British Journal of Orthodontics

ISSN: 0301-228X (Print) (Online) Journal homepage: http://www.tandfonline.com/loi/yjor19

Stability and Relapse of Dental Arch Alignment

Robert M. Little D.D.S., M.S.D., Ph.D.

To cite this article: Robert M. Little D.D.S., M.S.D., Ph.D. (1990) Stability and Relapse of Dental Arch Alignment, British Journal of Orthodontics, 17:3, 235-241, DOI: 10.1179/bjo.17.3.235

To link to this article: http://dx.doi.org/10.1179/bjo.17.3.235

British Journal of Orthodontics/Vol. 17/1990/235–241

Review Article

Stability and Relapse of Dental Arch Alignment*

ROBERT M. LITTLE, D.D.S., M.S.D., PH.D.

Department of Orthodontics SM-46, School of Dentistry, University of Washington, Seattle, Washington 98195, U.S.A.

Abstract. *For more than 35 years, research in the Department of Orthodontics, University of Washington has focused on a growing collection of over 600 sets of patient records to assess stability and failure of orthodontic treatment. All had completed treatment a decade or more prior to the last set of data. Evaluation of treated premolar extraction cases, treated non-extraction cases with generalized spacing, cases treated by arch enlargement strategies, and untreated normal occlusions demonstrate similar physiological changes.*

1. *Arch length reduces following orthodontic treatment, but also does so in untreated normal occlusions.*
2. *Arch width measured across the mandibular canine teeth typically reduces post-treatment whether the case was expanded during treatment or not.*
3. *Mandibular anterior crowding during the post-treatment phase is a continuing phenomenon well into the 20–40 age bracket and likely beyond.*
4. *Third molar absence or presence, impacted or fully erupted, seems to have little effect on the occurrence or degree of relapse.*
5. *The degree of post-retention anterior crowding is both unpredictable and variable and no pretreatment variables either from clinical findings, casts, or cephalometric radiographs before or after treatment seem to be useful predictors.*

Index words: Relapse, Alignment, Irregularity, Post-retention

Introduction

For more than 35 years, the faculty and graduate students in the Department of Orthodontics, University of Washington, have diligently collected diagnostic records of over 600 patients who a decade or more prior to that time had completed their orthodontic treatment. Evaluation of satisfactory and unsatisfactory treatment has tested our theories, our personal biases, and our clinical convictions. Clinical practice is a balance of experience and our intuitive clinical experimentation, an evolving process that shapes our philosophy of treatment. Modifications of our methods and techniques can, and should result from the range of treatment success as well as failures. In fact, we must be willing to examine our results critically, looking at those that fail so that we can learn and improve. The key to the successful practice of orthodontics is the re-examination of our treated patients and the careful evaluation of the results.

Of concern at the conclusion of treatment to both patient and practitioner, is the degree of anticipated stability and the potential for relapse. When can retainer use be discontinued and will significant change follow?

The focus of our research has been on the mandibular arch, the assumption being that alignment of the lower arch serves as a template around which the upper arch develops and functions. The purpose of this article is to summarize the results of this research on arch length problems and to suggest the clinical implications.

Inadequate Arch Length

Extraction of premolars in the full permanent dentition

Materials and methods. Sixty-five sets of first premolar extraction patient records were evaluated

