# Clinical Implications of the University of Washington Post-Retention Studies

Dr. Robert Little began his teaching career at the University of Maryland after graduating from the University of Washington orthodontic program in 1970. Later he returned to UW to teach and work toward a PhD from the College of Education, with a focus on curriculum design and educational administration. After 35 years of both teaching and private practice, he retired as a Professor Emeritus in 2006.

For more than three decades, Dr. Little was immersed in the collection and study of the well-known University of Washington post-retention sample. The findings of this exhaustive study of some 900 long-term follow-up records have changed how orthodontists deal with the problem of alignment relapse and how they counsel their patients before and after treatment.

In this issue, Dr. Little focuses on the lessons learned from the study, providing a number of clinical tips for the practicing orthodontist. Next month, I will interview him on how the sample was built and what the results mean in today's orthodontic practice.

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***Lesson 1: There is so much that we don't know.***

The nature and extent of post-retention change is unknown before treatment, at the start of retention, and during the retention phase. Determining the post-retention prognosis is the dilemma. For example, only about one-third of crowded cases treated with premolar extractions have acceptable alignment 10 years after retention (Fig. 1). At 20 years post-retention, only about 10% have acceptable results. We are unable to pick out the future "winners" or "losers" in advance of treatment, at the end of active treatment, or after several years of retention. There are no reliable clues. For example, an initially crowded case may work out fine post-retention (Fig. 2), while a mildly crowded case may experience a surprising level of relapse. Our ability to predict is quite poor. We just don't know how a given case will react once the retainer is removed.

*Clinical Implication:* Plan on lifetime permanent retention.

***Lesson 2: Expand the mandibular arch at your own risk.***

We should expect that nearly all of our cases will show decreasing dimensions after retention, whether they were overly spaced, had adequate space, or were crowded before treatment. With very few exceptions, post-retention reduction of mandibular arch width and length seems to be the norm. Expanding these same dimensions during treatment seems to exaggerate the relapse response. Maintaining arch width and length during treatment seems prudent and does seem to provide better results, but such a strategy is no guarantee of stability. We also found surprising examples of marked relapse in cases where treatment change was minimal. Typically, most cases that underwent arch enlargement showed significant relapse. The

trend is almost always toward arch constriction with time, but we can't predict the degree of this change.
*Clinical Implication:* Avoid increasing mandibular arch length and width during treatment, and follow active treatment with lifetime permanent retention.

***Lesson 3: Some are the lucky ones.***

We can be more optimistic about the future of cases that have generalized spacing or normal alignment before treatment (Fig. 3). A small percentage of spaced or adequate-arch-length cases will show varying degrees of future crowding, mild for the most part. Fortunately, those showing significant relapse are rare. I'd feel comfortable retaining such a case for a few years, with the plan of eventually removing the retainer. But I'd still caution the patient to be aware of the potential for undesirable change and to return for a remedy if change is noted.

*Clinical Implication:* Expect minimal relapse in cases that have adequate or excess pretreatment arch length.

***Lesson 4: Early stability is a mirage.***

Many cases are stable for several years after removing the lower retainer—what we've called the "honeymoon period". By the late teens and 20s, those cases tend to constrict and crowd to varying degrees. We can be duped by apparent stability for a few years post-retention, with relapse turning more aggressive at a later age. After age 30, the constrictive process seems to slow, but the trend of gradual constriction is ongoing and continues with age (Fig. 4). There seems to be no age at which constriction of mandibular arch width and length stops. The idea of balance and stability is more a hope and myth than a reality.
*Clinical Implication:* Lifetime permanent retention is the only way to ensure mandibular arch alignment stability.


**Fig. 1 A. 13-year-old patient with crowding before treatment. B. After 22 months of active treatment. C. Crowding 10 years after retention (age 27).**


**Fig. 2 A. 13-year-old patient with crowding before treatment. B. After 15 months of active treatment. C. Mild crowding 10 years after retention (age 32).**

***Lesson 5: Rotated teeth tend to relapse, usually toward their initial positions.***

Most rotations relapse toward the initial positions, some to a lesser degree, but a few even more than before treatment. Supracrestal fiberotomy seems beneficial in maintaining the correction or reducing the degree of rotational relapse. Overtreatment of incisor position does not seem to help. Surprisingly, about 20% of rotation overtreatment continues in the direction of treatment rather than rotating back toward the initial position. For a given case, one cannot predict which tooth will relapse toward the initial position, which treatment position will be maintained, or which tooth will continue in the direction of treatment (Fig. 5). The original position and rotation of a given tooth is our best predictor of the future position and rotation, but exceptions are so numerous that we cannot rely on this assumption.

