RETENTION AND RELAPSE

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INTRODUCTION

The orthodontists of today realize that stability of the end result is one of the prime objectives of orthodontic treatment for without stability neither proper function nor the best in esthetics can be maintained.

Although it has been stated that correct diagnosis and treatment planning followed by careful stabilizing of the final result, would minimize the importance of retention, relapse tendencies still exist in a fairly high percentage of cases treated.

Instability or relapse of the occlusion following orthodontic treatment may be divided in to '2' general categories

Changes related to growth, maturation & ageing of the dentition & the occlusion.

Changes related to inherent instability of the occlusion produced by orthodontic therapy.

DEFINITION

(Graber) "Retention may defined as the holding of teeth in ideal esthetic and functional position.

(Moyers) "Retention in orthodontics, is maintaining newly moved teeth in position long enough to aid in stabilizing their correction.

Retention is necessary for 3 reasons:-

- Reorganization of Gingival & periodontal ligament tissues after orthodontic tooth movement
- The corrected tooth – unstable after treatment due to constant soft tissue pressure - produce relapse tendency.

- Changes produced by growth may be alter the orthodontic treatment.

PHILOSOPHIES OR SCHOOLS OF THOUGHT

1. The occlusal school – kingsley stated, "The occlusion of the teeth is the most important factor in determining the stability in a new position".
2. The apical base school – In 1920's Axel lundstrom stated ' apical base was one of the important factors in the correction of malocclusion & maintenance of a correct occlusion.
3. The mandibular incisor school – Grieve & tweed suggested that the mandibular incisors must be kept upright & over basal bone.
4. The musculature school – Rogers introduced a consideration of the necessity of establishing proper functional muscle balance.
5. Hellmen discribed "In orthodontics retention phase is not separate from treatment it is a part of treatment itself & must be included in treatment planning.

CLINICAL APPLICATIONS:-

Mainly three categories – depending upon type of treatment.

- No retention.
- Limited retention.
- Permanent retention.

NO RETENTION REQUIRED:-

- Corrected cross bites
- Anterior : When adequate overbite has
    - been established
- Posterial : When axial inclination of
    - posterior teeth – after correction
- Dentitions treated by serial extraction.
- High canine extraction cases.
- Cases more than one extracted teeth
- Correction that have been achieved by retardation of maxillary growth, whether dental or skeletal (once the pt. has passed through the growth period).
- Dentitions in which the maxillary & mandibular teeth have been separated to allow for eraption of teeth previously blocked out (eg. Partially impacted mand.,II premolars, maxillary canines)

LIMITED RETENTION :-

- Class I non ext, cases with protrusion & spacing of upper anteriors – retention require until lip and tongue functional adaptations.
- Class I & II ext. cases require particularly in upper arch teeth be held in conduct until lip & tongue functional adaptation like non ext. group. eg. Hawley's appliance
    - Kloehn – type Headgear

- Correction of class II cases during growth period especially by functional appliances.
- Corrected deep overbites - either class I or II – require retention in vertical plane.
- Over correction is usually desirable & equilabration & adjustment to functional occlusion are necessary.
- Overbite correction – bite plate on upper arch – 4-to 6 months is given.
- Overbite correction – if by bite opening & the mandible was forced away from the maxilla, vertical dimension should be head until growth (i.e. mandibular ramus height)can catch up.
- Early correction of rotated teeth to their normal positions. i.e.
    a) Before root formation - completed.
    b) Gingivectomy after corrected rotation.
    c) In mandibular incisors area a removable retainer with labial bow is the best, also occlusal splint type retainer is used.

PERMANENT RETENTION

- Midline diastema
- Certain class II div 2 deep bite cases.
- Achievement of arch expansion (especially in low arch) without ensuring good occlusion.
- generalized spacing cases.
- Instances of severe rotation.(adults)
- Pt. With abnormal musculature or tongue habits.