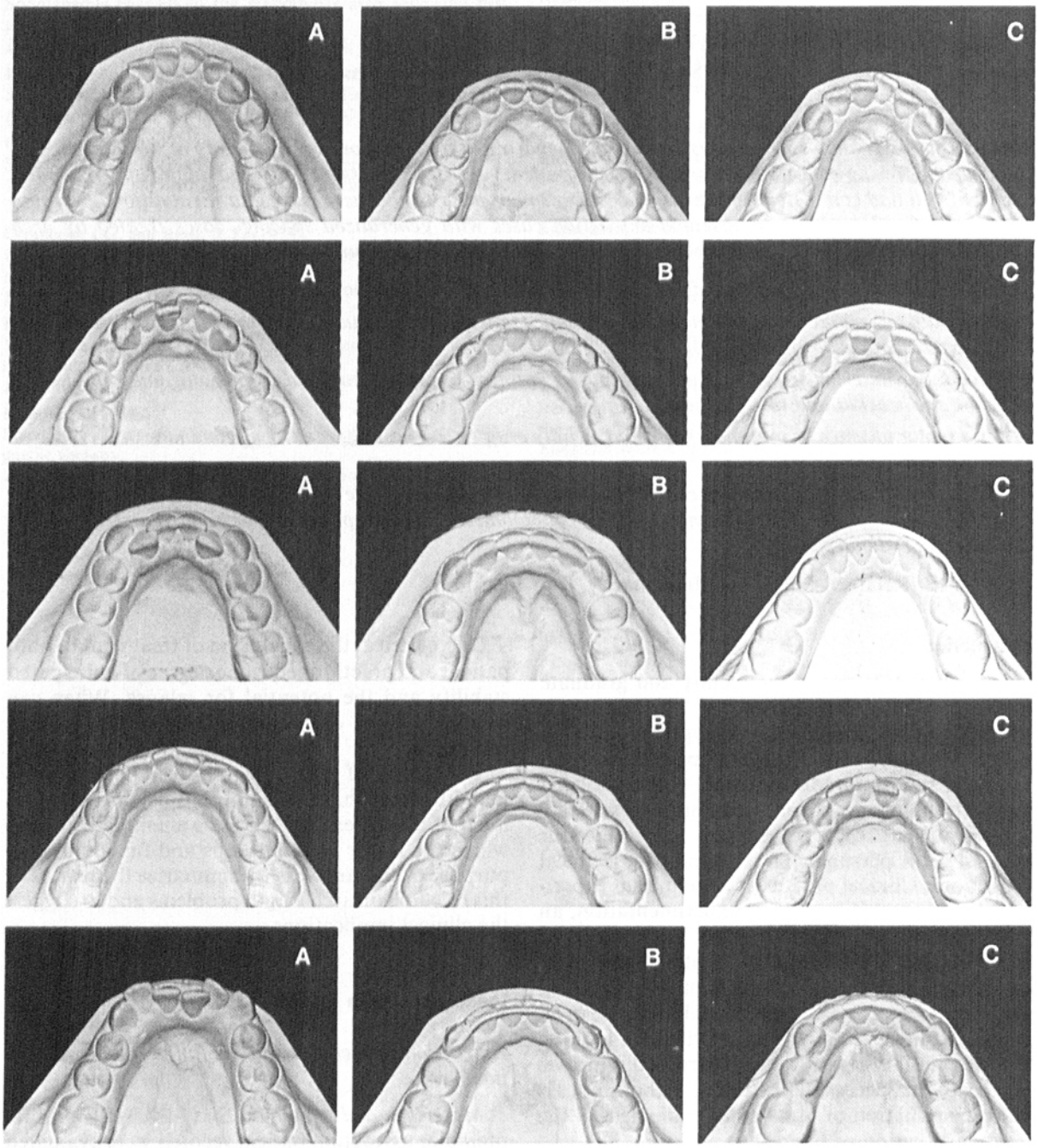
* Based on a paper delivered at the BOC, Birmingham, September 1989

0301-228X/90/008000+00$02.00

pretreatment, posttreatment, and a minimum of 10 years post-retention (Little *et al.*, 1981; Shields *et al.*, 1985). All cases had undergone a retention period, typically 2 years or more. A subsequent study was completed of 31 postretention cases a minimum of 20 years postretention (Little *et al.*, 1988). In a later article, 32 second premolar extraction cases were evaluated (McReynolds and Little, 1990). Additionally, the role of third molars as a cause of postretention relapse was evaluated (Amin *et al.*, 1990).

Results.