*Clinical Implication:* Play it safe: be a pessimist. Assume rotation and position change will occur for all mandibular incisors during and after retention, regardless of initial position. Bond each incisor to the mandibular fixed lingual retainer, and keep the fixed retainer for life. Utilize supracrestal fiberotomies for incisors that were rotated before treatment.

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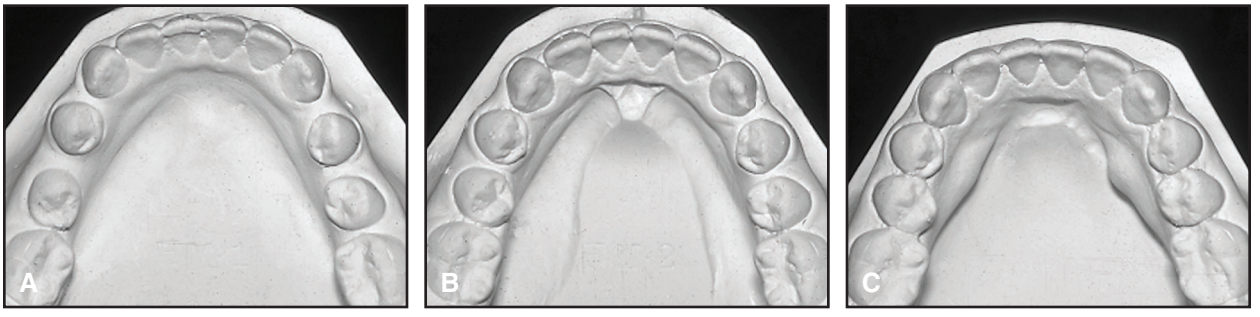


**Fig. 3 A. 12-year-old patient with arch spacing before treatment. B. After 18 months of active treatment. C. Good alignment 10 years after retention (age 28).**

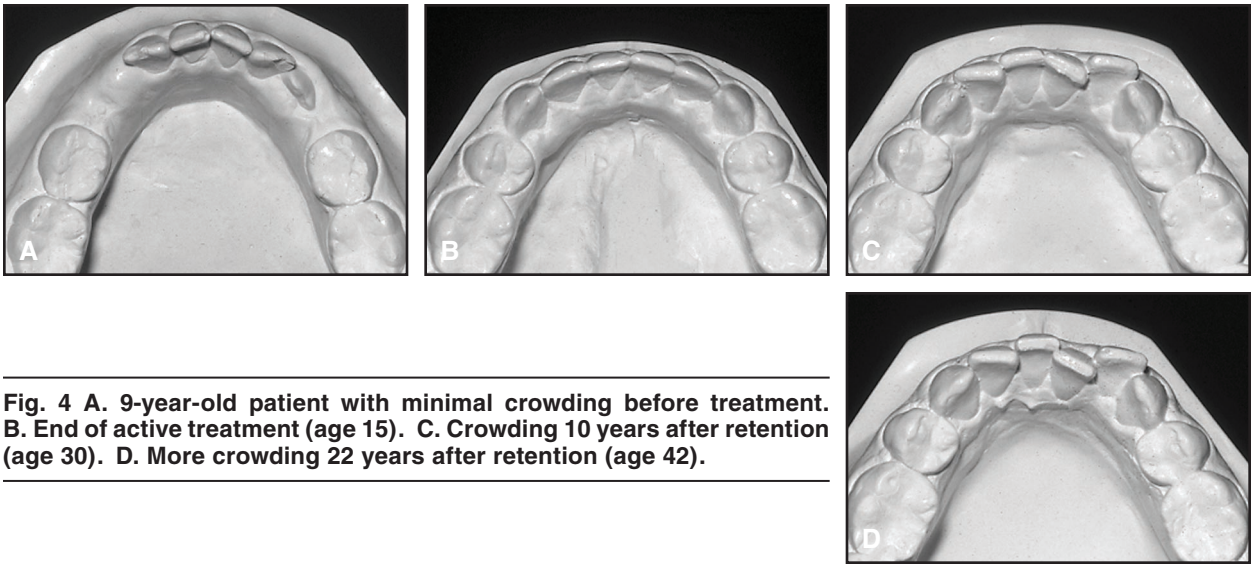


**Fig. 4 A. 9-year-old patient with minimal crowding before treatment. B. End of active treatment (age 15). C. Crowding 10 years after retention (age 30). D. More crowding 22 years after retention (age 42).**

