 DOI: 10.18231/2455-6785.2018.0004

Retention and relapse: An anamnesis

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Abstract
The problem of retention and relapse was born with the science of orthodontics and continues to persistently disturb Orthodontic researchers and clinicians. In spite of all the advances in the active treatment procedures, retention and relapse remains a problem for many practitioners. Several studies have been carried out to determine the changes taking place several years after orthodontic treatment and the influencing factors. Factors including growth, periodontium, age, third molars, tooth dimensions etc., have been held responsible for post treatment relapse. Several procedures have been devised to ensure stability and prevent or at least avoid post treatment changes so as to reduce relapse. To achieve this purpose, a proper understanding of the changes occurring, various factors affecting relapse and retention procedures is important. Thus problems of retention and the continued trend, which owes to the biological and mechanical limitations, demands to go through the state of art of this perennial problem "Retention and Relapse".

Keywords: Retention, Relapse, Orthodontics.

Introduction
Orthodontists have been concerned by relapse process for decades. The goal of Modern Orthodontics is creation of best balance among occlusal relations, dental and facial esthetics, stability of the results and its long term maintenance and restoration of dentition (TWEED).[1] Retention is that part of orthodontic treatment during which a passive appliance is used to maintain Orthodontic correction. Dental and skeletal structures relapse and hence retention is required to prevent return of characteristics to original malocclusion.[2]

Definition
Moyers[3] defined relapse as "loss of any correction achieved by orthodontic treatment."

Riedel[4] defined retention as "the holding of teeth in ideal esthetic and functional position."

Relapse may be defined as "return of the corrected malocclusion towards the original condition."

It has been stated that correct diagnosis and planning of treatment, followed by a careful stabilization of the final result, would minimize the importance of retention, relapse tendencies still exist in a fairly high percentage of cases treated. Even if these precautions are taken, however, relapse after tooth movement still remains a complex problem, with a varying number of factors involved.[5]

Historical Aspect: Weinberger in 19th century stated that orthodontics had its origins in medicine, as well as its beginning in aesthetics, the modern well-trained clinical orthodontist have recognized that the most desirable facial-dental esthetics might be just as important as excellent posterior occlusion and good function., Weinberger, stated that people sought relief after the disfigurement of the crooked and irregular placed teeth. Paul Agina, considered that if supernumerary teeth cause irregularity of the dental arches, they may be corrected by resection of each tooth or by extraction.[6]

1860-1960: Emerson C. Angell (1860), described the method of employing a jackscrew for rapid opening of the maxillary median suture or to enlarge the face in the maxillary dental arches, in order to establish occlusion without extraction of teeth. The time for the expansion should be around two weeks, after which it is only necessary to preserve or retain the space until complete Coleman (1865) found that muscular pressure was the main reason for relapse. C.A. Marvin (1866) described the physiologic reasons for retention. Indeed, preservation of correct facial expression or aesthetics as one of the objectives of orthodontic treatment. Brown-Mason (1872) (in England) described a retaining plate for surgically rotated teeth. James W. Smith (1881) gave simple vulcanite plate with a bar extending over the labial aspect of the maxillary incisor teeth. In 1883, H.C. Quinbey described a maxillary retaining plate that had strips of metal extending from the vulcanite plate over the anterior teeth.[6]

Jackson (1904) described the importance of retention and designed many retaining devices to prevent the tendency of the teeth to change their positions after the removal of the retainer. Angle (1900) stated that obtaining normal occlusion during the eruption period would decrease retention time, but when habits are not overcome and the rotations and disturbance to the fibers of the periodontal membrane are very marked, cutting gingival fibers to counteract this problem. Angle described many ingenious mechanical combinations of cemented bands and spurs, the action of which were, to quote his uniquely

descriptive phase, to antagonize the movement of teeth only on the direction of their tendencies. Case described post treatment influence of surrounding tissues would return to their former irregular position after retention because of important factor of hereditary. A hundred years ago, Bonwill described arrangement of teeth and jaws based on his study of more than 2000 skulls. He placed study models in anatomic articulators, used wax set-ups of plaster teeth for extraction decisions; and thoroughly informed his patients on the limits of treatment and the necessity of adequate retention.[6]

Norman Kingsley (1908), stated that it is difficult to straighten crooked teeth to get the dental system into a position acceptable to your patients and yourself, but to hold it there until it becomes permanently settled, is a much more serious problem.