1. Long-term alignment was highly variable and unpredictable (Figs 1–5).



FIGS 1–5 Results following premolar extraction, edgewise orthodontics, and retention: (A) pretreatment; (B) end of active treatment; (C) post-retention.

2. No characteristics such as Angle classification, length of retention, patient age at the beginning of treatment, gender, or any measured variables such as initial or end of treatment alignment, overbite, overjet, arch width, or arch length, were of value in predicting the long-term result. No multiple correlations combining these variables improved our ability to predict the long-term stability or relapse of the cases.
3. Arch length and arch width typically decreased following retention, as crowding increased. This seemed to occur in spite of treatment maintenance of the initial arch width, treatment expansion, or treatment constriction.
4. Success at maintaining satisfactory alignment was less than 30 percent with nearly 20 per cent demonstrating marked crowding many years after removal of retainers.
5. Pre- and post-treatment cephalometric data were of little value in predicting the long term result. Combinations of cephalometric variables such as incisor position and facial growth were poor predictors of future arch irregularity. Postretention changes of cephalometric variables failed to explain crowding. Combinations of dental cast variables, descriptive characteristics and cephalometric variables failed to show useful associations with long term stability or relapse.
6. Arch length and arch width reduction with concomitant crowding continued well into the 20–30 age span and apparently beyond, but the rate of change seemed to diminish after age 30.
7. There appears to be no difference in treatment quality between first and second premolar extraction cases.
8. Third molar absence or presence, impacted or fully erupted, seemed to have little effect on the occurrence or degree of relapse.

Serial extraction of deciduous teeth plus premolars

Materials and methods. Thirty cases were evaluated following a series of deciduous tooth extractions in the mixed dentition followed by the removal of the four first premolars. All had undergone routine edgewise orthodontics, retention a minimum of 2 years, and had aged to qualify as a 10-year post-retention case (Little *et al.*, 1990). Fourteen cases of second premolar serial extraction were subsequently evaluated (McReynolds and Little, 1990).

Results.

1. Alignment usually improved during the physiological drift stage following extraction of premolars and before the start of active treatment.
2. Serial extraction cases were no better aligned post-retention than late extraction cases. Success was less than 30 per cent.
3. Serial extraction cases were also unpredictable and highly variable relative to long-term alignment (Figs 6–8).
4. As with late extraction cases, arch width, and arch length typically decreased postretention.
5. There appears to be no difference in post-retention quality between first and second premolar serial extraction cases.
6. No descriptive, cast or cephalometric variables were useful predictors of long-term stability or relapse.

Arch length increased actively during the mixed dentition

Materials and methods. Twenty-six patients with records pretreatment, post-treatment, and a minimum of 6 years post-retention were assessed. All had arch length actively increased at least 1 mm during the mixed dentition with either fixed or removable appliances (Little and Riedel, 1990).