***Lesson 6: Lingual vs. labial or buccal relapse is unpredictable.***

Teeth initially blocked to the labial or buccal often remain stable after treatment, while those initially blocked to the lingual are prone to more relapse. Defying such generalities, anterior teeth in normal positions can unexpectedly move labially or lingually after retention, making specific recommendations difficult. Even during fixed anterior retention, some mandibular anterior teeth will move labially away from the lingual fixed retainer. Most orthodontists would prefer not to bond incisors to the lingual fixed retainer for reasons of hygiene and periodontal health. But if all mandibular incisors are not bonded to the fixed lingual retainer, there is the possibility of unexpected labial or rotational change away from the lingual bar.

*Clinical Implication:* Bond each lower incisor to the lower fixed retainer.

***Lesson 7: Life-long retention = life-long insurance.***

Retention postpones the inevitable relapse tendency. Treatment, including retention, interrupts nature, but does not change the physiologic trend of arch constriction. The retainer seems to temporarily block relapse. When the retainer is removed, the teeth are released to change in various undesirable manners.

Cases of extremely long mandibular fixed retention typically show rapid initial relapse after removal of the retainer, rather than the usual few years of apparent stability. A decade or more later, those long retention cases have the same range of relapse as in cases with only one or two years of fixed retention.

*Clinical Implication:* Mandibular anterior stability is a rare occurrence. Lifetime permanent retention is the only reliable method to ensure long-term success.

***Lesson 8: Extraction of "wisdom teeth" is not necessarily a wise choice.***

The clinician should not feel more optimistic about long-term stability simply because third molars have been removed or are congenitally absent. The range of post-retention alignment in cases of third molar extractions or agenesis is no different from that in cases with third molars still in place. Removal of third molars may be appropriate for reasons such as periodontal problems or impaction, but relapse is not likely to be lessened by third molar extraction. Although I was taught that mandibular fixed retainers should be maintained until the third molars are removed, the reality is that the percentage of stable vs. unstable results is the same whether the third molars are removed or not removed, present or congenitally absent, impacted or erupted.

*Clinical Implication:* Maintain lifetime permanent retention regardless of third molar presence, extraction, or congenital absence.

***Lesson 9: Younger is not necessarily better.***

Timing full treatment to occur during early adolescence yields no better or worse stability than waiting until late adolescence or early adulthood.

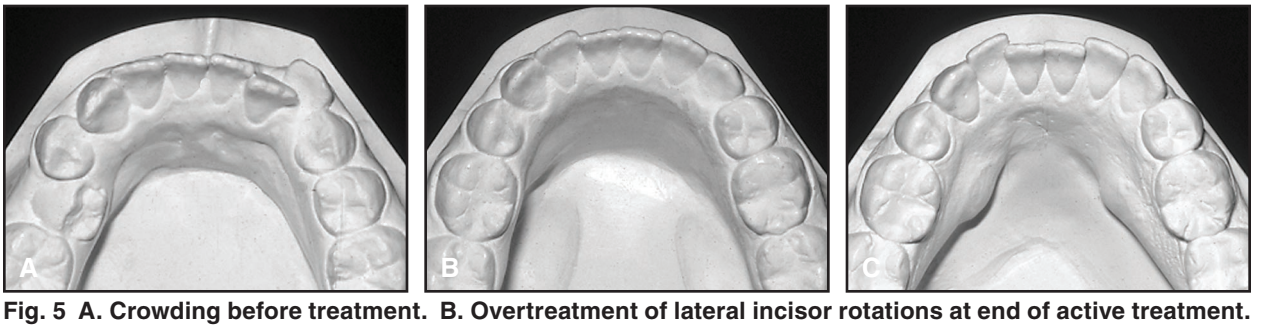


**Fig. 5 A. Crowding before treatment. B. Overtreatment of lateral incisor rotations at end of active treatment. C. Worsening of overtreatment 10 years after retention.**

Serial extraction treatment of a crowded case was once believed to be more stable, the assumption being that the crowding problem was addressed early and not allowed to continue into the full permanent dentition. Unfortunately, serial extraction cases relapse to the same degree as extraction cases treated in the permanent dentition (Fig. 6). Similarly, adult treatment was thought by some to produce better results than typical teen-age treatment by eliminating growth as a risk factor, but the outcomes seem no better or worse than for treatment during the growing years.
*Clinical Implication:* Schedule comprehensive treatment for reasons other than anticipated future stability.