Ferrar (1831-1913) stated that when the teeth are fully regulated they should be retained in position for a year, perhaps longer. Angell's use of a retaining plate in his palate-splitting technique, there was general adherence to the necessity of retention and even a similarity of appliances, but the knowledge gained was based solely on the clinical experience and observation of the aforementioned pioneer orthodontic masters.

Lundstrom's (1929) clinical studies on apical base limitation did much to counteract the dominance of the expansionists led by Angle. Lundstrom's work appears to have been fundamental in helping to reduce the relapse problems.[6]

George Anderson's (1942) observed that developing masticatory field or in the fully erupted denture, retention was not a minor but a very serious matter and a basic part of orthodontic therapy.[6]

Fischer (1943) stated that a compensatory adjustment of facial growth would since there has been an interference in the unfolding of the face. Schwartz stated that internal and external forces playing on the denture lead to zero and stability. It is only a momentary static situation, because growth and change is occurring and the equilibrium that results must somehow anticipate and include both growth and change to insure stability.

George Grieves (1944) described that the cause of most malocclusions was the forward translations of teeth and that when teeth have been placed backward and upright over basal bone they would be stable and hence have no need for retention.

Dallas McCauley (1944) emphasized on maintaining canine position, arch form, and width as related to functional jaw movements to achieve post treatment stability.

1960- Present: Stedman (1961, 1967), stated that an enlarged pharyngeal space, or muscle hypertension, and anterior component of force of mandibular third molars, bring about an undesirable post treatment changes or relapse.[6]

Graber (1966) stated that relapses of crowding, rotations, mesio-distal relations, overbite, overjet and arch width and form reappear subsequent to retention. There is no assurance that relapse will not happen even when surgery is combined with orthodontic treatment.[6]

Parker (1969), in a clinical study of transseptal fibers, stated that rotational relapse is a normal, predictable, physiological response to abnormal forces.

Kelston (1972) described a technique for realignment with wires and ligatures after stripping of crowded lower incisor teeth. Boese reported a combined procedure of stripping and circumferential supracrestal fiberotomy with no lower retainer placed. It was concluded that CSF and re- approximation is not a guarantee for permanent ideal lower anterior tooth alignment, but was perceived as a useful process, which appears to work within a framework of natural changes that inevitably will occur.

Tweed referred to a retrospective study (25 years post treatment) on retention that he had conducted on a follow-up group of his own patients, the extraction cases seemed to be good than non extraction cases many years after treatment. Tweed acknowledged abnormal muscle function was a major factor in relapse.

Sandusky (1984) reported a post retention relapse study (10-year average) of 85 Tweed treated cases-45 by Tweed himself and 40 by tweed foundation members. The mandibular incisor relapse was shown to be quite small less than 10% using the little index-but other changes occurred, namely, forward movement of lower incisors and change of occlusal plane.[6]

Little (1984) reported on a 10-year post retention relapse study showed that 66% of cases exhibited mandibular incisor relapse. James L Vaden did a study to quantify changes in tooth relationships in a series of cases at 6 years and again at 15 years after treatment. The rate of change decreased with time, supporting the contention that most relapse occurs soon after the treatment. There were minor, but statistically significant, associations between increased incisor irregularity and parasagittal growth of the jaws. Greater irregularity occurred when mandibular growth exceeded that of the maxilla, decreasing overjet and crowding the lower incisors within the containing arch of the maxilla.[7]