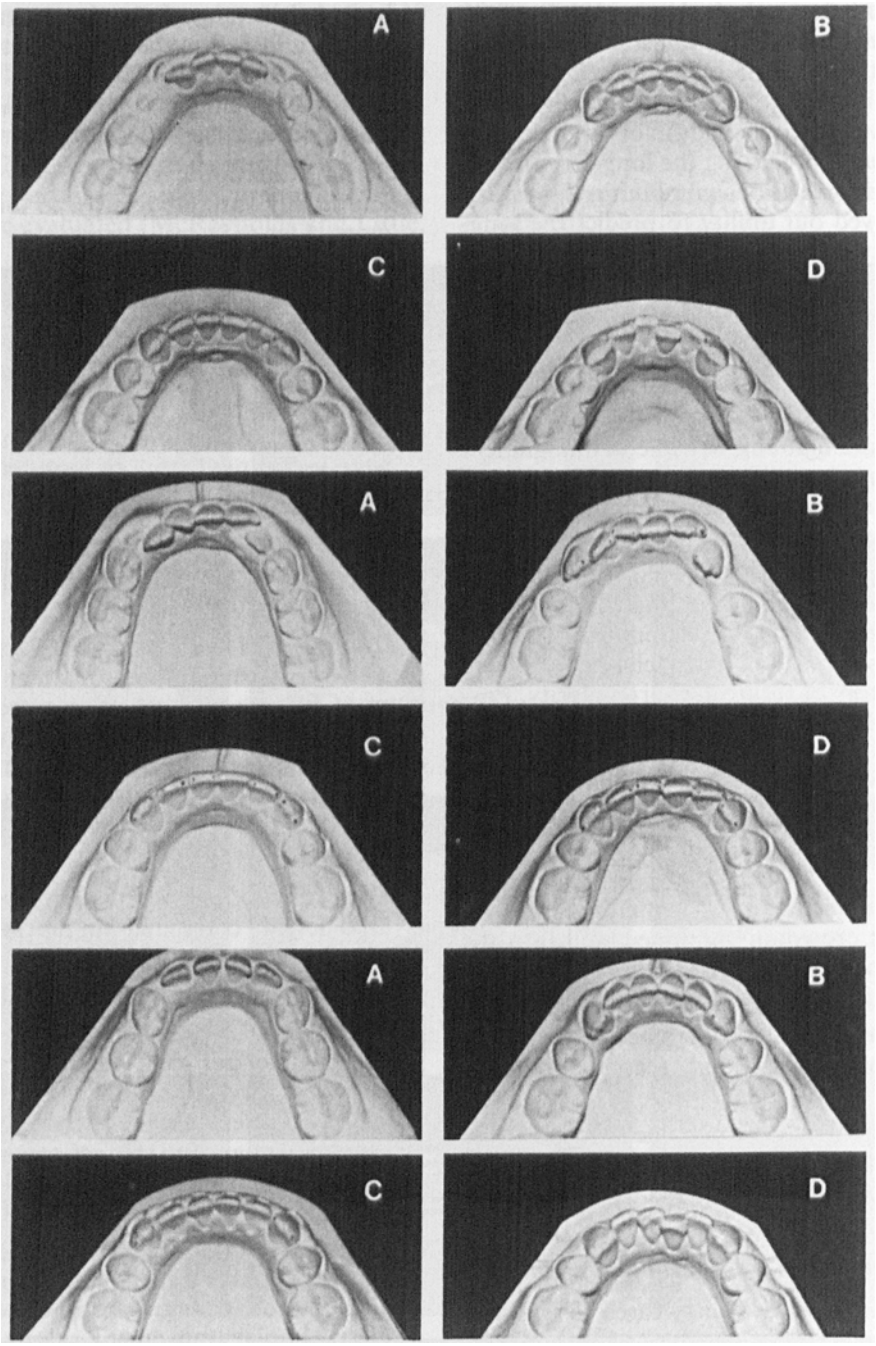
Results.

1. Twenty out of 26 cases demonstrated a net loss of arch length compared to the initial measurement.
2. Width constriction was a typical finding post-retention.
3. Eighty-nine per cent demonstrated clinically unsatisfactory alignment at the post-retention stage. Very few enlarged arches had acceptable long-term alignment. In fact, this sample showed a greater degree of relapse than all other samples examined from our files (Figs 9–11).
4. Superimposition of cephalometric tracings showed variable direction and amount of molar and incisor change postretention. However, mesial molar movement, along with lingual tipping of incisors were the most common cephalometric findings.

Adequate Arch Length

Untreated normal occlusions

Materials and methods. A sample of 65 'normal occlusion' cases all with serial records were evaluated utilizing the same criteria as with our treated cases. Dental casts and cephalometric radiographs were assessed for the mixed dentition, early perma-

