Stability of Mandibular Intercuspid Width After Long Periods of Retention

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This is a long-term study of treated cases, with observation periods averaging more than 12 years. Final observations were 4 to 6 years out of all retention. All cases showed a postretention reduction in intercuspid width regardless of whether that width was increased in the course of treatment, but a significant part of therapeutic increases remained.

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Any discussion among orthodontists would show that there are numerous methods, appliances, and techniques used for treating the different types of problems that present themselves at our offices daily. However, we must admit that once our final result is attained, the problems of the retention phase and evaluation of stability are common denominators that put all of us back together again.

It seems only fitting that the success of our orthodontic treatment should be judged not only on our mechanical ability to handle the appliance in use, but also upon what happens during retention and in later years.

This is a report on the stability of expansion of arch width in the lower canine area after retention for periods of four, five and six years The advantages and disadvantages of extended periods of retention are also considered. All of these cases were treated nonextraction. They had no

retention appliance of any kind in place for at least 24 months prior to the final evaluation, with an overall average of 65 months.

Since the earliest days of orthodontics, our specialty has been striving to create and develop the most efficient and convenient techniques for accomplishing tooth movement, foretelling growth, and measuring skeletal landmarks. Of all of the problems encountered in the treatment of malocclusion, none seems to be filled with more uncertainties than that of retention.

Literature on Retention

It has been my observation in reviewing the literature that retention has been generally overlooked or intentionally avoided. In the *American Journal of Orthodontics* from 1948 to 1978, only seven articles and one editorial dealt with this subject. In the Angle Orthodontist for the same period there were only five such articles. Numerous papers make some mention of retention, but the above figures denote articles actually written with retention as the main topic.

Dr. Angle,[1] in his 7th edition, included a chapter mostly concerned with the principles and mechanics of retention. He writes briefly about the length of retention, stating that the time required for mechanical retention varies from a few days to two years or often longer, depending on the age of the patient, occlusion gained, causes overcome, tooth movements accomplished, length of cusps, health of tissues, etc. In the case of unconquered lip or tongue habits, retention may be required for an indefinite period.

Case[2] states "It is possible and even probable that the art of retention will never approach so nearly an exact science as that of regulating, because of certain natural influences over which one can have little or no control. Those who fully grasp underlying principles of retention and appreciate its difficulties and advantages, and who are able and willing to devote to it the high order of mechanical skill which adequate retaining appliances demand, will find few things in orthodontics that will bring more satisfaction."

In Anderson's[3] text, it is noted "Retention is probably the least understood and it is certainly among the most difficult problems in orthodontics. It would be a hardy orthodontist who would say before accepting all cases for treatment, that no retention would be used on any of them."

Even during Brodie's[4] lectures to his classes, the duration of retention received but a short comment that there really were no specific rules that dictate the length of time that retainers should be left in the mouth. Anywhere from six months to two years was generally considered acceptable.

Throughout the literature there seem to be two main theories that are discussed. These theories are directly related to the question whether patterns of muscle function change during treatment or retention.

The first concept is that dental arches cannot be expanded and maintained. Howes[5] states, "Arch form cannot be changed and extraction is obligatory in a very high percentage of cases if treatment objectives are to be attained." Both Strang[6] and McCauley[7] have indicated that molar and canine widths are of such an uncompromising nature that one might establish them as fixed quantities and build the dental arches around them; width has to be maintained in treat-

ment if one is to expect stability in the finished result.

The second theory is that dental arches can be expanded and that this expansion will be maintained and even continue to increase more in some cases. Walter[8] showed in 1953 that of cases expanded during treatment, some returned to the original width, others held their expansion and still continued to expand after retention. His two works, along with comments made by Brodie, Hahn and Steadman[9] seem to indicate that such variable response is fact, not fiction.

Methods

All cases used in this study were treated nonextraction by the author since April 1956 and met the following criteria. No palatal expanders were used. No retaining appliances were worn for a minimum of twenty-four months prior to the final records. Third molars had been removed during the retention phase. This list was divided into patients who had been retained for four years, for five years, and for six years.

The retainers used routinely on the upper arch of all cases were Hawley-type appliances with a .012 × .028 ribbon wire to encompass the upper central and lateral incisors. Anterior spacing can be closed when necessary by shortening this wire at the midline.

The lower retainer was a .036 lingual wire soldered to bands cemented on the first bicuspids. All nonextraction cases are retained in this way to maintain the corrected contact between the first bicuspid and cuspid. Proper contact in this area will greatly lessen the tendency for overbite relapse. Removal of the lower retainer dated the termination of retention.

