

Creating Brighter Futures

LINGUAL braces



Australian Society
of Orthodontists



THE UNIVERSITY OF
SYDNEY

Lingual Braces

Introduction

Increasing public demand for discrete or 'invisible' orthodontic treatment has seen a rise in aesthetic orthodontic appliances, including ceramic labial brackets, sequential clear plastic aligners and fixed lingual appliances (lingual braces). Over the years, lingual braces have attracted notoriety as difficult appliances for practitioners to manipulate and patients to tolerate. However, advances in lingual biomechanics, CAD-CAM and digital technology, improved bonding agents and customisable bracket and archwire designs have meant that contemporary lingual appliances have been made less difficult to use effectively and efficiently to treat most common malocclusions.



History

The concept of placing appliances on the lingual surfaces of teeth was first proposed by Pierre Fauchard in 1726¹. However, it wasn't until 1975, and following the advent of acid-etch resin bonding, that Kurz modified the labial edgewise appliance to create lingual braces. A short time later in Japan, Fujita developed a lingual bracket system with the valuable addition of a mushroom-shaped archwire to better reflect the lingual archform². These early systems utilised directly-bonded, non-customised brackets and archwires. As a result, a number of biomechanical and technical challenges existed.

How are Lingual Appliances different?

Lingual braces present some key differences in both their design and clinical handling to their labial counterparts.

Anatomical Considerations and Bonding Challenges

The buccal morphology of teeth is relatively uniform within and between individuals and hence, preadjusted labial appliances with prescription values based on population norms reliably produce good clinical outcomes (Fig 1). Conversely, lingual morphology is highly variable and lingual arches do not align nearly as well, requiring numerous in-out (first order) compensations (Fig 2). Additionally, the potential for slight bracket positioning errors to induce significant undesirable changes is greatly increased with lingual appliances (Fig 3). Considering these two points, numerous 3-dimensional compensations are incorporated into either the lingual bracket and/or the archwire to account for individual variation within a case.



Figure 1

Good dental arch alignment is achievable using stock buccal brackets and a stock natural arch from wire.



— individualised or completely customised
--- Fujita archform
— straight wire

Figure 2 Numerous in-out (1st order) compensatory bends are required to obtain dental arch alignment. Note the superior adaptation of the customised archwire (red), which reduces the profile of the brackets.

Where stock lingual brackets are used, directly bonding the brackets in an accurate position can be exceedingly difficult and complex wire bending is almost always required. Stock brackets adapt poorly to the variable lingual surface resulting in increased debonding rates and inadvertently introducing unfavourable tooth movements.

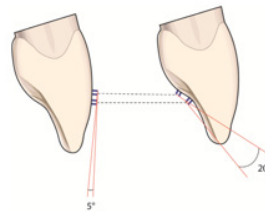


Figure 3

Shows how small vertical (inciso-gingival) changes in bracket position change the bracket slot orientation (torque expression). On the buccal surface, this may produce up to a 5° degree change in bracket position may alter the torque expression by up to 20° on the lingual surface.

Today, indirect bonding is used to achieve accurate bracket placement. Low profile brackets optimise patient comfort and mitigate against breakages, while custom-formed bracket bases ensure intimate adaptation of the bracket to the lingual tooth surface and accurate expression of in-out, tip and torque movements.

Reduced Interbracket Distance

Lingually positioned brackets, particularly anteriorly, occupy a smaller arch perimeter thereby reducing the interbracket distance. Archwire stiffness is a function of its modulus of elasticity, cross-sectional diameter and length. As such, the relatively stiffer wire makes it difficult to apply light, constant forces and to fully engage all the brackets to resolve crowding³. The introduction of light superelastic nickel titanium archwires for the initial levelling and alignment phase of treatment have helped overcome this challenge.

Finishing Considerations

When finishing a case, detailing bends should be applied in small increments on light rectangular wires to avoid excessive forces. In addition, sufficient intervals between visits (usually 6-8 weeks) should be allowed for the bends to adequately express. It is important to understand that the correction of undesirable changes which have been introduced during early phases of treatment with lingual appliances can be difficult and time-consuming to correct in the finishing phase, often resulting in protracted treatment times. With this in mind, it is

important to maintain meticulous biomechanical control of the case throughout the course of treatment.