***Lesson 10: There is good news!***

One might assume that the upper anterior teeth would be held in proper alignment by the occlusion. It might seem logical that the lower anterior teeth would provide a template around which the upper anteriors wrap. Neither assumption is true. The upper arch fares much better than the lower in most cases, regardless of the relapse of the lower anterior segment. Even in cases where an anterior open bite returns, the upper arch alignment is better than that of the lower arch. One might assume that the occluding upper anteriors would follow the relapse pattern of the lowers, but not so: the arches seem to respond independent of each other.
*Clinical Implication:* Over the first few years of retention, we can gradually reduce upper retainer wear in most cases. But keep in mind that fixed lower retention is a lifetime proposition.

***Lesson 11: Arch development is the riskiest treatment in terms of stability.***

If a crowded case is treated by arch development (increasing arch length and/or proclining the incisors), significant post-retention relapse will be the routine result. Arch development of mixed dentition cases produced the most severe relapse of any form of treatment we studied. Arch development in the permanent dentition has been known as a prescription for failure since the inception of modern orthodontics. I'm reminded of Charlie Tweed, who retreated at no charge a large number of his relapsed cases, which he had enlarged according to the Angle style of arch development in vogue at the time. Unfortunately, we don't know the degree of relapse for those cases that underwent a second treatment with premolar extraction. Tweed just assumed that extraction treatment of crowded

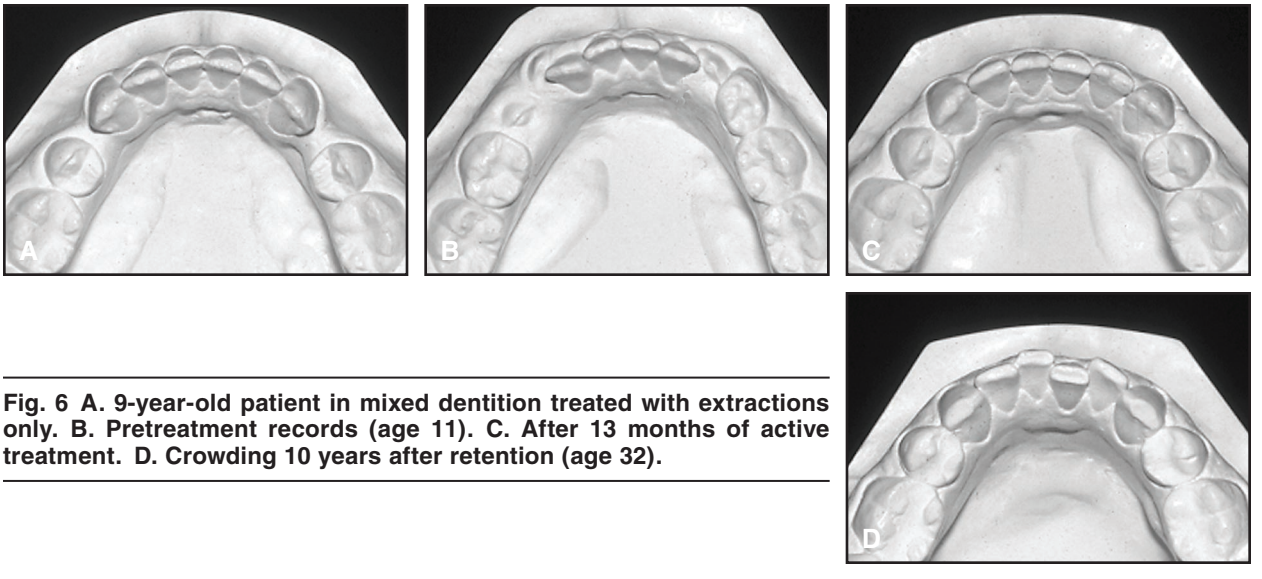


**Fig. 6 A. 9-year-old patient in mixed dentition treated with extractions only. B. Pretreatment records (age 11). C. After 13 months of active treatment. D. Crowding 10 years after retention (age 32).**

cases would be more stable. For generations of orthodontists, severe relapse was the expected result of arch development. I recall that Hayes Nance called such treatment "suicidal". Newer brackets and wires have not changed the outcomes.

A second problem of arch development is flaring of incisors beyond cephalometric norms. This is not only an issue of esthetics and stability, but it can foil our efforts to achieve a proper occlusion.