Thomas. E. Southard (1985) found that transeptal fiber system is thought to stabilizes the teeth against separating forces. It is hypothesized that this fiber system may actually maintain the contacts of approximating teeth in a state of compression, the long term result of which could be contact slippage and collapse of the arch. The interproximal force at the mandibular first molar-second premolar was investigated on the basis of previous studies with this representative contact. It was concluded that the periodontium exerts a continuous force on the mandibular dentition and that this force acts to maintain the contacts of approximating teeth in a state of compression. This force is increased after occlusal loading and may helped to explain the long term

crowding of the mandibular anterior teeth, physiologic drifting of the teeth, and maintenance of posterior dental contacts after interproximal wear.[8]

In the year 1989 Robert M. Little did the assessment of cases that had been out of retention for 10 years and had displayed generalized spacing of anterior teeth before treatment showed consistent reduction of arch length and intercanine width into adult years. Intercanine width constriction typically occurred while arch length decreased in every case with time.[9]

In the year 1992 Ram S .Nanda took a dentofacial growth into consideration in long term retention and stability it was found that out persons growth pattern, and a distinction must be made in the selection of retention devices on the basis of the nature and the extent of dentofacial dysplasia. The nature and duration of retention should be depend on the maturation status of the patient and on anticipated future growth.[10]

In the year 1995 Andres De La Cruz studied to evaluate the long -term stability of Orthodontically induced changes in maxillary and mandibular arch form. Dental casts were evaluated before treatment, after treatment, and a minimum of 10 years after retention for 45 patients with Class I and Class II Div I Malocclusions who received four first premolar extraction treatment. It was found that rounding of arch form during treatment followed by a change to more tapered. Arch form tend to return toward the pretreatment shape after retention.[11]

In the year 1996 Barbel Kahl-Nieke did a long term follow -up study of Orthodontically treated patients to analyze the postretention changes in arch width dimension and to isolate factors that may serve as predictors of long term prognosis. The findings indicate that postretention arch width relapse occurred more frequently in the upper intermolar and intercanine region.[12]

In the year 2014 Manoela Favaro studied which aimed to compare the relapses of maxillary and mandibular anterior crowding, overjet and overbite 5 years after treatment in subjects with class I and class II malocclusions treated with and without. It was found that there was greater maxillary crowding relapse in the non extraction group and greater overbite relapse in the extraction group. There was significant and positive correlations of overjet and overbite relapses with mandibular anterior crowding relapse and consequently between overjet and overbite relapses.[13]

Basic Theorems

Table 1 summarizes the basic theorems of retention and relapse

Table 1: Basic Theorems 5, 6

Theorem 1	Teeth that have been moved tend to return to their former positions.
Theorem 2	Elimination of the cause of malocclusion will prevent recurrence.
Theorem 3	Malocclusion should be overcorrected as a safety factor.
Theorem 4	Proper occlusion is a potent factor in holding teeth in their corrected positions.
Theorem 5	Bone and adjacent tissues must be allowed to reorganize around newly positioned teeth
Theorem 6	If the lower incisors are placed upright over basal bone, they are more likely to remain in good alignment
Theorem 7	Corrections carried out during periods of growth are less likely to relapse
Theorem 8	The further teeth have been moved, the less likelihood of relapse.
Theorem 9	Arch form, particularly in the mandibular arch, cannot be permanently altered by appliance therapy

Of these theorems the following seem to be the most important:

1. Teeth do tend to move back toward their former position;
2. The arch form of the mandibular arch cannot be permanently altered by appliance therapy.
3. Bone and adjacent tissues probably should be allowed time to reorganize around newly positioned teeth and
4. Early corrections are less likely to relapse.

At this point we can be certain that orthodontic case analysis has come to include a plan for retention, not as a separate post treatment period demanding different or unusual appliances, but rather as a part of active treatment inseparable, dependent and intimately associated with the changes brought about during treatment.

Physiologic Recovery or Relapse: Relapse is a return of detrimental features of the original malocclusion while developmental changes refer to the individual's maturation process.