RETAINERS

Defination:- Retainers are passive Orthodontic appliances that help in maintaining and stabilizing the position of teeth long enough to permit reorganization of the supporting structures after the active phase of orthodontic therapy.

REQUIREMENTS OF GOOD RETAINER (Acc. To GRABER)

- It should restrain each tooth that has been moved into the desired position.
- It should permit forces to act freely on the retained teeth in a physiologic manner.
- It should be self cleansing.
- It should be strong enough over required period of use.

TYPES

REMOVABLE

- Hawley's retainer
- Wrap around or clip on
- Tooth positioner
- Keslings retainer
- Ram Retainer
- Esthetic maxillary retainer
- Begg's retainer

FIXED RETAINERS

- Banded & bonded
- Direct bonded lingual retainer
- Bell shaped bonded lingual splint
- Simplified placement of bounded 3.3 retainers
- Permanent lingual bounded retainers
- Computer aided fabrication of bonded lingual retainers

HAWLEY RETAINER:-

Designed by Charles Hawley in 1920,Consist Of clasps on molar teeth and labial bow

Modifications

- Continuous labial bow soldered to the molar clasps.
- C' Clasp around the II molar.
- Extn. Of bow from 4 to 4 .
- Inclusion of a bite plane to control deep bite.

Worn 24hr/day for the first 6 months following removal of appliances

Clip on or wrap around retainer:-

Described by H.D. Kesling in 1945 made of a thermoplastic ruuber like material that spans the inter-occlusal space and covers the clinical crowns of the upper and lower teeth

Drawbacks – Difficulty in speech

_ TMJ problems

Kesling tooth positioner:-

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Drawbacks – Difficulty in speech

_ TMJ problems

Essix retainer:-

John J. Sheridian, JCO 1993 Jan

These are thermoplastic copolyester retainers are a thinner, but stronger, cuspid-to cuspid version of the full-arch.

Advantages – Absolute stability of the anterior teeth

- Durability and ease of cleaning
- Low cost and ease of fabrication
- Minimal bulk and thickness(.015”)
- Appliances serves as a night guard against bruxism

Ram retainer:-

- Robert A.Messe , JCO, APR ’89
- These designed so that clasps do not cross embrasres and with a wraparound effect.

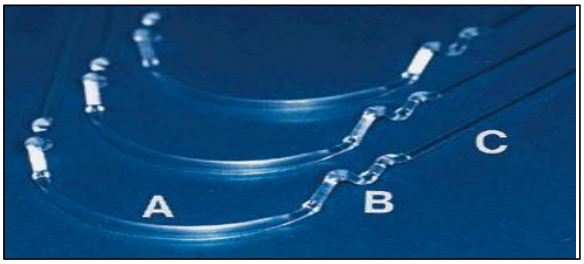
Advantages

- Distortion problems are minimal
- Adjustment on one side will not affect the wire on the other side.

Expansion screw/auxillary spring can be added to upper or lower retainer.

Esthetic maxillary retainers:-

- Watanabe,JCO ’96 May
- It is fabricated with a organic polymer maxillary wire made from 1.6mm diameter, round polyethylene terepathalate.



Begg Retainer:-

This was popularized by P.R.BEGG. It consists of a labial wire that extends till the last erupted molar and curves around it to get embedded in acrylic that spans the palate.

Advantage-

No.cross over between canine and premolar there by eliminating risk of space opening up.

Fig. 23.11B: Wrap around Begg's retainer

Fixed Retainers:-

The fixed appliance:-

The fixed appliance that was used for orthodontic correction can be left in place to serve as a retainer.

Bonded lingual retainers:-

Bonded on the lingual aspect. Stainless steel or blue Elgiloy wire is adapted lingually.

Diastema Maintenance:-

Prolonged/Permanent retainer is needed, best is bonded section of flexible wire.

Band and Spur Retainer

Used in corrected rotation or labio-lingual displacement cases.

Direct bonded lingual retainer:-

Kenneth K.K.Lew,JCO July1989.

