Relapse, Debond and Theory of Bonded Retainers

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1

Objectives

- Understand occlusal features prone to relapse
- Understand the factors which can result in post treatment change
- Explain the different types of fixed retainers and their indications
- Understand how to place a fixed retainer

2

Occlusal features associated with relapse

- Rotations
- Spacing
- Lower incisor crowding
- Previous periodontal disease
- Crowding later in life has been found to occur in untreated individuals and as such, should be regarded as an age-related change rather than relapse.

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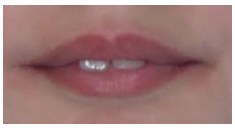
Unfavourable post-treatment local environments

- Incompetent lips
- Poor tongue posture
- Lack of anterior occlusion



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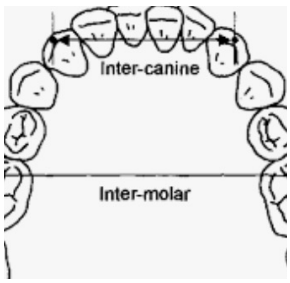
Arch form related changes created during treatment

- Increased lower inter-canine width
- Significant movement of mandibular labial segment



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Lower incisor crowding

- Crowding of the lower incisors is one of the most common problems encountered in the permanent dentition
- Studies of untreated subjects followed from the mixed dentition into adulthood have shown a tendency for:

1. the width and length of the mandibular arch to decrease
2. crowding of the anterior teeth to increase

6

Primary crowding

- Primary crowding refers to a discrepancy of tooth dimension and jaw size, mainly determined genetically.

7

Secondary crowding

- Secondary crowding is caused by environmental factors, including local space conditions in the dental arches and the position and function of the tongue, the lips and the buccal musculature.

8

Tertiary crowding

- Tertiary crowding occurs during adolescence and post-adolescence with a tendency for the lower labial segment

9

Factors contributing to late lower incisor crowding

- Mandibular growth rotations
- Anterior component of occlusal force
- Physiologic mesial drift
- Soft tissue maturation
- Degenerative periodontal changes allowing teeth to drift under light pressures
- Change in diet and lack of interproximal wear
- Tooth size and shape
- Tooth loss and drifting leading to changes in occlusal function

10

Impact of wisdom teeth

- Randomized Controlled Trial conducted by Harradine et al. (1998) investigated the effect of third molar extraction on late lower incisor crowding.
- The principal conclusion drawn from this randomized prospective study is that the removal of third molars to reduce or prevent late incisor crowding cannot be justified.

11

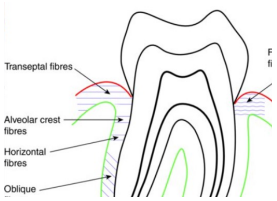
Post treatment changes

- Four broad areas have been suggested as possible reasons for post treatment changes:
- Gingival and periodontal factors
- Occlusal factors
- Soft tissues factors
- Growth factors.

12

Gingival and periodontal factors

- When teeth are moved, the periodontal ligament and associated alveolar bone remodels.
- Until the periodontium adapts to the new position, there is a tendency for the stretched periodontal fibres to pull the tooth back to its original position.
- Different parts of the periodontal ligament complex remodel at different rates:
  - Alveolar bone remodels within 1 month
  - Principal fibres rearrange in 3–4 months
  - Collagen fibres in the gingivae reorganize after 4–6 months.
  - Elastic fibres in the dento-gingival and interdental fibres can take more than 8 months to remodel.



13

Occlusal factors

- The way the teeth occlude at the end of treatment may affect stability.
- Good interdigitatation at the end of treatment may result in more stability, however has not been proved clinically.
- E.g. Anterior crossbite correction can remain stable if an overbite present on completion of treatment

14

Soft tissues

- The teeth lie in an area of balance between the tongue and the cheeks and lips.
- **Neutral zone**
- Forces from the tongue are stronger, the activity of a healthy periodontium will resist proclination of the teeth.