A third problem and, in my opinion, a more serious consequence of mandibular arch development is the potential for periodontal repercussions in response to labial or buccal tipping or bodily movement in an effort to gain arch length. Anecdotal evidence suggests that labial or buccal periodontal problems, such as dehiscence, will be likely if permanent retention is utilized following such treatment. Our orthodontic forebears warned of pushing the teeth off what they called "basal bone". I'd suggest that much more study is needed on the iatrogenic effects of long-term retention in arch-development cases.
*Clinical Implication:* We have several dilemmas if arch development is used: We can't achieve post-retention stability. We must use permanent retention. Long-term maintenance of the enlarged state may cause iatrogenic problems such as gingival recession and dehiscence.

***Lesson 12: Maintain—don't change—the archform.***

Archform typically reverts toward the original pattern. In general, greater archform change produces more relapse and less change produces less relapse, but there is considerable variation. Using a preconceived archform seems less desirable than using the patient's initial archform. It is also interesting that post-retention archform relapse is often markedly different in the upper vs. the lower arch. One arch does not necessarily follow the other, but we can expect more archform relapse in the lower arch.
*Clinical Implication:* Treat to the patient's initial mandibular archform.

***Lesson 13: Constricted maxillary arches are more amenable to expansion than constricted mandibular arches.***

Palatal expansion, rapid or slow, has a history of success. Not so for the mandibular arch. A lower arch that is widened to match a normal or mechanically widened upper arch typically relapses and is not necessarily held stable by occlusion with the widened upper arch. As in Fränkel treatment, temporary removal of buccal muscle forces results in buccal expansion of the arches, but will the result be stable? Unfortunately, we do not have a sample of Fränkel cases in our UW collection. I hope those with access to Fränkel-treated patients will undertake studies of post-retention stability and relapse of such treatment.
*Clinical Implication:* Don't count on the occlusion to maintain lower arch expansion.

***Lesson 14: Alignment stability is improved by maintaining leeway space.***

Mixed dentition maintenance of leeway space, as suggested by Hayes Nance, to permit the correction of anterior malalignment without arch expansion or premolar extractions appears successful in preventing post-retention relapse (Fig. 7). Nance suggested using a passive lingual arch during the transition from the mixed to the permanent dentition to capture the excess space and offset anterior crowding. A later study of such treatment showed more than 70% stability, verifying our observations.[1] In contrast, our study of mixed-dentition arch development beyond leeway space showed 90% failure just a few years post-retention.
*Clinical Implication:* Maintain leeway space for incisor alignment.

***Lesson 15: Facial growth is not useful in correcting crowded arches.***

There is no intra-arch growth, only constriction—first during the transition from the mixed to the permanent dentition, and then later as the arches undergo normal physiologic constriction with time. Since there is no enlargement of the arch during or after the growth years, we must

**Fig. 7 A. Patient before placement of lingual arch and extraction of all deciduous teeth. B. End of active treatment. C. Good alignment 10 years after retention.**

work within that limitation. Of course, growth can be quite helpful in correcting anteroposterior problems such as Class II malocclusions. Conversely, growth can aggravate malocclusions in Class III cases. But neither facial growth nor lack of facial growth during treatment seems beneficial in terms of long-term alignment stability.

On the other hand, our long-term records did show that post-treatment growth may be related to relapse as a risk factor. For example, when comparing cases with minimal or no relapse to those with major relapse, the extremes—males growing well into their 20s—showed more alignment relapse than females who were not actively growing through those years. Perhaps more post-treatment growth can be related to more relapse, but we don't yet know why. At least we can say that later growth is not helpful in preventing relapse.

Our studies were focused on alignment issues and did not address factors such as the influence on stability of Class II mechanics or overcorrection of anteroposterior problems, or the prognosis for different types of malocclusions. There is much yet to learn.

*Clinical Implication:* Don't count on normal growth to aid in alignment correction or improve the stability of the correction.

***Lesson 16: "Return to normal physiology" may be a more correct description of the post-retention process than "relapse".***

For both treated and untreated cases, arch length and width reduction occurs from the mixed dentition stage into the teen-age years, and to a lesser degree during adulthood. This process is a physiologic fact of life. We need to recognize it as a normal process. Preventing this normal arch change with orthodontic treatment followed by retention only postpones the normal physiologic process. Permanent retention can block the process as long as the retainer is maintained. If the retainer is removed, at whatever age, relapse to some degree will follow. Enlarging the lower arch during treatment only makes the case more prone to greater relapse, and at a faster rate.

*Clinical Implication:* Retention blocks normal physiologic constriction of the lower arch. Removing the retainer releases the block and permits normal physiology to resume—what we mistakenly label "relapse".

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