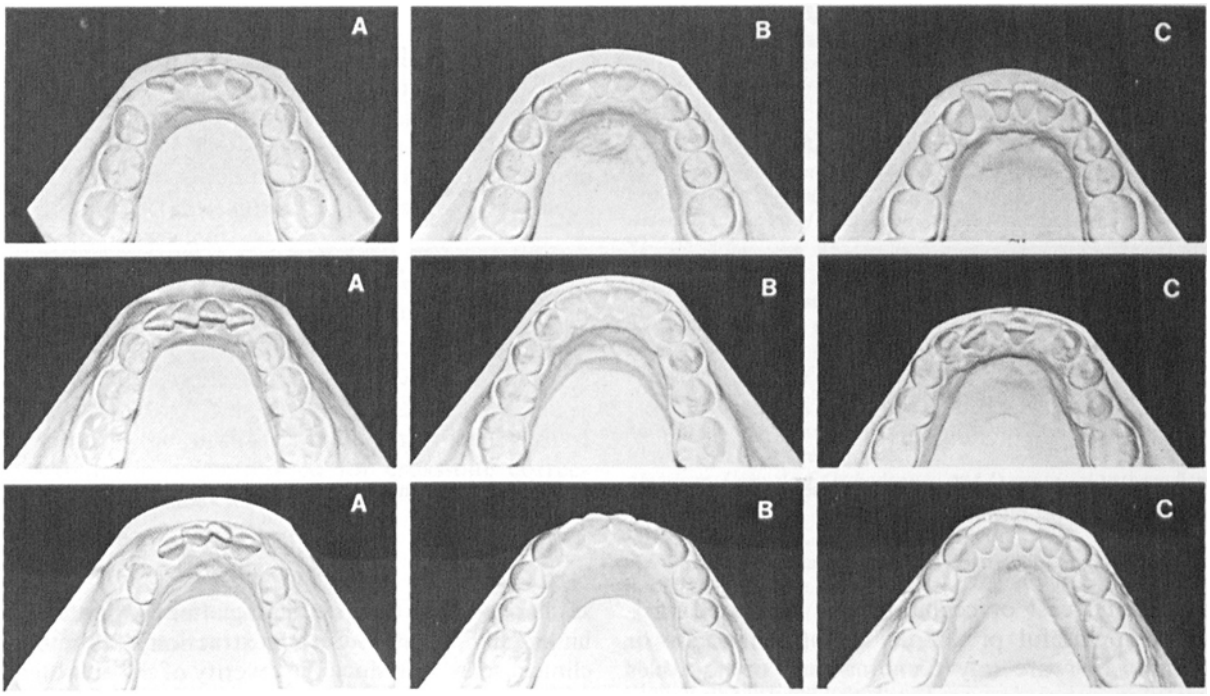


FIGS 6–8 Results following first premolar serial extraction, physiological drift, edgewise orthodontics, and retention: (A) pre-extraction; (B) after physiological drift; (C) end of active treatment; (D) post-retention.

nent dentition and into early adulthood (Sinclair and Little, 1983, 1985).

Results.

1. As with treated cases, arch length, and arch width typically decreased with time, a few cases progressing from 'normal' to crowded by the early adult years.
2. Females showed the greater arch constriction trend and crowding tendency.
3. No single or multiple associations of clinical value were found when assessing stability or



FIGS 9-11 Results following non-extraction arch enlargement in the mixed dentition: (A) pretreatment; (B) end of active treatment; (C) post-retention.

relapse versus cephalometric, dental cast, or descriptive variables.

Generalized spacing

Materials and methods. Thirty cases with generalized spacing in the permanent dentition were evaluated pretreatment, post-treatment, and a minimum 10 years post-retention. All had minimal or no rotated anterior teeth and minimal or no labiolingual deviations from 'normal arch alignment' pretreatment. All had undergone edgewise orthodontics plus retention (Little and Riedel, 1989).

