted set up and the final outcome^{REF7}.

Newer technologies such as SureSmile are now using digital planning platforms and fourth-generation robots to bend wires with median deviations of 0.19-0.21 mm based on translational movements and 1.77°-3.04° based on rotational movements^{REF8}. These bends may be made in ductile and non-ductile wires. The accuracy of the bends in these wires is superior to that which is achievable through manual wire bending.

The use of the SureSmile platform has also allowed for greater flexibility in providing treatment. It is now possible to accurately plan treatment for a patient using different types of braces for the upper and lower arch. For instance, it is now possible to plan tooth movements and co-ordinate arch relationships with lingual braces in the upper arch and aligners or fixed labial braces in the lower arch.

It must be remembered that digital technology is a powerful tool that is there to facilitate the management of the treatment. Proper mechanics and careful planning underscored by sound orthodontic principles must be applied in order to move the teeth and achieve a good outcome. ●

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AIMS AND OBJECTIVES

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EXPECTED OUTCOMES

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VERIFIABLE CPD HOURS: 1

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