Enamel Demineralisation

Enamel demineralisation is an often cited undesirable adverse effect of fixed braces. A study comparing the incidence of white spot lesions in patients using lingual versus labial appliances reported a 6-fold increase in the incidence of enamel demineralization in the labial appliance group⁴. Where labial surfaces are already heavily or recently restored, it may be advantageous to consider a lingual appliance system.

Adaptation To Speech & Function

All orthodontic appliances have an immediate effect on speech and function. Lingual appliances are no different⁵ and in the past produced more significant speech and comfort problems than labial appliances. With the customised bracket base systems, brackets are lower in profile and highly polished, making for easier speech and masticatory adaptation. Staging the bonding of upper and lower arches also improves their comfort and speech adaptation with these difficulties usually resolving within the first few weeks.

Case Selection

The decision as to which orthodontic appliance to use should be made on a case-by-case basis by the practitioner in consultation with the patient following a comprehensive diagnostic evaluation. Lingual appliances have a number of advantages and disadvantages to both practitioner and patient that should be considered (Table 1).

The knowledge and experience of the orthodontic practitioner dictates which cases are appropriate to be treated with lingual appliances, although it is possible to treat a spectrum of cases from simple malocclusions through to complicated cases. A number of diagnostic and patient-related factors may make a particular patient more or less amenable to treatment with fixed lingual appliances.

Simpler Lingual Cases:

- Cases with mild to moderate crowding and anterior deep bite
- Good gingival and periodontal health
- Dental and skeletal Class I pattern
- Mesofacial (normal) or mild/moderate brachyfacial (short face) skeletal pattern
- Compliant patients who are able to adequately open their mouths and extend their neck

More Difficult Lingual Cases:

- Dolichofacial (long face) skeletal pattern
- Maximum anchorage cases, unless treated with techniques to augment anchorage
- Class II & Class III dental pattern
- Presence of multiple large restorations or crowns
- Low level of compliance or motivation
- Limited ability to open their mouth
- Patients with cervical ankylosis or other neck injuries that prevent neck extension
- Complex orthognathic cases



Table 1 Lingual Appliances

ADVANTAGES	DISADVANTAGES
Optimal appliance aesthetics (virtually invisible)	Increased laboratory and appliance costs relative to fixed labial appliances increasing the cost to patients
Buccal surfaces are preserved, minimising the risk of treatment-related buccal enamel demineralization	Some aspects of treatment mechanics differ significantly from labial appliances and can be technically challenging
Avoids appliance-related buccal mucosal irritation and ulceration	Anatomical/bonding challenges
Can treat most malocclusions treatable with conventional labial braces with some malocclusions such as deep bites more readily. Although some malocclusions are more difficult to treat.	Reduced inter-bracket distance
	Practitioner ergonomics
	Increased chair time, further increasing cost of treatment
	Initial period of speech adaptation
	Greater potential for tongue irritation and ulceration



Colgate has had a long and successful relationship with the Australian Society of Orthodontists. This newsletter is one of the ways that Colgate has been able to provide assistance. It has been a pleasure to be able to help support the production of this very informative publication over so many years.

This will be the last Colgate Care Column and we hope they have been informative and helpful to all the readers. We wish our readers all the best and hope you continue to enjoy the Brighter Futures Newsletter. We hope to find other ways to work together in the future.

Are Lingual Appliances as effective as Labial Appliances?

Two recent systematic reviews evaluated the relative efficacy of lingual appliances versus labial appliances^{6,7}. A key point to consistently emerge is that lingual appliances are equally as effective as labial appliances, especially in the hands of an experienced lingual practitioner.