Horowitz and Hixson[14,15] suggested that the term relapse should be replaced by the term physiologic recovery as the dentition continuously changes throughout life. Biologically these changes represent a recovery and rebound of individual dental development pattern. Growth and remodeling are factors of physiologic adjustments after active treatment; this remodeling never stops, but the balance between apposition and resorption change with ageing. In

addition to physiologic recovery, normal growth changes must be included as contributing to continuous adaptation process that sustains the long-term stability of dental apparatus.

To establish an esthetically harmonious, functionally efficient and structurally balanced dental arches in the area of functional tolerance various cardinal points like establishment of proper static functional occlusion, archform and intercanine width maintenance, lower incisors positioning, proper understanding of growth and development etc are very important. Violation of the law of optimality is likely to reject the alteration imposed on an existing orofacial environment leading to relapse.

Causes of Relapse: The tendency of the teeth to undergo change of position immediately upon the removal of the orthodontic appliances can be attributed to various factors like bone changes, periodontal ligament tension, general metabolism, endocrine dysfunction, functional adaptation of occlusion, inherent growth, tooth-size discrepancies, axial inclinations, soft tissue maturation, connective tissue changes and interference with the trajectorial forces established in function. Table 2

Table 2: Causes of relapse

1.	Skeletal
2.	Systemic Disease
3.	Dental
4.	Surgrical

1. Skeletal

Late Mandibular Growth: Late mandibular growth may result in increased pressure at the front of the mouth. Typically, the mandible grows and displaces forward at a faster rate than the maxilla (measured to occlusal plane) and the lower basal bone more than alveolar bone. Tooth compensations include the tendency of the lower incisors to move lingually. If the mandibular incisors are not free to move forward because of the restraining influence of the upper arch, it is likely that they will become retroclined and, could be a contributing factor to crowding in the lower anterior region. However, no direct relationship between the increase in crowding and the change in incisor inclination or position has been demonstrated. Lundstrom[16] examined 25 pairs of twins between the ages of 12 and 15 years and 23 and 26 years. He found no relationship between anterior growth of gnathion and increased crowding, or between changes in lower incisor inclination and increased crowding.

Richardson[16] measured changes in lower incisor inclination and position of the incisal edge relative to the maxillary plane in 51 subjects with intact lower arches. Between the ages of 13 and 18 years, the average change was proclination of just over 1° with forward movement of 1.0 mm. Incisor inclination was measured on the most procumbent lower incisor. As contacts slip to permit imbrication, one or more incisors may procline as the others retrocline in response to increased lingually directed force. This may mask any relationship between increased crowding and incisor angulation.

2. Systemic Disease

Systemic diseases that may affect bone turnover would cause adverse relapse. The common disease that affect the bone turnover are hyper-parathyroidism and disorders of pituitary like acromegaly. While in hyperparathyroidism the lamina dura mat not be directly affected, the jaw bones show area of bone formation and resorption where the bone is replaced with multinucleated giant cells in 'Brown nodes'. In acromegaly, the mandibular condyle would show excessive growth and lengthening of the mandible, therefore, causing relapse of the treatment outcome.

3. Dental

Mandibular Incisor Dimensions/ Tooth Structure: Crowding is slightly more common in persons whose teeth have large mesiodistal dimensions than in those with smaller teeth. Small but statistically significant correlations between crowding and tooth width have been found by some. Others found non significant correlations between these variables.

No direct relationship has been established between an increase in lower arch crowding and tooth structure. It might be argued that teeth with large labiolingual dimensions and broader contacts would be more stable and less likely to slip under pressure or tension.

Smith et al.[16] found non significant correlations between crowding and labiolingual incisor width in 100 untreated orthodontic subjects and 100 untreated adults, and low significant correlations between crowding and mesiodistal/labiolingual incisor ratio.