15

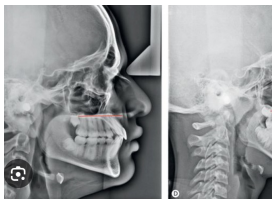
Soft tissues

- Excessive proclination or retroclination of incisors may make relapse more likely.
- If the archform is markedly changed, it is more likely to relapse due to soft tissue pressures.
- Changes in the intercanine width are more unstable than changes in the intermolar width, which in turn are more unstable than changes in the interpremolar width.
- The original lower archform should therefore be maintained throughout treatment, and the upper archform is then planned around the lower.

16

Growth

- Majority of patient's growth is complete by the end of puberty, however small changes may be occurring throughout life.
- Subtle changes in the relative positions of the maxilla and the mandible mean that the oral environment and therefore the pressures on the dentition are constantly changing.
- Late growth changes may at least partly explain the late lower incisor crowding that is seen in patients who have had, but also in those who have not had, orthodontic treatment.



17

Prevention of relapse

- Unable to predict the nature of late changes
- These late changes may have little or nothing to do with the orthodontic treatment, but patients may attribute the unwanted post-treatment changes to their orthodontic treatment.
- During the consent process for orthodontic treatment, it is important that patients are informed about the effects of these unpredictable late age changes, and how they can be minimized.

18

Post treatment changes

- Long-term studies of post-treatment changes following fixed appliances have shown that 10 years after retainers are stopped, up to 70% of patients may need retreatment due to these post-treatment changes.
- These changes continue to get worse over the following decades.

19

Post treatment changes

- It is difficult to predict, on an individual basis, what post-treatment changes
- Unable to identify which patients will have teeth that will remain in a reasonably stable position, and which patients will not, so we have to presume every patient has the potential to show post-treatment changes.
- As a result we recommend long-term retention for as long as the patient wants to keep their teeth stable.
- This information must be passed onto the patient as part of the informed **consent process.**

20

Debonding

- Bands are removed using special pliers, which exert an occlusally directed force from the gingival margin.
- Because of the anatomy of molar teeth, the force is applied from the palatal aspect in the maxillary arch and buccally in the mandible.
- In contrast to bands, the bond strength for bondable attachments must be higher to prevent repeated failures.
- The aim upon removal of a bonded fixed appliance is for the failure to occur between the bracket base and composite junction, and not at the junction between enamel and composite, to avoid the risk of enamel fracture.
- To achieve this, a shear force is applied across the bracket base with debonding pliers

21

Debonding

- This distorts the bracket base and causes failure at the junction between bracket base and composite.
- Residual composite is removed from the tooth, ideally using a tungsten carbide fissure burr in a slow handpiece.
- Ceramic brackets initially had very high bond strengths, which resulted in a significant risk of enamel fracture on debonding.
- To overcome this, most contemporary systems have a failure point built into the bracket base, which means that when a shear force is applied, the bracket fractures down the midline, collapsing the tie-wings of the bracket that can then be easily removed.

22

Bonded retainers

- Bonded retention, the splinting of two to eight anterior teeth together, became popular in the 1980s.
- There has also been an increasing recognition that adherence to wear of removable retainers is often suboptimal.

23

Retainers

- Vacuum formed retainers remain the most popular and commonly used retainer in the UK
- BOS members report that bonded retainers are used more commonly in private practice than either primary or secondary care.

24

Bonded retainers

- Fixed or bonded retainers are usually attached to the palatal aspect of the upper or lower labial segment, using normal acid-etch composite bonding.
- Multistrand stainless steel have been used since 1980's
- 1. Widely available
- 2. Flexibility of multistrand SS allows minor physiological movement, therefore reducing risk of breakages
- 3. Textured, grooved surface of multistrand wire ideal for retention with composite resins

25

Types of bonded retainers

- Multistrand retainers bonded to each tooth
- Flexible chain retainers bonded to each tooth
- Nickel titanium computer-assisted design/manufacture (CAD/CAM) retainer
- Rigid canine-and-canine retainers, which are only bonded to the canine teeth
- Reinforced fibres

26

Multistrand retainers

- Three stranded wires with high resilience are found to be more prone to fracture than retainers using a softer five strand wires
- Six stranded co-axial wires with a core filament surrounded by five peripheral filaments are used frequently
- Multi-stranded wire is round in cross-section and formed from strands that are twisted, made from 0.015", 0.0175", 0.0195" or even 0.0215" stainless steel strands.
- Round, sandblasted stainless steel wire, 0.030"–0.032" in diameter.

