Salient Features of Retention in Adolescents

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Although it is written in orthodontic literature that retention is a part of treatment itself,[1] there are features of the retentive phase that distinguish it from the corrective phase. For one thing, active treatment is controlled by the orthodontist but, unless fixed prosthetic devices or no appliances are used, retention is controlled by the patient and is subject to the patient's desire and memory. Another feature is that, during active treatment, positions of the teeth are determined by the orthodontist and his application of an appliance system and are largely predictable; on the other hand, during retention the patient's oral environment determines the positions of the teeth and is, for the most part, unpredictable. Also, in contrast to active treatment, retention has no sharply-defined termination but can continue as long as the patient wants to.

It can be said, therefore, that uncertainty, unpredictability, and uncontrollability are features of retention. Angle stated it this way in 1907,[2] "It is far easier to lay down rules for the governing of tooth movement than for retention." And Oppenheim wrote in 1934,[3] "Retention is the most difficult problem in orthodontia; *in fact, it is the problem.*"

Still another feature is that the maintenance of the correction is far less satisfying and requires a longer period of responsibility than the esthetic and functional alteration of the malocclusion. Citing a friend, Hawley[4] stated in an article in 1919, "If anyone would take my cases when they are finished, retain them and be responsible for them afterward, I would gladly give him half the fee." Also, Muchnic[5] believed in 1970 that, "It (retention) can be a headache. . . ."

Despite the long-standing recognition of the difficulties involved in retention, a survey of the orthodontic literature has revealed no controlled studies or basic research on retention. There was an attempt by Riedel[1] in his 1960 paper to classify retention according to the requirements of various types of cases. He categorizes three groups. Group I consists of "cases that require no retention in either arch." In Group 2 are "cases in which it is necessary to continue permanent or semipermanent retention in one or both arches." Group 3 is made up of "cases requiring varying lengths of retention." Because there are qualifying conditions and a wide latitude of application, it lacks the positive quality of Angle's classification of malocclusion, but it is a step toward grouping of retentive procedures.

Since 1907 when Angle[2] stated that the main factor of retention was "to antagonize the movement of the teeth only in the direction of their tendencies," that principle has become the basis for retention and the strategy for such procedures. But there have been no published theories with which to explain the underlying processes involved in retention.

This paper seeks to further the understanding of retention by focusing the current views of eminent orthodontists on the following questions concerning the adolescent patient:

1. What are the goals of active treatment prior to retention? Or, what is being retained?

2. How much time elapses between the completion of correction and the onset of retention? Or, how soon should retention start so that none of the gains made by correction are lost?

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3. Which appliances, if any, are used and for how long?

4. Is occlusal equilibration part of retention?

5. What are the chief concerns of retention?

Part I of this paper concerns information gathered during telephone interviews in the fall and early winter of 1977. Part II presents theories and their applications and comments.

Procedure and Data

Twelve orthodontists were selected for interviewing on the basis of their diverse professional training and experience and their significant contributions in work and thought to the present state of orthodontics. In addition, three of their co-workers have been included with their associates because of their shared beliefs on retention and because of their prominence in orthodontics today. Because of widespread teaching and lecturing activities, the data that are reported represent more than the isolated ideas of fifteen practicing orthodontists. Rather, because of their influential roles and many students and followers, their views are expressive of a large segment of today's orthodontic practitioners.

Except for directive questions the phone conversations were mainly unstructured. Later, the facts were organized for logical presentation and corroborated by mail.

Goals Prior to Retention

This is an area of wide divergence, as objectives vary from "solid Class I" to "super Class I" to "overcorrection." These terms are best described in the words of the respondents themselves.

Solid Class I

As portrayed by Schudy, "solid Class I" is secure centric relation and centric occlusion, i.e., long centric of no more than 1 mm, overbite of 1 mm, overjet of 1 mm, rotations, arch form, and torque established early, and the roots of the canines distal to the crowns.

Andrews describes "Six Keys"[6] as a static goal, a cuspid rise scheme as a functional goal, and centric occlusion and centric relation the same.