Punky et al.[17] found nonsignificant correlations between labiolingual lower incisor dimensions, or their labiolingual/ mesiodistal ratio and lower arch alignment in 77 treated cases or 86 untreated adult malocclusions.

Glen et al.[18] could find no relationship between mesiodistal/labiolingual ratio and incisor irregularity in 28 nonextraction orthodontically treated cases, either before treatment or 3 years after-retention.

Evidence from these studies suggests that tooth structure plays only a minor role (if any) in the etiology of late mandibular incisor crowding.

Boese[19,20] introduced a concept of lower incisor reproximation to provide broader contact points and increase the available arch space in the mandibular anterior region. He did a retrospective study that involved continued intervention during the retention period, even in the presence of minor relapse. Hence, we are unable to compare the results of this study with results from other retention studies.

Occlusal Factors: The attachment apparatus of all teeth is an effective hydrodynamic damping system, like an automobile shock absorber, and is well-designed to withstand occlusal forces. If teeth did reposition themselves in response to occlusal forces, it would not be necessary for dentists to be so careful with occlusal relationships. The teeth would make minor corrections for themselves. This does happen just after the completion of orthodontic treatment, when the teeth are hypermobile and the attachment apparatus is reorganizing. Alterations in functional occlusion may produce a different pattern of masticatory forces or an occlusion with premature contacts. The importance of functional and stable occlusion post treatment is repeatedly stressed in the literature.

Brodie[16] suggested that with each stroke of mastication, the upper incisors receive a separating impulse, whereas the lowers tend to come into closer contact. This implies retroclination of lower incisors. The principle may also be applied to individual teeth coming into premature contact, being displaced by the force of occlusion, and allowing adjacent teeth to move toward each other, thus creating a crowded situation. Canine guidance in lateral excursion may cause a lingually directed force on lower canines, with a reduction of inter-canine width.

Influence of the Elements of the Original Malocclusion: The most basic cause of relapse to occur is the persistence of the elements of original malocclusion or the etiology. If the underlying etiology is not removed, the treatment is destined to relapse. It is mandatory for all clinicians to first diagnose a case properly, and plan the treatment and retention initially itself, keeping the etiology in mind. The removal of the etiologic factor before finishing is mandatory.

When teeth are aligned by orthodontic treatment, there is a documented tendency for a return toward the original pattern of malocclusion. For this reason, rotational overcorrection has been advocated. Little et al., however, note that there are many exceptions to this rule with greater than 50% of the rotations or displacements relapsing in an opposite direction.[18]

Udhe et al.[21] formed a multiple regression analysis of overjet, overbite, intercanine width, and intermolar width changes. They revealed that 41% of late lower incisor crowding could be explained by these variables. The relative contribution by these variables varies between individuals with a similar degree of irregularity.

Alteration of Arch Form: It is generally agreed that arch form and width should be maintained during orthodontic treatment.[7, 18] In certain cases, where arch development has occurred under adverse environmental conditions, arch expansion as a treatment goal may be tolerated.

There is evidence to show that intercanine and intermolar width decreases during the postretention period, especially if expanded during treatment (Amott, Arnold, Welch, and others). For this reason, the maintenance of arch form rather than arch development is generally recommended. Expansion is thought to be better tolerated in class II division 2 cases that show a significantly greater ability to maintain intercanine expansion than class I and class II division 1 cases. This statement, however, was based on a sample of 6 patients and was not accepted by Little et al[22] who maintained that intercanine and intermolar width will relapse if expanded in class II division 2 cases as much as in other Angle classifications.

Another exception to the maintenance of arch width may be found in cases of mandibular expansion concurrent with rapid palatal expansion. Haas[23] and Sandstrom et al.[24] found that maintenance of 3 to 4 mm intercanine width and up to 6 mm intermolar width was possible when expansion was carried out concurrently with maxillary apical base expansion. These two studies, however, are quite misleading.