The upper retainer was worn full-time for the first six months, part-time for the next six months, and for twelve months was worn every night when sleeping. At least, this was the schedule given the patient. I am sure, as we all know, that it would be naive to think that this schedule was followed exactly. After the twenty-four months as described, the patient could continue to wear the upper if needed.

In the total group of fifty-six cases the malocclusion classification broke down as follows:

4 years	4 Cl I	16 Cl II
5 years	5 Cl I	15 Cl II
6 years	2 Cl I	14 Cl II

Records on all patients included plaster casts, lateral and oblique cephalometric radiographs, and lateral, frontal and intraoral photographs. The intercuspid measurements were made from cusp tip to cusp tip with a needle-pointed metric caliper of each cast at: A—start of treatment, B—when all active appliances were removed and retainers placed, C—Final, two or more years after termination of retention.

Findings

The scattergrams in Fig. 1 show the change in intercuspid width during active correction (A-B, solid circles) and over the entire observation period (A-C, open circles) for each subject in the study. The following data summarize overall responses.

Four-year retention group

This group included 13 females and 7 males, with an average age of 11.5 years at the start of treatment (A) and 23.9 years at the final recording (C).

Intercuspid width was increased during treatment (A to B) in 19 cases,

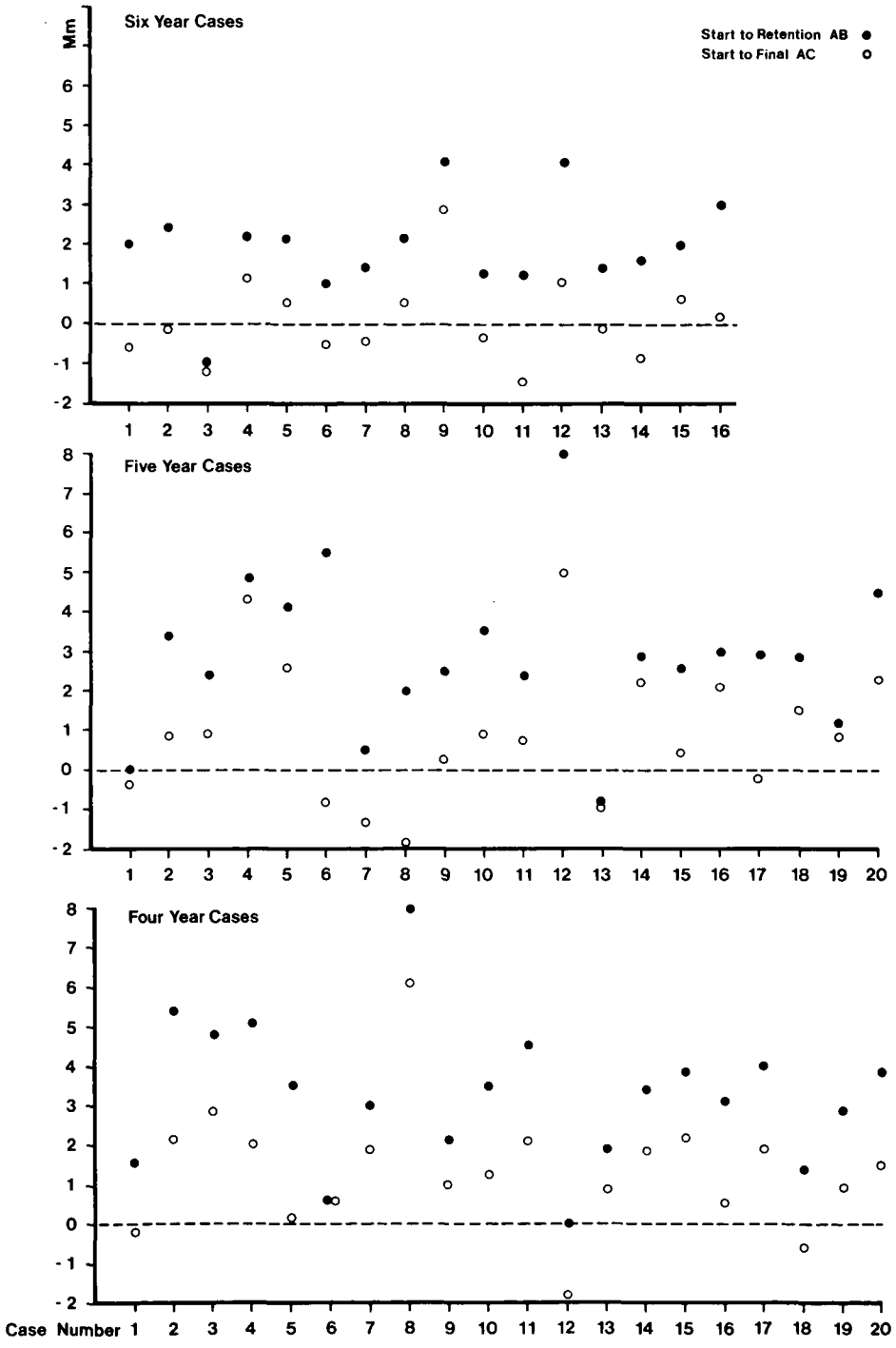

Fig. 1

with no change in one. The average increase for the entire group was 3.3 mm, with an average of 3.5 mm for the 19 cases that were expanded.

The postretention period (A-C) averaged 5.7 years. After that period the width had decreased in all subjects; 17 retained some of their increase for an average gain of 1.8 mm and the remaining 3 decreased below the original width for an average net loss of 0.9 mm. The average net increase was 1.4 of the original 3.3 mm.

Five-year retention group

This group also included 13 females and 7 males, with an average age of 11.0 years at the start of treatment (A) and 24.1 years at the final recording (C).

Intercuspid width was increased in the treatment of 18 of the 20 cases, maintained in one, and decreased 1.0 mm in one. The average increase for the entire group was 2.9 mm.

The postretention period (A-C) averaged 5.6 years. After that period the width had again decreased in all subjects. The average net increase was 1.0 mm of the 2.9 mm original expansion.

Six-year retention group

This group of 17 subjects included 13 females and 3 males, with average age 11.3 years at the start of treatment (A) and 24.7 years at the final recording (C).

Intercuspid width was increased in the treatment of 15 cases, held in one, and reduced 1.0 mm in one. The average increase for the entire group was 1.9 mm.

The postretention period (A-C) averaged 5.0 years. After that period the width had again decreased in all subjects; 7 retained an average 1.0 mm increase and 9 decreased below the original width an average of 0.7 mm. The overall net change was *zero*.

Total Sample

Of the 56 cases evaluated, lower intercuspid width had been expanded in the treatment of 52. Two were unchanged and two were constricted 1.0 mm.