Super Class I

Lang uses the term to portray a slight overtreatment of the buccal occlusion.

Williams visualizes a Class I relation of the canines and the concurrence of the mesial surface of the upper first molar in the buccal groove of the lower first molar with the apices of the canines and lateral incisors distal to the crowns.

Overcorrection

Bench and Gross depict "overcorrection" of the buccal occlusion in Class II cases as the distal marginal ridge of the upper second premolar riding up the mesial ridge of the lower first molar. Also, rotations and overbite are overcorrected.

Time Interval Between Debanding and Insertion of Retainers

Most commonly the time interval is three to seven days. However, the range is wide. For instance, Holdaway inserts retainers the same day as debanding. Buchin, Burstone, and Gross allow weeks for settling and for observing the stability of the correction.

Retention Appliances and Their Duration

In the sense that some retention is used by each of the group, there is agreement, but the degree and mode of application provide wide divergence. Gross, who relies on appliances the least, uses retainers in about twenty percent of his cases. Only "in cases in which perverse habits persist or in which there is an abnormal musculature"[7] does he use an upper Hawley

with a bite plane and in these cases it is *forever.*

Burstone performs a predebanding analysis and, if three criteria are met, no retainers are provided. These criteria are: (1) evidence of favorable mandibular growth in Class II cases, (2) good lip tonus in cases of crowding, and (3) early correction of rotations. In the sixty to seventy percent of the cases that do receive retainers, the appliances are mainly removables and are not used for very long in the average case.

Buchin, Magill (in cases with no lower crowding), and Williams use only upper Hawleys. The latter two discontinue the upper Hawley after one year of use. Buchin retests for stability after six months and again at maturity; if perverse habits exist or there is a skeletal dysplasia, i.e., an ANB angle greater than five degrees, the upper Hawley is continued indefinitely.

Magill (in cases with lower crowding), Andrews, Bench, Holdaway, Schudy, Shapiro, and Swain use fixed lower lingual retention and upper removables. Magill discontinues retention after one year; Andrews, Holdaway, and Schudy continue retention until maturity and the third molars are resolved. Bench, Shapiro, and Swain continue with the removables as long as the patient is willing. In Swain's instance the removable is a positioner.

Lang uses upper and lower Hawleys through the end of college, or 20 to 21 years of age, and then as long as the patient wants to.

Headgear is used by Bench, Burstone, and Shapiro where there is, or may be, slippage of the Class II correction.

Occlusal Equilibration

A majority advocates equilibration for occlusal interferences, but equilibration is not done routinely except in temporomandibular joint cases.

Chief Concerns

The three most frequently listed concerns are recrowding of the lower incisors, recurrence of deep overbite, and spacing of upper incisors. Also mentioned are functional problems of the musculature, perverse habits, third molars, slippage of the buccal occlusion, spacing in the extraction sites, and marked relapse after rapid maxillary expansion.

Conclusions

From these data, five conclusions have been drawn.

1. Retention procedures are unrelated to treatment goals. For examples let us consider Bench and Schudy and Bench and Gross. In the first example, retention is the same, treatment goals differ. In the second example, treatment goals are similar, retention is different. Bench strives for overcorrection and Schudy for solid Class I. Yet each retains with a fixed lower lingual wire and an upper Hawley. Both Bench and Gross strive for overcorrection, but Gross uses retainers as the exception, and then only in the upper arch.

2. When retainers are used, the time element after debanding does not seem to be critical, varying between hours for Holdaway and seven days for Bench.

3. With the exception of Burstone, the mode and duration of retention are not related to the malocclusion but are related to an established office pattern. Retention procedures are standardized and unique to each practice.

There is also no relation between retention modes and active appliance systems. When Andrews changed from the edgewise to the straight wire appliance, he added a gnathological element to the preretention positioner to refine the occlusion after debanding, but his basic system of retention remains the same. Magill evolved from edgewise to com-

bination to modular self-locking, Schudy from edgewise to bimetric edgewise, and Swain from edgewise to Begg to straight wire without altering retention methods. An exception, however, is Williams, who eliminated lower retainers when he switched from edgewise to Begg.