Moussa et al.[25] reported on a sample of 55 patients who had undergone rapid palatal expansion in conjunction with edgewise mechanotherapy a minimum of 8 years postretention. Their results showed good stability for upper intercanine and upper and lower intermolar widths. Stability of the mandibular intercanine width, however, was poor with the posttreatment position closely approximating the pretreatment dimension.

De La Cruz et al.[26] carried out a 10-year postretention study on 87 patients to determine the long-term stability of orthodontically induced changes in maxillary and mandibular arch form. The results showed that although there was considerable individual variability, arch form tended to return toward the pretreatment shape. They concluded that the patient's pretreatment arch form appeared to be the best guide to future stability.

Periodontal Forces: In series of experiments on monkeys, Picton and Moss[16] and Picton[16] demonstrated that the teeth are joined together by a system of transeptal fibers under tension.

Proffit[17] claimed that a slight imbalance of force between the tongue on one side and the lips and cheeks on the other is normally present. He suggested that the teeth are stabilized against this slight imbalance by forces produced in the periodontal membrane by active metabolism.

Periodontal and Gingival Tissues: Orthodontic tooth movement to correct tooth rotations is proposed to result in stretching of the collagen fibers. These stretched fibers (transeptal/collagen) have been implicated in rotational relapse by pulling the teeth back toward their pretreatment position.[35, 36]

Brain and Edwards[18] advocated gingival fiber surgery (Circumferential Supracrestal Fiberotomy) to allow for the release of soft tissue tension and reattachment of the fibers in a passive orientation after orthodontic tooth rotation.

The theory of stretched collagen fibers as the cause of rotational relapse has recently been questioned by Redlich et al.[27] who analyzed gingival tissue samples obtained from rotated incisors in dog. They found that the rotational forces caused significant changes in the integrity and spatial arrangement of the gingival tissues, changes that are inconsistent with stretching. After fiberotomy, reorganization of the fibers similar to the control group was evident. They concluded that the rotational relapse may actually originate in the elastic properties of the whole gingival tissue rather than stretching of the gingival fibers as previously believed.

Soft Tissue Maturation: It is generally accepted that dentoalveolar structures are responsive to soft tissue pressures and adapt to a position of balance between the muscles of the lips, cheeks and tongue.

Frankel and Loffler[16] showed that the reduction in mandibular arch length found in an untreated control group was prevented in subjects treated with the functional regulator (FR) appliance. They claimed that the vestibular shields of the functional regulator appliance favorably influence the saggital development of the mandibular dental arch by eliminating the restraining forces of the external muscular environment.

Connective Tissue Changes: Engel et al.[16] claimed that bone and periodontal membrane are biologically labile in response to hormonal changes. Laskin et al. suggested that hormonal changes during adolescence or pregnancy may cause increased plasticity of bone. Bone loss as result of aging or periodontal disease may allow teeth to move under pressures that they previously resisted. These factors are more likely to be the cause of crowding that develops in later life, after a period of relative stability, than those responsible for increasing crowding during the teenage years.

Influence of Environmental Factors and Neuromusculature: Strang[28] theorized that the mandibular intercanine and intermolar arch widths are accurate indicators of the individual's muscle balance and dictate the limits of arch expansion during treatment. Weinstein et al. and Mills[18] stated that the lower incisors lie in a narrow zone of stability in equilibrium between opposing muscular pressure, and that the labiolingual position of the incisors should be accepted and not altered by orthodontic treatment. Reitan claimed that the teeth tipped either labially or lingually during treatment are more likely to relapse.

Role of Developing Third Molars: The role of third molars in lower incisor crowding has been debated for more than a century. The literature is almost equally divided with arguments for both sides.

One theory commonly reported is that of the third molars creating space to erupt by causing anterior teeth to crowd. Woodside[29] postulated that in the absence of third molars, the dentition could settle distally in response to forces generated by growth changes or soft tissue pressures. This implies a passive role of the third molars in the development of late crowding by hindering that adjustment.