Can be made for either arch and can include as many teeth as desired.

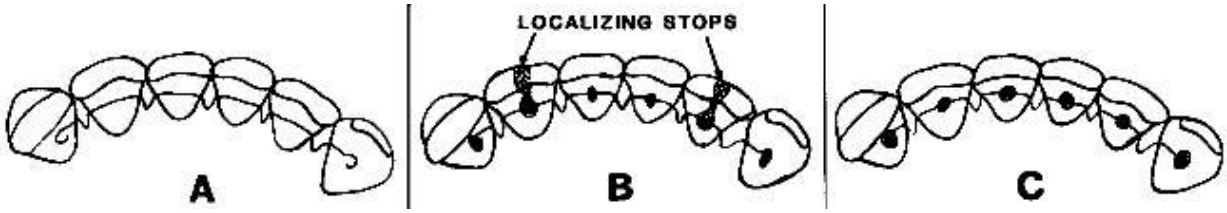


Fig. A. Cuspid-to-cuspid mandibular retainer adapted to working model.

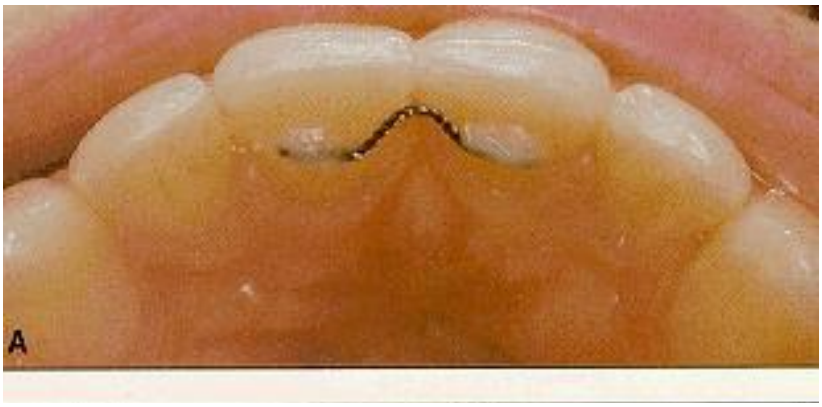
B. Inlay wax (black) used to affix wire to model. Hourglass-shaped composite stops (arrows) built over lateral incisors.

C. Bonded retainer in mouth. Thin mixture of composite resin (shaded areas) bonds wire to each tooth.

Bell shape bonded lingual splint:-

Jack C. Case , JCO June'94

Made up of 0.0195 twisted wire by bending into a bell shape, extending incisally over interproximal papilla and ends of splint should rest on or just gingival to cingulum.

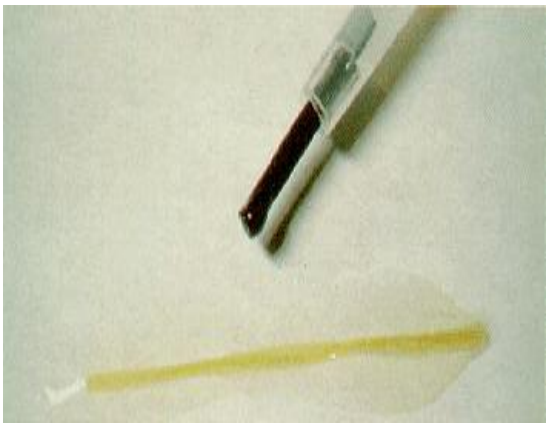


Permanent lingual bonded retainers:-

Orchin, JCO April’90

Developed a lingual bonded retainer kit includes a specially formulated, fiber thread light cure composite. Fiber thread has four times the strength of stainless steel of same dimensions .

It is soft and flexible prior to bonding, which permits easy and rapid adaptation.


Fiberthread impregnated with resin.

 Resin painted on etched lingual surfaces.

Computer-aided fabrication of bonded lingual retainers:-

Brinkamann, JCO Oct'96

The bending art system(BAS) is the first computer-aided device designed to bend individual orthodontic archwires.

