

Fixed appliances

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Aims of Orthodontic Treatment



To improve dento-facial appearance



To correct the occlusal function of the teeth



Eliminate occlusion that could cause long term damage to teeth

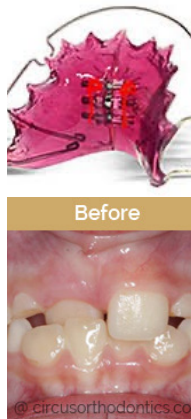


To prevent trauma

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Removable Appliances

- Simple tipping movements
- Few teeth moved at a time
- Space closure difficult
- Difficult to correct rotations
- Minimal chairside time
- OH easier to maintain
- Compliance dependent



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Advantages of Fixed Appliances

- Controlled tooth movements (including space closure)
- Multiple tooth movements
- Full range of tooth movements
- Ability to correct complex malocclusions
- Correction of rotations
- Ability to 'detail'
- Independent of patient compliance

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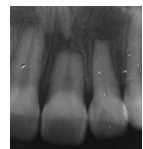
Disadvantages of fixed appliances

- Increased chair-side time
- Repairs time-consuming
- Non-aesthetic
- Trauma/discomfort
- Requires excellent oral hygiene (avoid risks of decalcification and periodontal disease)
- More complex
- Require well motivated patient
- More expensive

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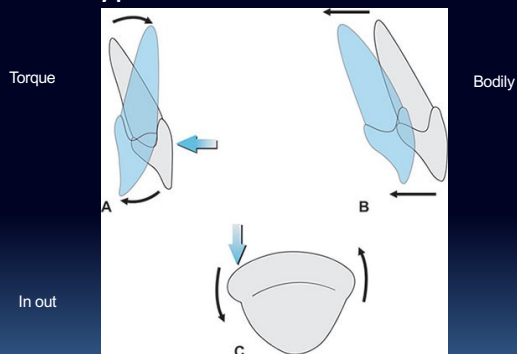
Contra-indications

- Poor oral hygiene
- Active caries
- Poor motivation
- Mild malocclusions
- Active perio problems
- Severe resorption



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Types of tooth movement



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Types of tooth movement



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Tooth movement – derotation

- Labial or lingual movements around the long axis of the tooth
- Force couple created between tooth and bracket required to derotate tooth without tipping
- Requires light forces = 35-60g



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Tooth movement – intrusion

- Bodily displacement of tooth along its long axis in an apical direction
- Force concentrated at root apex
- Requires very light forces = 10-20g



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Tooth movement – extrusion

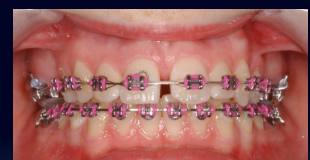
- Bodily displacement of tooth along its long axis in an occlusal direction
- Often required for impacted canines
- Requires light forces = 35-60g



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Tooth movement – bodily movement

- Sliding mechanics
- Used to close spaces
- Translation movement of the crown and root in the same direction rather than crown tipping into space
- Requires heavier forces 70-120g

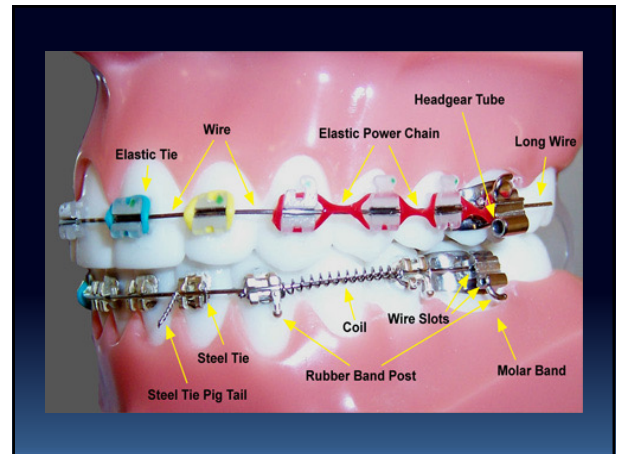


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Components of a fixed appliance