4. Occlusal equilibration does not receive detailed attention except in temporomandibular joint cases.

5. The three concerns of retention are phenomena of the anterior teeth and are intimately associated with esthetics. Functional concerns, such as slippage of the buccal occlusion, are not considered primary.

Discussion

The most surprising finding in the data is the emphasis placed on the retention of a particular arch. Buchin, Gross, Magill, and Williams emphasize the retention of the upper arch when they find that retention is necessary. Andrews, Bench, Holdaway, Schudy, Shapiro, and Swain find it necessary to have more positive, full-time retention in the lower arch. At present we have no satisfactory explanation for this disparity on emphasis between upper and lower retention, nor do we have a knowledge of the underlying processes of retention. Currently, our retention concepts are based on the observations of individual orthodontists. The next step in a scientific approach is to move toward a comprehensive theory of retention for organizing and explaining these observations. For now, no comprehensive theory is available. However, several retention theories of more limited scope are being used as the rationale for specific modes of retention including: (1) discrepancy theory, (2) equilibrium theory, and (3) partial assistance theory.

Discrepancy Theory

At debanding a discrepancy between the corrected positions of the teeth and their oral environment is present or will develop between the time of debanding and the time of maturation. The desired mechanical retention must then be of sufficient amount and duration to counter this discrepancy. An example of the application of this theory is the lower canine to canine, left in place until maturity to prevent crowding of the lower incisors from posttreatment growth and developing third molars. Another example is the full-time use of the upper Hawley to prevent the recurrence of deep overbite or spacing of the upper incisors.

Equilibrium Theory

At debanding an equilibrium exists between the corrected positions of the teeth and the oral environment; posttreatment growth and development will be favorable for maintaining equilibrium. No mechanical assistance is needed for the teeth to remain in their corrected positions. An example of the application of this theory is no retainers at debanding.

Partial Assistance Theory

At debanding a quasi—equilibrium exists between the corrected positions of the teeth and their oral environment, so the teeth require partial mechanical assistance until a stable equilibrium is attained. Part-time wearing of removable retainers is an example of the partial assistance theory.

Among the observations still unaccounted for by these limited-scope theories are those which pertain to the sudden and forceful changes in equilibrium associated with emotional stress as reported by Fried[8] and the observations of Barrer as seen in adults.[9]

Standard of Occlusion, Expectations, Terminations

One of the factors that enters into the scheme of retention is the standard of occlusal perfection set by each ortho-

dontist. This may be an interpretation of the desires of the patient or parents for an ideal set of teeth, a Hollywood smile, "I don't want perfection for my child," or "Just give her a good bite and a healthy mouth." Or the orthodontist may unilaterally set the standard by striving for the ideal in every case or by working toward fair alignment and esthetics and a normal range of intercuspation and overjet. The expectations of the orthodontist and the patient will then determine the degree of retention and the duration.

Those orthodontists who advocate "as long as the patient wants to" make the patient a partner in deciding how much of the treatment result to maintain and for how long. In this instance retention is open-ended and becomes the responsibility of the patient.

Those orthodontists who predetermine the duration of retention, such as one year or until maturity, set a term without involving the patient. Retention has a cut-off date and the patient phases out of the orthodontic stage of his life.

The Future

Basic research on retention is difficult for a variety of reasons. Since each case is unique unto itself, experimental and control groups are not readily established. Long-range studies are needed but these are unwieldy and costly. Many variables are involved, some of which are difficult to quantify, such as habits.

On the optimistic side are the tremendous advances made in documenting growth and development since the advent of the cephalometer.

One factor that was mentioned repeatedly during the interviews on retention was the musculature. If basic research on retention is to begin, it must involve the accumulation of data on muscles. Just as our grasp of growth and development awaited the widespread use of the cephalometer, so a practical instrument is needed to quantify muscle activity before progress can be made in understanding the underlying process of retention.

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