It has three components – an intraoral stereoscopic camera, a computer software program and a wire bending unit.

BAS allows exact 3-D tooth positions, which in turn produces the appropriate wire design, including accurate 1st , 2nd & 3rd order bends.

RELAPSE:-

Enlow defined relapse as " a histogenetic and morphogenic response to some anatomical and functional violation of an existing state of anatomic and functional balance".

Relapse due to various causes and characteristics:-

- Growth Related Changes.
- Bone adaptation .
- Muscular forces.
- Failure to eliminate the original cause.
- Role of III molars.
- Facial pattern.
- Neuromuscular coordination.
- Tooth form.
- Inadequate archlength.
- Tooth sizes .
- Mandibular canines.
- Low alveolar height.

Growth Related changes:-

Class-II, Class-III, open bite, deep bite-exhibit relapse due to growth continuation after orthodontic therapy.
Original growth pattern resurfaces if the treatment is completed before growth.
Prolonged retention is required.

Bone adaptation:-

- Orthodontically moved teeth is surrounded by calcified osteoid bone – tendency to relapse
- Normally bony trabeculae - long axis of teeth ; during treatment – parellal to the direction of force.
- Retention phase again go back to normal pattern.

Muscular forces:-

- Teeth are encapsulated by blanket of muscles.
- Imbalance of muscle at the end of therapy reappearance of malocclusion
- Orthodontist should archive muscular balance

Failure to eliminate the original cause:-

- Improper diagnosis, improper treatment steps

Role of III molars

- Most of the cases III molars erupts 18-25 yrs.
- Most cases completes ortho treatment before it .
- Due to eruption – pressure - anterior crowding –relapse.

Facial pattern:-

- Mainly three skeletal relation ships they are
- Facial angle (FH-Npog)
- FMA
- The angle of convexity(NA-Pog)
- All above '3' with good occlusion better prognosis.

Neuromuscular coordination:-

- Affects function of the dentition in a malocclusion
- Children (Functional cases) have dual bites-the proprioceptive impulses from the periodontium & muscles of mastications failed to deliver impulses to CNS – relapse

Inadequate arch length

- Tooth size – jaw size discripancy – Relapse

Tooth form:-

- Posterior cuspal interdigitation – Antero posterior & lateral stability
- Anteriority – incisor & canine relationship
- contributed to stability of overbite, overjet & rotations.

Tooth size

- Disharmonies in tooth sizes of same jaw/upper to lower tooth size – functional problems
- Primary teeth M-D width & tooth length affects permanent teeth size.

Mandibular canines:-

- Key to stability in the mandibular arch
- If bicanine width much greater after treatment in the same space – relapse
- If canines positional posteriorly – No relapse.
- If mand. Canines well forwarded & widened laterally to accommodate crowded lateral – Relapse
- Howes – "move the canine into wider portion of their apical bases – stability"

Rotational relapse:-

- Rotational teeth – Relapse – periodontal fibers mainly supracrestal & transceptal fibers
- Early treatment such long retention period , over correction , proper contact points – minimize relapse
- Supra alveolar fibrotomy – prior to 2 months before debonding the appliance.
- Rotational relapse studies by Douglas, Gahrens, et al. following supraalveolar fibrotomy indicates the relapse to vary from 0 to 4º with a mean value of 0.42 degrees in orthodontically corrected teeth.

FEW STUDIES ON RELAPSE:-

Non-extraction orthodontic treatment

Cyril Sadowsky and Group,AJO 1994

Results:-

1) Arch length decreased during post retention period.

2) Overjet and overbite relapsed 16% of their treatment change.

3) Maxillary inrregularity index lost 16% of treatment change.

4)The mandibular irregularity index lost 33.3% of its improvement.

5)Mandibular molars, mandibular first premolars, mandibular second premolars and mandibular canines lost 34%, 45%, 31% and 50%

Of their treatment changes respectively.