- Bands: stainless steel
- Brackets: stainless steel, ceramic, gold
- Archwires: SS, NiTi, TMA
- Auxiliaries: ligatures, modules, lace-backs, Bennet modules, NiTi coil springs

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Buccal tubes and brackets



- Attachments bonded to tooth surface
- Features of brackets
 - Base – sandblasted mesh to retain bonding cement
 - 4 tie wings to secure archwire in place with a ligature
 - Slot to accommodate archwire
 - Line down long axis to aid in correct placement
 - Distolingival marker to indicate orientation and tooth

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Molar bands

- Molar tubes may be welded to bands which encircle the tooth
- Used for more robust means of attachment including partially erupted teeth, teeth with large restorations.
- Inscribed on the bands are the quadrant of the mouth and size of the band.
- Elastomeric separators used to open space between teeth in order to place molar bands.



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Brackets and molar tubes - adhesives

- Acid-etch technique and composite resin:
 - Separate etch and bond
 - Self-etching primer
- Molar bands cemented to tooth using glass ionomer



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Archwires

- After the brackets are placed on the teeth, an arch wire must be placed in the slots.
- Archwires are fabricated in several alloys, cross sections, sizes.
- The choice of which wire to be used is dependent on the stage of treatment
 - Initial stages – aligning teeth
 - Later stages – sliding teeth to close spaces



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Initial aligning

- Properties required
 - High springback (returns to original shape following deflection)
 - Good flexibility
 - Low friction
- Use round wires with small diameter – low forces
- Typically nickel titanium (NiTi)
- May be multistrand stainless steel (SS)
- Gradually progress to stiffer wires

Archwires used during aligning
0.012 NiTi
0.014 NiTi
0.016 NiTi
0.018 NiTi
0.0175 multistrand SS



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Preparing for sliding mechanics

- Properties required
 - Good flexibility
 - High friction
- Rectangular NiTi wires
- 19/25 NiTi or 20/20 NiTi to completely fill bracket slot
- Allow torque expression before inserting wires required for sliding teeth

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Archwires for sliding mechanics

- Properties required
 - High stiffness
 - Low friction
- Typically 19x25 stainless steel
- Completely fills bracket slot to express prescription
- Hooks allow attachment of space closing auxiliaries
- Cannot be inserted until teeth fully aligned due to stiffness
- Low friction of stainless steel allows teeth to slide along wire



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Definitions

Shape memory:

- Ability of arch-wire to return to original shape without deformation; allows engagement into displaced teeth without permanent deformation

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Definitions

Super-elasticity:

- Ability to deliver constant low force despite amount of deflection

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Definitions

Stiffness:

- Amount of force required to deflect an archwire; the larger the wire (diameter) the stiffer it is

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Definitions

Formability:

- Ability to be bent into a desired shape; ideally without fracture (loops etc.)

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Definitions

Biocompatible:

- No adverse reactions

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Definitions

Frictional properties:

- "Rubbing/resistance"; for faster tooth movement wires with low friction are ideal

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Aligning Arch-wires

- Flexible (to allow engagement)
- Shape memory (to avoid permanent distortion)
- Low force (physiologically effective/safe)
- Biocompatible
- Super-elastic

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Working Arch-wires

- Rigid (to maintain archform)
- Stiff (to counteract unwanted forces of elastics)
- Low friction (to allow space closure)
- Large (to fully engage bracket slot and express prescription)
- Biocompatible

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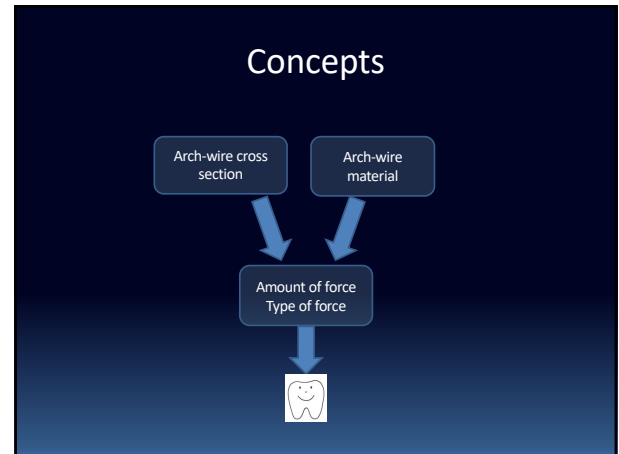
Nickel Titanium

