Lingual Orthodontics

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23/9/2026

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Objectives

- Understand the history and development of lingual orthodontics
- Explain the difference between labial and lingual orthodontics
- Understand the risks and benefits of the lingual appliance system

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Background

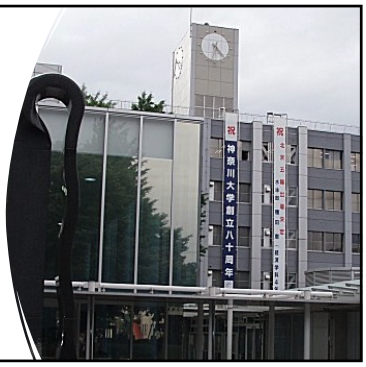
- Demand for adult orthodontic treatment
- Aesthetic orthodontic system
- 75% increase in adult treatment
- Lingual and aligners >ceramic>metal in terms of attractiveness
- 10% of 960 specialists offer lingual orthodontics



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Evolution of lingual appliances

- 1968 at Kanagawa University, Japan
- Kinya Fujita submitted the lingual appliance concept
- Started to manufacture and use his system in 1975



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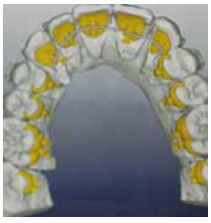
Origins (1970s–1980s)

- **Concept introduction:** Lingual appliances were first developed in the **1970s** in Japan (Kinya Fujita credited pioneer).
- **Motivation:** The main driver was **aesthetics**—patients wanted orthodontic treatment without visible labial brackets.
- **Early appliances:** Standard labial brackets were simply repositioned onto the lingual surfaces.
- **Limitations:** Poor fit, lack of torque control, difficulty in bonding and finishing, speech problems, and discomfort.

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Refinement (1980s–1990s)

- Manufacturers began **designing brackets specifically for the lingual surface**, rather than adapting labial ones.
- Custom-made appliances using setup models were introduced, improving **precision of bracket placement**.
- However, **technical challenges** remained: chairside time was long, patient comfort was poor, and mechanics were difficult for orthodontists to master.
- Adoption remained limited mostly to specialist practices.



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Customization Era (2000s)

- Advances in **CAD/CAM technology** and **indirect bonding techniques** revolutionized lingual orthodontics.
- Systems like **Incognito (3M)**, **WIN**, and **STb Light Lingual System** emerged, offering:
  - Customized brackets to fit lingual anatomy.
  - Robotic wire bending for precise mechanics.
  - Reduced bracket profile for comfort.
- This dramatically improved efficiency, comfort, and treatment outcomes.



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Digital & Modern Era (2010s–Present)

- **Full digital workflow**: 3D scanning, virtual treatment planning, and digital setups for precise appliance fabrication.
- **Hybrid systems**: Combining lingual appliances with clear aligners or labial brackets in some cases.
- **Patient comfort improvements**: Smaller brackets, smoother designs, and better wire sequencing.
- **Current trends**:
  - Lingual braces are considered the most "invisible" fixed option.
  - Growing popularity in adult orthodontics, especially among professionals and public figures.
  - Still requires specialist training due to technical complexity.



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Difference between labial and lingual appliances

- Position
- Aesthetics
- Patient comfort
- Biomechanics
- Oral hygiene
- Technical aspects
- Cost and accessibility

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Position

- **Labial appliances**: Brackets are bonded on the **front (labial/buccal) surface** of the teeth (the visible side).
- **Lingual appliances**: Brackets are bonded on the **back (lingual/palatal) surface** of the teeth (hidden from view).



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Aesthetics

- **Labial**: Visible when speaking/smiling (unless ceramic/clear brackets are used).
- **Lingual**: Completely invisible from the front—highest level of aesthetics.



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Patient Comfort

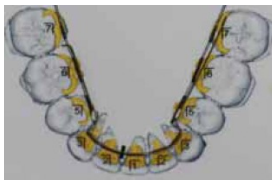
- **Labial**: May irritate lips and cheeks initially but generally well tolerated.
- **Lingual**: Can cause tongue irritation, speech difficulties, and discomfort at first, though patients usually adapt.



