DR AVAN MOHAMMED
Avan is an award-winning specialist orthodontist working in private practices in Marylebone, Islington and South Kensington.

YAN HUANG
Yan qualified from Barts and London Dental School in 2007. Having completed her orthodontic specialist training she obtained her doctorate degree and membership in orthodontics in 2018. Yan works in mixed NHS/private specialist orthodontic practices in London and Kent.

ENHANCED CPD

GDC anticipated outcome: C
CPD hours: one
Topic: Orthodontics
Educational aims and objectives: To discuss orthodontic treatment planning considerations and factors affecting stability in dental arch alignment, including relevant literature. This article qualifies for one hour of enhanced CPD; answer the questions on page 88.

Orthodontic relapse is defined as the return, following correction to the original features of the malocclusion (British Standards Institute, 1983).

Moyers (1973) described retention as: 'The holding of teeth following orthodontic treatment in the treated position for the period of time necessary for the maintenance of the results.'

Stability can only be achieved if the forces derived from the periodontal and gingival tissues, the orofacial soft tissues, the occlusion and post-treatment facial growth and development are in equilibrium (Moss, 1980).

Orthodontic retainers resist the tendency of teeth to return to their pre-treatment positions under the influence of:

- Resolution of bone metabolism
- Periodontal (tension in periodontal fibres particularly those around the necks of the teeth – interdental and dento-gingival fibres)
- Occlusal (quality of final occlusion – with unwanted displacing occlusal contacts potentially leading to unfavourable changes in tooth position). For example, reducing an overbite will be more stable if the lower incisal edge lies anterior to the centre of upper incisor root centroid (Houston, 1989)
- Soft tissue forces and continuing dentofacial growth – unwanted tooth movement after treatment can occur as a result of normal age changes. Due to changes in soft tissue pressures and skeletal structure around the dentition (minor ongoing growth) – these can be regarded as a part of normal ageing process and unpredictable.

Therefore, retainers are indicated not only to resist the tendency of teeth to return to their pre-treatment positions, but also to resist unwanted long-term age changes.

SHORT-TERM STABILITY

Short-term stability is the first one to two years following orthodontic treatment. Reitan and collegues (1967) found that settling of gingival fibres takes up to seven to eight months.

Factors affecting short-term stability include:

- Poor planning of mechanics with unstable treatment (transverse arch expansion)
- Excessive arch lengthening (ie lower labial segment proclination)
- Moving teeth outwit bony limits
- Severe rotations (a long-term study by Edwards in 1988 confirms that circumferential supracrestal fiberotomy reduces relapse of rotations)
- Spaced dentition
- Deep bites
- Anterior open bites
- Soft tissue factors – large tongue
- Habits – thumb sucking, nail biting
- Failure to plan appropriate retention
- Poor compliance with retention
- Continued growth with skeletal changes and soft tissue maturation.

LONG-TERM STABILITY

Literature overview

Little and colleagues (1981) conducted a study of 65 patients who underwent extraction of all first premolars. After 10 years of completion of orthodontic treatment, 70% became crowded with 20% of markedly crowded need of retreatment. Mean crowding was 5.25mm.

Another study carried out on 31 cases who had completed orthodontic treatment 20 years ago found that crowding increased by 1mm on average whereas both arch length and width reduced and only 10% patients had a clinically acceptable result. They found no significant predictors of stability of lower incisor alignment (Little et al, 1988).

Avan Mohammed and Yan Huang discuss orthodontic treatment planning considerations and factors affecting stability in dental arch alignment, including relevant literature

Retention and stability

Malocclusions most likely to relapse
Diastemas and spacing (Edwards, 1977)
Rotations (Edwards, 1970, 1988)
Deep overbite (Sadowsky and Sakols, 1982)
Cleft lip and palate patients
Arch form changes (De la Cruz et al, 1995)
Altered lower labial segment position (Mills, 1968)
Periodontally involved teeth

TABLE 1: *Malocclusions and relapse*

FIGURES 1A *and* **1B:** *Palatally displaced upper lateral incisors*

FIGURES 2A *and* **2B:** *Significant retroclination of upper lateral incisors and proclination of upper central incisors*

These two studies generally had small sample sizes and no randomisation. However, similar findings have been demonstrated by others (Vaden et al, 1997):

- Little and Reidel (1989) – 30 cases observed for 10 years and assessed relapse in cases with generalised spacing and found 50% cases showing minimal irregularity. Arch length and inter canine width constriction continued into adult years
- Houston and Edler (1990) – no evidence that aligning lower incisor tips to Apo line (proposed by Rayleigh Williams) will guarantee a stable result. 62% case relapse away from Apo position towards their original position
- De la Cruz et al (1995) did a 10 year post retention review of class II div 1 cases with four first premolars extractions. They found increase change in arch form will increase risk of relapse. However, minimising treatment changes was no guarantee of post retention stability with huge individual variation seen. Exceptions are class II div 2 (Mills, 1968), habits, bimaxillary proclination cases (Keating, 1985, 1986), retroclined lower labial segment (LLS) trapped in palate and very mild crowding (Paquette et al, 1992).