	NiTi
Shape memory	✓
Stiffness	✗
Formability	✗
Friction	✗
Biocompatible	??
Super-elasticity	✓

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Stainless Steel	
SS	
Shape memory	✗
Stiffness	✓
Formability	✓
Friction	✓
Biocompatible	✓
Super-elasticity	✗

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Types of NiTi Arch-Wires	
• Regular NiTi • Heat-activated NiTi (HANT) • Copper NiTi (Cu NiTi)	
• Sizes • Round: .012, .014, .016, • Rectangular: 16x22, 17x25, 19x25	

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Other Arch-Wire Types	
• TMA (torque, formability) • Cobalt chromium (formability)	
Sizes • 19x25 ss • 0.020, 0.025, 0.030, 0.036	

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Types of SS Arch-Wires	
Regular SS	
Braided - finishing/detailing	
Twisted (twist-flex, co-axial) – retention	
Sizes	
Round: .018, .020	
Rectangular: 16x22, 17x25, 19x25	

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FIXED APPLIANCE SYSTEMS	
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Straight Wire Appliance

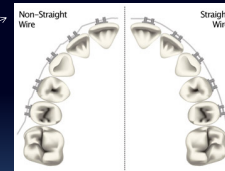
- The current orthodontic appliances known as pre-adjusted edgewise appliances or straight wire appliances were developed in 1970s.
- Each brackets has in-built prescriptions to control the labio-lingual, mesio-distal and inclination of the teeth. The prescription of the bracket is expressed when a straight rectangular archwire is placed through the slots.
- Minimal wire bending required
- Accurate bracket positioning on tooth surface essential



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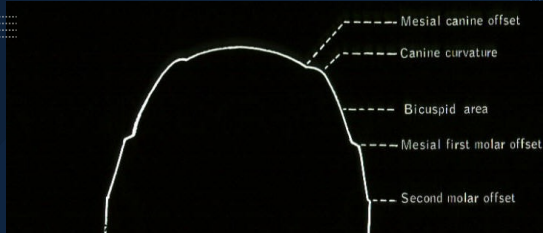
Straight wire appliance

Standard edgewise appliances require detailed wire bends to achieve the desired results



Pre-adjusted Edgewise brackets have individual prescription built into the brackets.

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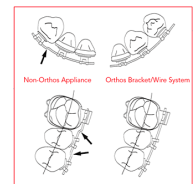
Example of 1st order bends

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1st Order Bends

- Bucco-lingual bends in AW to contour the labial surface of individual teeth

- Pre-adjusted edgewise: In/out molar offset – Variation of thickness of the brackets base



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2nd Order Bends

- Angled bends in AW for mesio-distal root positioning: angulation of the brackets relative to the long axis of the tooth.
- Pre-adjusted edgewise: Variation in bracket slot angulation

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3rd Order Bends

- Refers to bucco-lingual/palatal inclination of the crown or root
- A varying twist in segments of rectangular AW in order to achieve the correct torque of the tooth
- Pre-adjusted edgewise: Variation in bracket slot inclination

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Edgewise

- No 'prescription' tip/torque/labial/palatal movement pre-programmed into the bracket
- Multiple bends in arch-wires to achieve tooth positions

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Ceramic Straight Wire systems

- Advantages
 - Improved aesthetics
- Disadvantages
 - Brittle – prone to fracture
 - High friction – higher forces required
 - Harder than enamel – wear of upper incisor tips against lower incisor brackets



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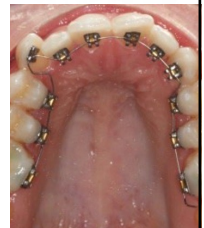
Lingual appliances



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Lingual appliances

Non customised



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Lingual appliances

Fully customised



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Lingual appliances

Advantages:

- Premium aesthetics
- Decreased risk of decalcification
- Significantly increased cost
- Highly specialised and labour intensive
- Increased chair-side time
- All the advantages of labial systems in terms of mechanics and tooth movement

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Lingual appliances

- Disadvantages:
- Patient comfort
 - speech problems
 - Non-customised variety can only be used for simple cases where no torque – needs increased wire bending

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Self-ligating Straight Wire systems

- Advantages
 - Low friction = lower forces required
 - Certain archwire engagement
 - Less chairside time
 - Improved oral hygiene
- Disadvantages
 - Less control of torque
 - Calculus
 - Increased cost
 - Swivelling of wires



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Self Ligating Brackets



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Active or Passive Self ligation System?

Active

Spring/clip encroaches slot, active force on AW
Range of labiolingual action: more alignment than passive slide
Higher friction and high forces

Passive

Passive labial surface slot, no ability to invade slot and store force by clip deflection
Lower forces are more advantageous with direction of force and OTM

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Self Ligating Brackets

- No modules – therefore can leave patient longer between re-ties
- Complete archwire ligation
- Potentially easier to maintain oral hygiene
- Adjustments are faster – decreased chair-side time

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Self Ligating Brackets

- Concept of 'friction-free' tooth movement; Arch development (?non-extraction) Resultant faster treatment
- No evidence to support shortened treatment times
- No evidence to support 'arch development' concept
- Expensive

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Tip-edge system

- Advantages
 - Light forces required
 - Reduced anchorage requirements
- Disadvantages
 - Difficult to achieve precise tooth positioning
 - Requires intermaxillary elastics from start of treatment



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Begg/Tip-Edge

- Round wire that fits loosely into the channel
- Movements achieved via springs/loops
- Early and prolonged used of intra-oral elastics
- Hygiene maintenance difficult
- Finishing EXTREMELY difficult
- Tip-Edge is a hybrid of Begg plus SWA

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Methods of ligation

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Elastomeric Ligation



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Elastomeric Ligation

Advantages:

- Colours
- Easy to place
- Cheap
- Comfortable
- Increased engagement with figure of 8
- Can be fluoride coated

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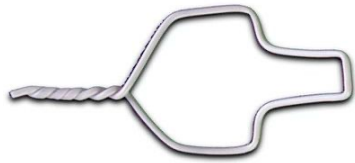
Elastomeric Ligation

Disadvantages:

- Friction
- Decay in oral environment
- Become inactive over time
- Need changing every 4-6 weeks

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Stainless Steel Ligation



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Stainless Steel Ligation

Advantages:

- Low friction
- Can regulate how much to tie in (partial vs full engagement)
- Not as plaque retentive
- No force decay over time



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Stainless Steel Ligation

Disadvantages:

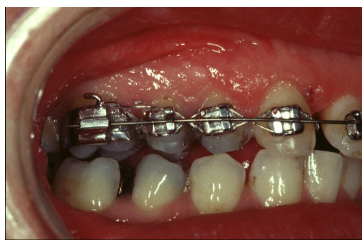
- Placement more time consuming
- Discomfort from ends
- More difficult to remove (small headed ligature cutters with SHARP beaks!!)

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Auxiliaries

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Lace-Backs Continuous Ties



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Space Closure

- Niti Coil springs: 9mm/12mm
- Power chain
- Active ligatures
- Closing loops



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NiTi coils



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Powerchain



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Active ligatures



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Closing loops



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Crimpable Hooks and Posted Archwires



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Kobayashi Hooks



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Transpalatal arch



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Nance palatal button



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Expansion



Quadhelix

Rapid maxillary expansion



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Elastics



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Archwires



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Practical skills

- P

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Inserting an Archwire



What you need:



[Closeback](#)

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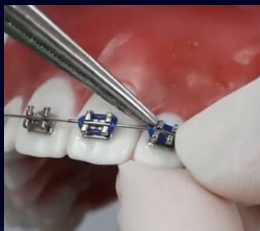
Customising and coordinating archwires

- The patient's pre-treatment lower arch form should be maintained during orthodontic treatment as much as possible.
- Original lower inter-canine width should be maintained as much as possible because expansion of lower inter-canine width is prone to orthodontic relapse.