Broadbent[30] was an early advocate of the insignificant role played by third molars in late lower incisor crowding. Several studies show a reduction in arch length and an increase in crowding with age. However, no difference in incisor crowding could be found in groups with impacted, erupted, missing, or extracted wisdom teeth.[31] Richardson demonstrated a significant forward movement of first molars between the ages of 13 and 17 years. This was correlated with the increase in lower arch crowding that occurred during the same period. There was no difference, however, in the forward movement of the first molar, in cases with or without impacted third molars. A recent study on 42 patients from the Belfast Growth Study confirmed these findings.

4. Surgical

Relapse following orthognathic surgery for the correction of the skeletal dysplasia could be attributed to several factors. The outcome of orthognathic surgery would be stable only when skeletal movements are within the confines of neuromuscular adaptation. A stable and functioning occlusion is mandatory for the success of the orthognathic surgery. A pre-surgical orthodontic treatment followed by post surgical orthodontic phase is mandatory to achieve a good occlusion.

Duration of Retention

1. Cases requiring minimum or no retaining appliance[1]
2. Cases requiring indefinite retention[1]
3. Cases that require operative procedures with indefinite retention[1]

Table 3: Cases requiring minimum or no retaining appliance[1]

1.	Blocked out canines in class I extraction cases without incisor crowding
2.	Class I anterior crossbite with sufficient degree of overbite
3.	Posterior crossbites with very steep cusps and no anterior crowding.
4.	Class II cases slightly over treated with headgear to restrict maxillary growth with sufficient arch length indicated by mandibular anterior spacing and absolutely no mandibular incisor rotations.

Table 4: Cases requiring indefinite retention[1]

1.	Class II division 2 deepbite cases
2.	Severe rotations with poor periodontal health.
3.	Undue arch expansion treatment for aesthetic demands.
4.	Patients with tongue thrust or uncontrolled muscular habits.

Table 5: Cases that require operative procedures with indefinite retention[1]

1.	Tooth size discrepencies such as larger maxillary teeth may result in increased overbite.
2.	Conversely, large mandibular teeth will result in end-to-end incisor relationships, maxillary spacing, or buccal end -on occlusion.
3.	A vertical incisal relationship, will lead to deeping overbite and should be retained.
4.	Proximal recountouring of the mandibular incisor may resolve the Bolton Discrepency if mandibular anterior tooth material is in excess or vice- versa for the maxillary teeth.
5.	Microdontia tooth may require aesthetic build ups with tooth coloured restorative or laminates to resolve this problem.
6.	Severe rotations would need circumferential supracrestal fiberotomy(CSG) procedures.
7.	Frenectomy may be needed to prevent relapse of the midline diastema.

Conclusion

The problem of "retention and relapse" is likely to continue to tense the orthodontist because of the complexities of the etiological factors and one has to be thorough with all the implicating concepts. The choice of the type of retention, duration of retention, has a great bearing on successful post retention cases. Any violation of the biologic limit, which trespasses the low of optimality, will end in miserable failure.

Retention is considered to be one of the most fascinating and on the other hand it is considered the most important aspect of orthodontic treatment as far as treatment results and stability from the patient and from the operator's point of view. Long back it had been called as the stepchild of orthodontics since no attention was paid towards this aspect. Even today debate still continues regarding post treatment stability and the role-played by retainers in providing this stability. Even after so much of advancement, great deal of studies; research is still required on this subject. Results will improve as we strive for perfection and realistically balance the scale with more planning for retention. A thorough knowledge of retention is necessary for those of us with bruised egos and a desire to improve.