Over the total time of about 12 years from initiation of treatment to final records (A-C), 38 remained expanded to some degree while 18 lost an average of 0.8 mm from their initial intercuspid width.

From the start of treatment to retention, 92% of the group had been expanded; after the postretention period 68% still retained some of that added width.

Even though most cases showed some decrease from the immediate posttreatment width at final measuring, some of this could be attributed to settling, band space closure and, in some cases, slight lower anterior rotations. However, most of the cases did hold some of the expansion acquired during treatment.

In all three groups there were no cases where the lower intercuspid width increased after retention.

Since the scattergrams for all three groups are very similar, it might be surmised that extended retention periods are not beneficial or necessary. Why hold a case in retention for six years when five or four years would be sufficient to gain the same stability?

To try to answer this question the arch *length* from lower cuspid to cuspid of all 56 cases was measured at the start of treatment, at the time retainers were placed, and when final records were taken. Five of the most severe cases of lower arch length loss in each group were compared at the

start of treatment to see if there were any significant differences in the three groups.

In the five most severe cases of arch length deficiency in the four-year group the *arch length* from cuspid to cuspid was increased an average of 4.0 mm by treatment (A-B). From placement of retainers to final records the net increase diminished by half, to 2.0 mm. The average time out of retention for these cases was 5.3 years.

In the five-year group, the arch length of the five most severe cases was increased an average of 3.5 mm, with an average posttreatment loss of 1.3 mm, for a net gain of 2.2 mm. The time out of retention averaged 5.0 years.

The arch length of the most severe of those retained for six years was increased an average of 6.5 mm and reverted 2.5 mm, for a net gain of 4.0 mm. The average time out of retention for these cases was 6.1 years.

In all three groups the individual decreases from B to C varied from 0.5 to 3.5 mm.

Arch length was increased in the six-year group almost twice as much as in the five-year group and over a third more than in the four-year group. This suggests that this group included the most severe arch length deficiencies.

It is also interesting to note that this was the group in which intercuspid width was increased the least. The large increases in arch length in these cases were apparently accomplished more by incisor advancement or buccal retraction than by increasing intercuspid width.

Conclusions

From the preceding data, the following conclusions may be drawn:

There is need for varied and extended periods of retention due to the varied types and severity of problems inherent in each case treated.

Patients can be treated with cuspid expansion and a significant part of this expansion can be maintained in some cases.

Some arch width and arch length increases may be lost from settling, band-space closure and other causes.

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