LOWER LABIAL SEGMENT CROWDING: AETIOLOGY

- Proclination of lower incisors and expansion of inter canine width during ortho treatment (Mills, 1968, Little et al, 1981)
- Anterior component of force – relationship occurs between LLS crowding and occlusal force but hit may not be cause and effect relationship (Southard et al, 1989, 1990)
- Late mandibular growth with significant growth rotation (Bjork and Skieller, 1972)
- Mesial drift (Southard et al, 1992)
- Lack of interproximal wear (Begg, 1954)
- Tooth size discrepancies (triangular incisor crowns increase risk of irregularity) (Peck and Peck, 1972)
- Tight interproximal contracts increase risk of irregularity (Southard et al, 1990)
- Arch length increased during mixed dentition (Little et al, 1990b)
- Periodontal disease allowing drift.

THE ROLE OF THE THIRD MOLARS

Third molars do not influence long-term stability of lower labial segment. Prophylactic extraction of third molars as a means of preventing relapse of lower labial segment is not recommended.

Harradine and colleagues (1998) conducted a prospective, randomised controlled clinical trial into the effect of third molars on late lower incisor crowding. Patients recruited to study had completed retention following orthodontic treatment and were no longer wearing retainers. Treatment with appliances in upper arch only, in lower arch premolar extractions or no treatment. All patients had crowded third molars.

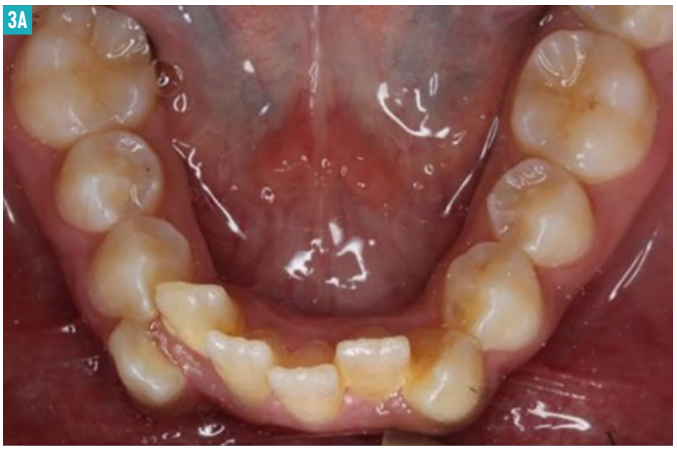
Patients were randomly allocated into third molar extraction and non-extraction groups. Of the original 164 patients, 77 attended five years following the end of retention.

The start and finish study models were digitised to determine Little's irregularity index, intercanine width and arch length. The study found a very small decrease in lower labial segment irregularity in patients who had had lower third molars removed, therefore the findings were not statistically or clinically significant.

Another study by Ades and colleagues (1990) studied groups of absent eights, impacted eights, aligned and functional eights and extractions eights 10 years previously and found no significant differences between groups for lower labial segment crowding or amount of crowding or in growth pattern.

There is no justification for removable of eights on the grounds of LLS crowding (Harradine et al, 1998; NICE, 2000).

Yu and colleagues' (2013) Cochrane review on interventions for managing relapse of lower front teeth after orthodontic treatment found no evidence on best practice in managing relapse of the lower labial segment. The removal of third molars in an attempt to reduce the degree of late lower incisor crowding cannot be justified.



FIGURES 3A *and* **3B:** *Severe crowding of lower labial segment corrected, bonded retainer placed*

FIGURES 4A *and* **4B:** *Upper lateral incisor in anterior crossbite*

FIGURES 5A *and* **5B:** *Tongue thrust resulting in an open bite and proclination of lower labial segment*

HOW TO MINIMISE RISK OF RELAPSE

When it comes to minimising the risk of orthodontic relapse, factors to consider include the following:

- Extraction of the most displaced teeth or rotated teeth
- Maintain existing arch form if possible
- Maintain intercanine width
- Do not alter anterior-posterior position of the LLS (Mills, 1968; Proffit, 1978)
- Placing lower two to two outside lower three to three (Zachrisson, 1997)
- Correct rotation early in treatment
- Consider interproximal reduction (IPR) for triangular teeth to increase area of interproximal contact (Boese, 1980). However, this contention is disputed by Gilmore and Little (1984) due to the relapse cases being excluded from published results
- Active retention for skeletal discrepancies throughout growth (use bite plane effect in cases with residual growth) (Nanda and Nanda, 1992)
- Obtain an adequate centroid/edge relationship – lower incisor edge occludes 0-2mm anterior to upper root centroid (Houston, 1989)
- Move upper incisors to within the control of the lower lip
- Maximise interdigitation (Pancherz and Fackel, 1990; Lloyd and Stephens, 1990)
- Use bonded/fixed retainers.

CONCLUSION

Retention in orthodontics is necessary in order to allow for periodontal and gingival reorganisation (Blake and Bibby, 1998), minimise changes due to continued growth, permit neuromuscular adaptation to the corrected tooth positions and to maintain unstable tooth positions, if such positioning is required for reasons of compromise or aesthetics. CD

REFERENCES

siobhan.hiscott@fmc.co.uk