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Biomechanics

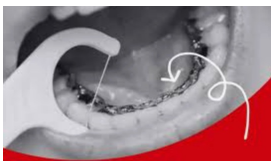
- **Labial**: Easier force application, more predictable mechanics, and simpler finishing.
- **Lingual**: Mechanics are more complex due to bracket position, torque control is harder, and treatment often requires advanced training.



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Oral Hygiene

- **Labial**: Easier to clean and monitor plaque accumulation.
- **Lingual**: More difficult to clean, higher risk of calculus build-up on the lingual surfaces.



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Technical Aspects

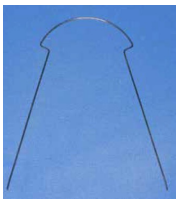
- **Labial**: Standardized brackets and archwires, easier bonding and adjustments.
- **Lingual**: Often requires **customized brackets and wires** (e.g., CAD/CAM, robotic bending). Indirect bonding is usually needed.



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Cost & Accessibility

- **Labial**: More affordable, widely available, less technique-sensitive.
- **Lingual**: Higher cost due to customization and lab work; fewer orthodontists offer it because of technical complexity.



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Benefits of lingual appliances

- Aesthetic
- Lower risk of decay/decalcification (labially)
- Mechanical advantages-overbite reduction
- Viewing of labial surfaces in finishing stages

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Risks of lingual appliances

- Discomfort (tongue)
- Speech disturbance
- Function (eating) lingual worse than labial
- Longer appointment times
- Cost

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Subject	Patient information
Appearance of the appliance	In day-to-day function your appliance will not be seen. Towards the end of treatment you may need to wear elastics between the upper and lower teeth and these may have to be attached to a small tooth-coloured button on the outside of your teeth.
Time to complete treatment	This will depend on the individual tooth movement required but it should not take longer than a labial appliance.
Time for appointments	You can expect that your appointments will take longer than for a conventional appliance. Depending on the experience of your clinician a normal review appointment will be around half an hour.
Quality of the result	With the advances in lingual treatment and appropriate appliance selection, the quality of the result will be comparable to labial treatment.
Discomfort	In addition to the discomfort experienced by all orthodontic patients, your lingual appliance is likely to give some increase in tongue soreness. Your discomfort will slowly disappear over one month.
Risks to teeth and gingival tissues	Good oral hygiene and a non-cariogenic diet are equally important during lingual and labial treatment to prevent harmful effects. Decalcification is more likely with labial appliances and, if it occurs with lingual appliances, the aesthetic impact is minimal.
Speech	Your speech will be affected after the appliance is placed and will particularly affect 's' sounds. This will improve in most people in the first week but small changes may last up to 3 months, but could be there throughout treatment.
Cost	It is highly likely that this will be higher than labial treatment but will depend on the type of lingual appliance used and the treatment required

Patient information

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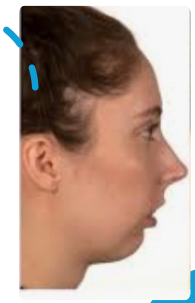
Patient selection

- As with all orthodontic treatment, a thorough assessment of a patient's expectations, a medical and dental history and extra-oral and intra-oral examination all come before a diagnosis of the malocclusion.
- Treatment planning for lingual orthodontic treatment is no different, although there are some specific considerations that need to be taken into account to maximize success

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Challenges

- Retrognathia then this is a good predictor for increased oral discomfort
- Retroclined lower incisors and decreased tongue space-lower appliances may be more appropriate
- The placement of lingual appliances in retroclined lower anterior teeth may also be technically challenging



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- The malocclusion must be looked at in detail when considering the suitability of lingual appliances from a mechanical perspective.
- All lingual appliances have a tendency to expand, flare and reduce overbites that can be beneficial in deep bite cases, but not when an already minimal overbite needs to be maintained.
- The real skill to success with treatment is knowing what your selected appliance can achieve.