Contemporary Lingual Appliances

Ongoing refinements have culminated in lingual appliance systems which circumvent many of the limitations that plagued earlier systems. The emergence and evolution of customised orthodontics has undoubtedly contributed greatly to the effectiveness of lingual orthodontics. Today, several completely customized and semi-customized lingual appliances are available:

- Incognito (3M-Unitek, Monrovia, CA)
- In-Ovation L and Lmtm (Dentsply GAC International, Islandia, NY)
- Alias (Ormco, Orange, CA)
- Harmony (American Orthodontics, Sheboygan, WI)
- Suresmile lingual (Orametrix, Richardson, TX)
- WIN (DW Lingual Systems GmbH, Bad Essen, Germany)



Figure 4 Fully customised lingual appliances. First-order (horizontal) bends are compensated for by a custom-bent archwire, while second-order (vertical) and third-order (torque) is accounted for in the custom prescription of the bracket bases.

Many of these systems utilise a digital setup (Figure 5) which is constructed from an intraoral scan. This confers diagnostic and therapeutic advantages by allowing evaluation of the anticipated tooth movements before commencing treatment, assessment of different treatment plans in complex cases and an estimation of treatment times. The result is the construction of a customised prescription appliance (brackets and archwires) that addresses the treatment objectives specific to that case. Importantly, it has been shown that with sound clinical mechanics, a precise reproduction of the digital treatment setup can be consistently achieved clinically^{8,9}.

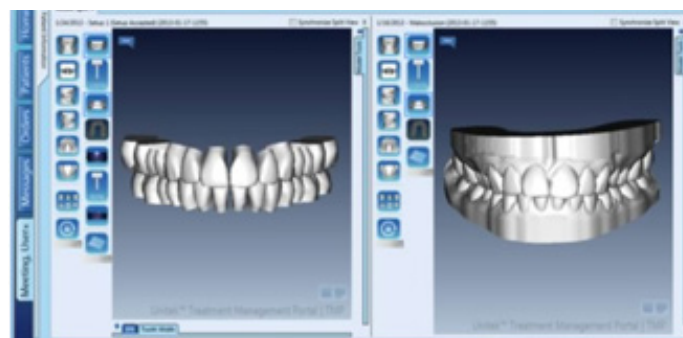


Figure 5 A digital setup of the desired tooth positions.

Conclusion

The appeal of having an invisible orthodontic appliance is obvious from a patient's perspective and lingual braces offer an invaluable addition to the orthodontists' armamentarium. Even with the introduction of customized lingual systems, these appliances still carry important biomechanical caveats that the practitioner must be cognisant of. As with all orthodontic treatment, appliance selection forms just one aspect of treatment planning. The quality of the final clinical outcome and efficiency in reaching it, is critically dependent on the fundamentals of accurate diagnosis, treatment planning and meticulous attention to clinical execution.

References available upon request

The Editors of the Brighter Futures Newsletter would appreciate feedback from readers about this and past newsletters and suggestions about future topics that would be of interest to readers. Please send your comments to editorbrighterfutures@gmail.com

Past issues of Brighter Futures can be accessed at:

www.asofre.org.au/continuing-education#brighter-futures-newsletters

The editors of this newsletter, on behalf of the members of the ASO NSW Branch and the readers of this newsletter, would like to thank Colgate for its tremendous support of this newsletter for so many years. It is very much appreciated.

 HENRY SCHEIN®

 Rely on Us

AUTHOR & EDITORS

Dr Brett Steele
PRINCIPAL AUTHOR

Dr Ross Adams
Dr Chrys Antoniou
Dr Susan Cartwright
Prof M Ali Darendeliler
Dr Ted Peel
Dr Steve Stramotas
Dr Dan Vickers

Brighter Futures is published by the Australian Society of Orthodontists (NSW Branch) Inc. in conjunction with the

Orthodontic Discipline at the University of Sydney.

The newsletter is intended to help keep the dental profession updated about contemporary orthodontics, and also to help foster co-operation within the dental team.

Without the generous support of Henry Schein and Colgate, who are an integral part of the dental team, this publication would not be possible.

The statements made and opinions expressed in this publication are those of the authors and are not official policy

of, and do not imply endorsement by, the ASO (NSW Branch) Inc or the Sponsors.

Correspondence is welcome and should be sent to:

Department of Orthodontics
University of Sydney
Sydney Dental Hospital
2 Chalmers Street,
Surry Hills NSW 2010

E: editorbrighterfutures@gmail.com

www.aso.org.au