References

1. Proffit WR, Fields HW, Ackerman JL, Bailey LJ, Tulloch JF. Contemporary Orthodontics. 3rd ed. St. Louis: Mosby;2000.
2. Shapiro PA, Kokich VG. The rationale for various modes of retention. Symp Orthod Dent Clinics North America 1981;25(1):177-193.
3. Moyers RE. Handbook of Orthodontics. 4th ed. Chicago: Year Book Medical Publishers; 1988.
4. Graber TM, Swain BF. Current Orthodontic Principles and Techniques. St. Louis:Mosby;2000.
5. Reitan K. Principles of retention and avoidance of posttreatment relapse. Am J Orthod Dentofacial Orthop 1969;55:230-244.
6. Kaplan H. The logic of modern retention procedures. Am J Orthod Dentofacial Orthop 1988;93(4):325-340.
7. James. L. Vaden. Relapse revisited AJO-DO 1997;(543-553).
8. Manoela Favaro. Overjet and overbite, and anterior crwoding relapses in extraction and non extraction patients, and their coorelations. AJO-DO 2014;46(1).
9. Gayle Glenn. Non extraction orthodontic therapy :Posttreatment dental and skeletal stability AJO -DO 1998, 1987;10,(321-328).
10. Andres de la cruz. Long term changes in arch form after orthodontic treatment and retention. AJO-DO1998,1995,(5):518-530.
11. Barbel Kahl. Treatment and postretention changes in dental arch width dimensions -A long term exaluation of influencing co factors. AJO-DO 1996,4:368-378.
12. Robert .M .Little Postretention evaluation of stabilty and relapse -Mandibular Arches with generalized spacing AJO-DO 1989;(1):37-41.
13. Thomas E. Southard. Periodontal force :A potential cause of relapse 1998 AJO-DO 1992;3.
14. Third molar extraction in anticipated crowding - Lindqvist and Thilander. AJO-DO, Volume 1982 Feb (130-139).
15. A long-term study of the relationship of third molars to changes in the mandibular dental arch - Ades, Joondeph, Little: AJO-DO, Volume 1990 Apr (323–335).
16. Surgical mandibular advancement - Lake, McNeill, Little, and West; AJO-DO, Volume 1981 Oct (376-394).
17. Stability of mandibular lengthening using bicortical screw fixation - Caskey, Turpin, and Bloomquist: AJO-DO, Volume 1989 Oct (320-326).
18. Mandibular advancement osteotomy with rigid internal fixation - Barer, Wallen, McNeill, and Reitzik. AJO-DO, Volume 1987 Nov (403-411).
19. Stability of LeFort I one-piece maxillary osteotomy - Bishara, Chu, and Jakobsen : AJO-DO, Volume 1988 Sep (184-200).

20. Simultaneous superior repositioning of maxilla and mandibular advancement - Turvey, Phillips, Zaytoun, and Proffit. AJO-DO, Volume 1988 Nov (372-383).
21. Ram .S Nanda. Consideration of dentofacial growth in long term retention and stability. AJO-DO1998,1992,(4).
22. Stability of double jaw surgery - Satrom, Sinclair, and Wolford: AJO-DO, Volume 1991 Jun (550-563).
23. Graber TM. Orthodontics: Principles and Practice. 3rd ed. Philadelphia: W.B. Saunders Company; 1992.
24. Jerrold L. A Toothborne Hawley type retainer. J Clin Orthod 1984; 18(4):282-283.
25. Levitt HL. High Labial Retainer. J Clin Orthod 1972; 6(1):35-39.
26. Shilliday DJ. A Removable Cuspid-to-Cuspid Retainer. J Clin Orthod 1973;7(2):118-120.
27. Howe RP. Removable Plastic Herbst Retainer. J Clin Orthod 1987; 21(8):533-537.
28. Sheridan JJ, Ledoux W, Mcminn R. Essix Retainer: Fabrication and supervision for permanent retention. J Clin Orthod 1993;27(1):37-45.
29. Wang F. A New Thermoplastic Retainer. J Clin Orthod 1997;31(11):754-757.
30. Knierim RW. Invisible lower Cuspid to Cuspid Retainer. Angle Orthod 1973;43(2):218-220.
31. Wolfson J, Servoss JM. Bandless but fixed retention. Am J Orthod Dentofacial Orthop 1974; 66(4):431-434.