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2 categories

- 2-D type pre-fabricated appliances
- 3-D type fully customized appliances

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2-D prefabricated

- These types of appliances are prefabricated and, in order to maximize success, must only be used where limited control of the tooth root is required.
- Examples of these types of appliances include :
- 2-D (Forestadent)
- Self-ligating bracket Innovation–L (GAC)



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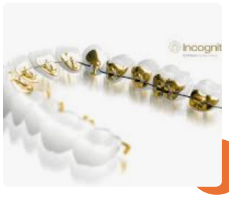
2D pre-fabricated

- The archwires are either pre-formed or individually formed by the clinician.
- Rectangular archwires can be used in an attempt to impart some root control, although:
- Variable distances between the point of force application and centre of tooth rotation
- Inability to hold the wire in the bracket slot
- Horizontal insertion of the wire mean that the 'torqueing' effects are limited.
- The lack of individuality in both the brackets and the wires means that time consuming finishing bends are often required.

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3-D fully customized lingual appliances

- Commonly used examples include;
- Incognito (3M-Unitek)
- Win (DW LingualSystems)
- Self ligating system Harmony (American Orthodontics)



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3-D customised

- Bonding area can be increased which which increases the bond strength and can minimize bond failures.
- The problems associated with finishing have also been addressed by:
- More accurate bracket positioning
- Archwire fabrication
- Reduction in torque play between bracket slot and archwire.
- Planned and final tooth position have been studied using computer software to look at the accuracy of fully customized lingual treatment.

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COST

The main drawback with this type of appliance



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Favourable for lingual appliances

- Mild incisor crowding and deep overbite
- Long uniform lingual tooth surfaces without fillings, crowns or bridges
- Good periodontal health
- Keen, compliant patient
- Good mouth opening and neck extension

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Unfavourable for lingual appliances

- Short abraded and irregular lingual surfaces
- Heavily filled/restored dentitions
- Limited mouth opening
- Patients with cervical anklyosis/neck problems
- Incompletely erupted dentitions

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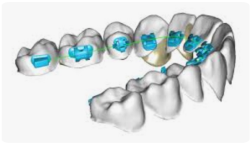
3D scanner



- High resolution optical 3D scanner permit non-contact scanning of therapeutic setup
- The resulting of the scan is a 3D representation of the teeth, consisting of many thousands of minute triangles that can be observed and processed in the computer

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Creating individualized bracket bases



- Specialised CAD/CAM software is used to design and build customized brackets
- Process begins with creation of individualized bases customized to lingual surfaces of the patients teeth
- Large pad surfaces improve bond strength and make it easy to place on the teeth for bonding/re-bonding

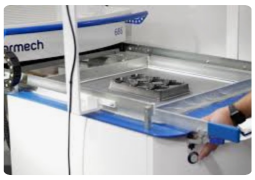
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Positioning the bracket bodies

- After the bracket bases are designed, the appropriate bracket bodies are selected from the library and arranged by the software
- The vertical height, angulation and torque are preset into each bracket
- This way the patients individual prescription is designed into the brackets

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Bracket manufacturing



- Patterns of the customized brackets are created using rapid protyping machines.
- The patterns are then placed in an investment cast, burned out and a dental gold alloy is poured into the cast to make the brackets.
- After casting, the brackets are tumbled and polished until smooth, to ensure patient comfort

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Wire ligation

- Self retaining slot
- O Ring
- Overtie
- Overtie with steel ligature

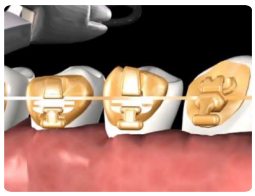
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Self retaining slot



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O Ring



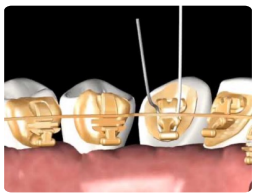
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Reverse Double Overtie



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Reverse Double Overtie with Steel Ligature



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Questions?

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