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Placing auxiliaries: Modules



What you need:

[Placing a module](#)



To remove:



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Placing auxiliaries: Quickties



[Placing a quicktie](#)

What you need:

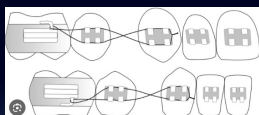


To remove:



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Placing auxiliaries: Lacebacks



[Placing a laceback](#)

What you need:



Also used to remove

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Placing auxiliaries: Powerchain



What you need:

[Powerchain](#)



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Placing auxiliaries: NiTi coil springs

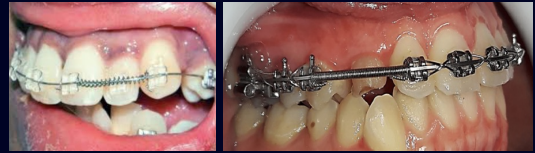


What you need:



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Placing auxiliaries: Open coil/Closed coil



What you need:



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STAGES OF TREATMENT WITH FIXED APPLIANCES

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1. Bond-up

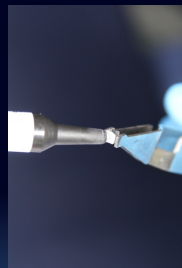
- Isolate teeth
- *Either*
 - Etch with 37% phosphoric acid
 - Wash and dry
 - Apply bonding agent to teeth
- *Or*
 - Apply combined etch and bond and air dry (single step – no washing required)



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1. Bond-up

- Apply composite resin to bracket base



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1. Bond-up

- Position bracket on tooth surface



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1. Bond-up

- Remove excess cement
- Light cure

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Advice at bond-up – what to expect

- Initial discomfort – lasts 3-4 days
- Analgesics may be required
- Comfort wax provided for any areas which rub



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Advice at bond-up – care of fixed appliances

- Brush twice daily with fluoride toothpaste
- Use an interspace brush for cleaning around brackets
- Use fluoride mouthwash daily at a different time to brushing
- Avoid sticky, hard and chewy sweets (including chewing gum)
- Cut up hard, crunchy or crispy foods into pieces
- Avoid sweet and acidic drinks
 - Any carbonated drinks (even if sugar-free)
 - All sports drinks
 - Anything fruit-flavoured



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2. Aligning and levelling

- Initial light flexible nickel-titanium wires – typically 0.014 NiTi
- Archwire must be passive before moving to a new wire
- Work through desired archwire sequence.
- This stage is complete once the 'working' archwire can be inserted – usually 19/25 stainless steel

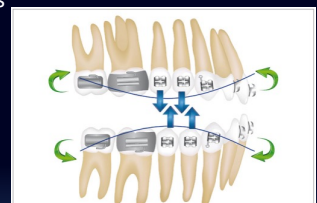
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3. Overbite control

- Deep overbite prevents space closure and overjet reduction
- Rigid 19/25 SS wire required
- If overbite difficult to reduce:
 - Add reverse curve of Spee to lower wire



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4. Overjet reduction and space closure

- Slide teeth along 19/25 SS archwire
- Close spaces using NiTi coil springs or powerchain
- Support overjet reduction with intermaxillary elastics
- Care with anchorage
 - Keep forces light
 - Ensure sufficient teeth in anchor unit to prevent unwanted tooth movements



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5. Finishing and detailing

- Intermaxillary elastics
 - Box elastics
 - Asymmetric elastics
- Light wires to allow occlusal settling e.g. braided stainless steel or 16/22 NiTi



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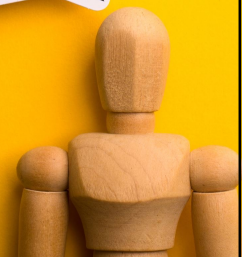
6. Debonding

- Use special debonding pliers
- Apply shear force to bracket to distort base
- Composite cement fails at junction between bracket and cement
- Remove residual composite using low speed tungsten carbide bur



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Thank You
Questions?



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