27

Flexible chain retainers

- Low profile chain like design derived from 14 carat gold or stainless steel is an alternative material (Ortho Flextech)
- Low profile lends to patient comfort

28

CAD/CAM bonded retainers

- Nickel-titanium CAD/CAM retainers to ensure a passive fit

29

Canine to canine retainers

- Fixed retainers bonded only to the canine teeth allow easier cleaning.
- These canine-and-canine retainers are more rigid, and are sometimes referred to as 'fail-safe'.
- This because if one attachment fails, the patient will immediately know about it and get it repaired.
- The disadvantage with the canine-and-canine retainers is that they may result in relapse of the incisors, which are not bonded to the wire.

30

Reinforced fibre retainer

- Reinforced fibres (often for direct placement).
- The fibreglass strips are soaked in composite and bonded to prepared enamel surface.
- This technique has the advantage of reducing the bulk of the retainer.
- The reinforced fibre retainers are not recommended as they tend to fracture more frequently due to lack of flexibility.

31

Bonded retainers

Advantages	Disadvantages
Easy and well tolerated by the patient	Their placement is time-consuming
Unlikely to compromise on aesthetics	Technique-sensitive
Unlikely to interfere with speech	Interference with the occlusion, especially in cases with increased overbite
Less compliance dependent than removable retainers	Gingival/periodontal disease and caries may develop due to plaque accumulation
It may reduce the risk of development of late lower labial segment crowding	May prevent settling of the occlusion
Allow some physiological movement of the teeth	Do not retain transverse expansion
Retain derotations well	High failure rates 23%14
Can be fabricated indirectly in the lab therefore reducing chairside time and complexity of fabrication	Fixed retainers can fail without the patient realizing – this may result in unwanted tooth movement
No evidence of increased periodontal or enamel damage	A back-up removable retainer should also be supplied to the patient to preserve tooth position if the fixed retainer fails.

32

Monitoring bonded retainers

- Fixed retainers should be reviewed periodically and maintained or repaired where necessary.
- They should be checked thoroughly at least annually to ensure that the composite and wire components are intact, with no distortions, and that there is no excessive calculus build-up around the retainer.

33

Complications of bonded retainers

- Generally safe and predictable
- Failure of bonded retainer
- Adverse effect on periodontal health
- Unwanted tooth movement 'Wire syndrome'

34

Failure of bonded retainer

- 1%-53% prevalence
- Wire-composite interface
- Composite-enamel interface
- Wire fracture
- If the composite is lost completely from one tooth, then simply cleaning the tooth and replacing the lost composites will suffice.
- If the composite is difficult to remove completely from the wire, then the retainer may need to be replaced.
- A fractured retainer will require removal and replacement following the usual bonding protocol.

35

Fractured composite pad

36

The remaining composite is removed from the tooth which is then re-etched.

37

A new pad is created for a good-as-new repair. The same process is used to replace a pad with bond failure

38

Negative effect on periodontal health

- Increased plaque and calculus accumulation
- Increased risk of gingival recession
- Placement clear of gingiva and avoiding papillae
- Challenges in upper arch due to occlusion

39

'Wire syndrome'

- Wire syndrome' is a phenomenon that involves fixed orthodontic retainers causing unwanted tooth movement.