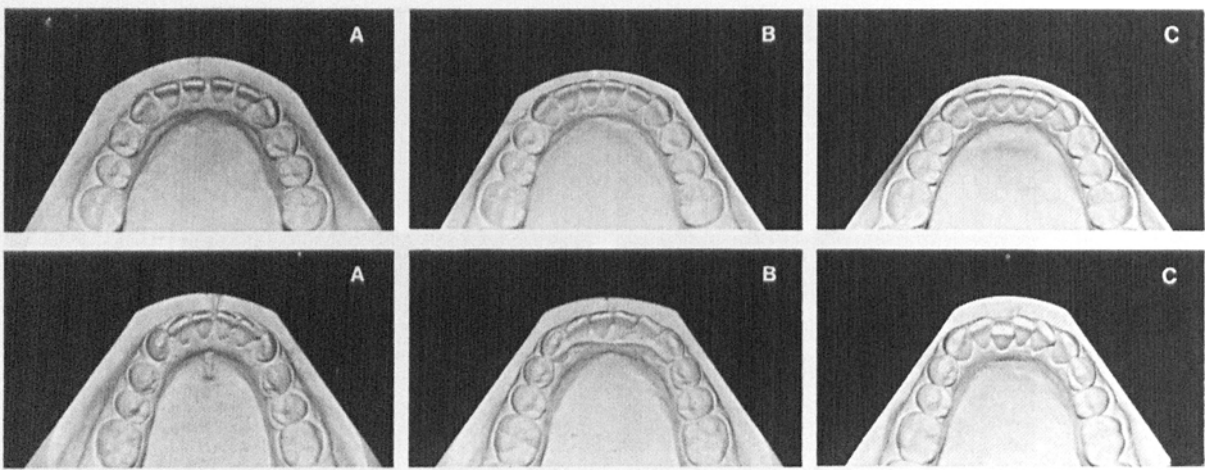
Results.

1. Arch length decreased following treatment. In every case the final arch length was less than the initial value (Figs 12, 13).
2. Arch width decreases were noted in nearly all cases following treatment.
3. As a group, the sample had quite satisfactory post-retention stability, over half considered minimally irregular post-retention.
4. Post-retention over-bite and over-jet relapse averaged less than 1 mm, further evidence of the sample stability.
5. Spaces did not re-open in any case, further illustrating the constrictive trend of the sample.

Clinical Implications

It is apparent that arch width and arch length constriction with time is a normal physiological process that routinely occurs following orthodontic treatment. The same process occurs with the untreated patient as evidenced by our studies of untreated normal occlusions. This process continues well after the cessation of growth and can be quite active during the 20–30 age span. From age 30 to 40 and beyond, the process seems to continue, but after age 30 the constrictive trend is much less. There is considerable patient variability, a few reaching a point of apparent stability by the late teenage years, but this is not typical. Most show active and significant changes for many years and even decades after the cessation of active treatment.

The degree of crowding that develops following retention is variable and unpredictable. Unfortunately, no factors such as length of retention, age at the start of treatment, Angle classification, gender, or



FIGS 12 and 13 Generalized spacing cases treated non-extraction followed by retention: (A) pretreatment; (B) end of active treatment; (C) post-retention.

any dental cast or cephalometric measured variables are useful predictors of future success or failure. Nor are any combinations of variables useful in improving predictability of the long-term result. Our patients and the parents of those young patients should be appraised beforehand of the liability for posttreatment change. They must understand clearly our limitations and their own role in the maintenance of the treated result. The orthodontist should not assume stability would occur, but should assume instability will likely be the pattern. Given such a posture, we can then plan against and prevent undesirable change.

Premolar extraction

Removal of premolars to permit alignment of crowded teeth has been an accepted procedure for decades and continues as the most common treatment utilized for patients with crowded arches. In spite of achieving suggested and accepted cephalometric norms, and in spite of adhering to usual clinical standards of arch form, over-bite, etc., the long-term maintenance of acceptable results is disappointing, with only 30 per cent of the patients demonstrating acceptable long-term results. Indefinite use of removable or fixed retainers, perhaps for life, seems to be the only logical recourse. Unfortunately, we do not yet know the undesirable sequella of such a retention program.