40

Two theories

- The first theory relates to procedural errors on placement of the bonded wire.
- The second theory relates to a break in the bond between the wire and the adhesive, leading to rotation of the wire, exerting force that can cause unwanted tooth movement

41

Wire syndrome

- Wire syndrome leads to unwanted and unexpected tooth movement.
- Teeth can be displaced in all three planes of space.
- It is important to review both pre-treatment photos and photos following debonding of appliances to determine whether tooth movements are caused by orthodontic relapse or are a result of wire syndrome.
- Extreme wire syndrome can lead to the root being torqued out of the alveolar bone, leading to gingival recession.
- This also puts pressure on the neurovascular bundle, resulting in loss of vitality.

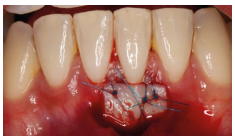
42



Wire syndrome

43

Free gingival graft

44

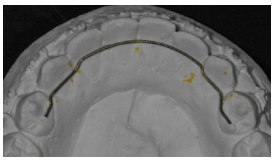
Practical considerations when planning bonded retention

- Ensure the risks and benefits of bonded retainers are fully discussed as part of the initial consent process
- Ensure patients are also aware of their own long-term responsibilities, including day-to-day maintenance
- Emphasise the need for excellent periodontal health throughout treatment and retention
- When planning upper bonded retention, plan to reduce the overbite sufficiently for the retainer to be out of occlusion
- Keep detailed records of the consent information and processes.

45

Preparation of wire

- The retainer wire should be passive and should fit rather than being actively pulled towards the teeth while curing the adhesive pads.
- An approach that can be recommended is to take an impression the visit before debond, which could be a few days or a few weeks beforehand, so long as the alignment of the teeth to be retained is not anticipated to alter.
- The wire can then be bent to a model either in the practice or by a laboratory



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Preparation of wire

- The chain alternative (for example, Ortho Flextech) requires no preparation before the debond visit as this product has no resilience.
- However, the quality of fit is constrained by its limited level of formability.
- While small detailing in/out bends are possible to ensure the chain sits flat against adjacent teeth, this product may not be suitable where substantial in/out adjustments or any vertical steps are required.

47

Preparation of teeth

- It is particularly important to avoid gingival haemorrhage or seepage while bonding retainers.
- Thorough debridement of the lingual surfaces on the day of debond, including interdentally, is recommended even if they look clean.
- The surfaces to be bonded may be cleaned with gentle use of debonding burs, sandblasting or ultrasonic cleaning and then polished with oil-free paste in a rubber cup.
- The surfaces should be etched for up to 45 to 60 seconds to ensure maximal bond strength. The subsequent washing must be thorough and drying must be with air that is free of oil and water.

48

Process of bonding

- A key to successful bonding is moisture control.
- The next step is sealing the enamel surface with unfilled resin followed by bonding of the retainer wire
- The wire can be held in place with dental floss or intraoral elastics while the composite is applied and cured.
- Another technique is to use a positioning jig to hold the wire while the composite is cured or to use a very sparing amount of composite to assist with initial location of the wire.

49

Sandblasting of enamel prior to etch and bond

50

Acid etch of enamel

51

Application of bonding agent

52

Light cure of bonding agent

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Small amount of flowable composite placed centrally on the lingual surface

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The wire is introduced with tweezers and the composite used to gently tack the wire in position

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Composite is cured

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Layer of heavily filled composite is applied using microbrush and probe to increased surface area

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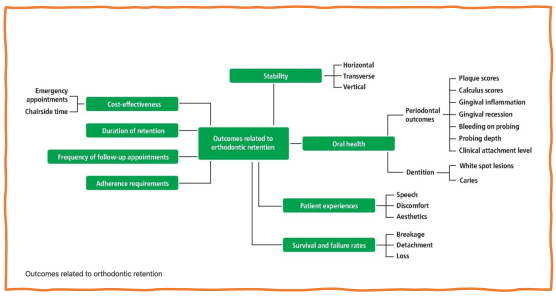

Outcomes related to orthodontic retention

58

Practical

Placement of bonded retainer

59

Questions?

60