Serial extraction

Although crowding is usually reduced during the mixed and early permanent dentition following serial extraction, long-term evaluation shows results no better than extracting after the premolars have fully erupted. Serial extraction still makes clinical sense to reduce the severity of the crowding pattern, to speed the ensuing orthodontic treatment, and to prevent erupting teeth from being blocked out of the band of attached gingiva. Long-term periodic retention or permanent retention seem to be the options that would ensure future success at maintaining the corrected result.

Arch enlargement or 'Development'

Anterio-posterior and/or lateral increase in mandibular arch form usually fails, the dental arch typically returning to the pretreatment size and shape. Most cases of mandibular arches 'developed' during the mixed dentition fail, with postretention dimension less than pretreatment. Such a strategy requires permanent retention since success following retainer use is quite poor resulting in only 10 per cent of patients with clinically acceptable results.

Generalized spacing

The most ideal long-term results were in this category but unpredictable degrees of crowding occasionally occurred. Continuing observation of these patients beyond the typical retention stage is indicated, just as continuing recall and observation is warranted and prudent in all other types of treated malocclusions. As a group, the degree of relapse is much less in generalized spacing cases but the practitioner will not know in advance which case will be the unusual one to demonstrate substantial relapse.

Summary

Over time, decreasing mandibular dental arch dimensions in both treated and untreated malocclusions appears to be a normal physiological phenomenon. The degree of arch length reduction, constriction, and resultant crowding is quite variable and unpredictable; however, several clinical guidelines are suggested:

1. Treat to ideal standards of perfection obtaining the best possible occlusion, oral health, and function.
2. Avoid enlargement of the lower arch unless mandated by facial profile concerns, or to harmonize the occlusion with maxillary palatal expansion accomplished for cross-bite correction or unusual narrowness.
3. Use the patient's pretreatment arch form as a guide to arch shape.
4. Retain the arch form long-term and continue to monitor patient response into and throughout adult life.
5. Obtain the highest quality pre- and post-treatment records and continue to utilize them to assess patient progress.

Acknowledgements

Derived from a paper presented at the British Orthodontic Conference, Birmingham, September 1989.

References

Ades, A., Joondeph, D., Little, R. and Chapko, M. (1990)
A long-term study of the relationship of third molars to mandibular dental arch changes,
American Journal of Orthodontics and Dentofacial Orthopedics **97**, 323–335.

Little, R. and Riedel, R. (1989)
Postretention evaluation of stability and relapse—Mandibular arches with generalized spacing,
American Journal of Orthodontics and Dentofacial Orthopedics, **95**, 37–41.

Little, R. and Riedel, R. (1990)
Mandibular arch length increase during the mixed dentition—Postretention evaluation of stability and relapse,
American Journal of Orthodontics and Dentofacial Orthopedics, **97**, 393–404.

Little, R., Wallen, T. and Riedel, R. (1981)
Stability and relapse of mandibular anterior alignment—first premolar extraction cases treated by traditional edgewise orthodontics,
American Journal of Orthodontics, **80**, 349–365.

Little, R., Riedel, R. and Artun, J. (1988)
An evaluation of changes in mandibular anterior alignment from 10 to 20 years postretention,
American Journal of Orthodontics and Dentofacial orthopedics, **93**, 423–428.

Little, R., Riedel, R. and Engst, E. (1990)
First premolar serial extraction: Postretention evaluation of stability and relapse,
Angle Orthodontist (in press).

McReynolds, D. and Little, R. (1990)
Mandibular second premolar extractions—Postretention evaluation of stability and relapse,
Angle Orthodontist (in press).

Shields, T., Little, R. and Chapko, M. (1985)
Stability and relapse of mandibular anterior alignment—A cephalometric appraisal of first premolar extraction cases treated by traditional edgewise orthodontics,
American Journal of Orthodontics, **87**, 27–38.

Sinclair, P. and Little, R. (1983)
Maturation of untreated normal occlusions,
American Journal of Orthodontics, **83**, 114–123.

Sinclair, P. and Little, R. (1985)
Dentofacial maturation of untreated normals,
American Journal of Orthodontics, **88**, 146–156.