Extraction of premolars in the full permanent dentition:-

Robert M.Little and group,AJO 1981

Results

1 . Long-term alignment was highly variable and unpredictable.

2 . No characteristics, such as Angle classification, length of retention, patient age at the begining 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.

3. Arch length and arch width typically decreased following retention as crowding increased.

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.

6. Arch length and arch width reduction with concomitant crowding continued well into the 20-to-30-years age span and apparently beyong, but the rate of change seemed to diminish after age 30.

7. Three appears to be no difference in treatment quality between first and second premolar extraction case.

8. Third molar absense or presense, impacted or fully erupted, seemed to have little effect on the occurrence or degree of relapse.

Serial extraction of deciduous teeth pluspremolars:-

Rober M.Little.Rechard and Group,Angles ortho 1990

Results

- Alignment usually improved during the physiologic drift stage following extraction of premolars and before the start of active treatment.
- Serial extraction cases were no better aligned postretention than late extraction cases. Success was less than 30 per cent.
- Serial extraction cases were also unpredictable and highly variable relative to long-term alignment

Mandibular incisor extraction:-

Richard.A.Riedel and Group ,AJO 1993

Results

- Overjet and Overbite remained acceptable post retention
- No association could be found to predict the amount of relapse.

STABILITY:-

" Occlosal stabilization must involve homeostasis; that is, the masticatory system should be self-stabilizing after orthodontic therapy" – Moyers.

$$\text{Success Index} = \frac{\text{Magnitude of improvement}}{\text{Magnitude of relapse}}$$

Growth considerations in stability :-

Anterior rotation of mandibular growth

Described by Bjork 1969 that the anterior rotation of the lower jaw in due to upward –forward growth of condyles – occurs with a fulcrum located in incisors.

Goal of treatment to establish normal overbite and overbite by creating a solid fulcrum at the incisors there by establish anterior & posterior occlusion followed by retention case until growth of the condyles is completed.

Posterior rotation of mandibular growth

Upward-backward condylar growth

Eruption of the lower incisors move verified

- lower crowding

Long term stabilization of the lower anterior teeth is absolutely necessary.

Maxillary growth and stabilility:-

- Associations with similar rotations in the mandible.
- In untreated cases rotation of the maxilla continuous mesial migration of the upper posterior teeth.
- In the maxilla, as in the mandible, there is less forward movement of the anterior than of the posterior teeth – anterior crowding.
- In the development Lower crowding the function of the lips plays an imp.role in the development of maxillary anterior crowding.

Dentoalveolar development and occlusion:-

The continuous forward movement of the posterior teeth in patients with forward rotation of the mandible is necessary to maintain stability of the anterior occlusion.

This tendency should be maintained in the orthodontic treatment of maintain the anterior teeth in their forward position so as to counteract the natural tendency of the incisors to upright.

Treatment timing:-

- Skeletal correction between maxilla and mandible – pubertal growth spurt – to take maximum advantages of facial growth.
- As growth in most orthodontic pt. Is not completed at the end of the growth spurt but continues for several years beyond the pubertal spurt, retention of the treatment result should also continue for a period of several years.

GENERAL CONSIDERATIONS FOR STABILITY (Theorems):-

1. Theorem1. Teeth that have been moved tend to return to their former positions.
2. Theorem 2. Elimination of the cause of malocclusion will prevent recurrence.
3. Theorem 3. Malocclusion should be overcorrected as a safety factor.
4. Theorem 4.. Proper occlusion is potent factor in holding teeth in their corrected positions.
5. Theorem 5.. Bone and adjacent tissues must be allowed time to reorganize around newly positioned teeth.
6. Theorem 6. If the lower incisors are placed upright over basal bone they are more likely to remain in good alighnment.
7. Theorem 7. Corrections carried out during periods of growth are less likely to relapse.
8. Theorem 8. The Farther the teeth have been moved, the less is the likelihood of relapse.
9. Theorem 9. Arch form, particularly the mandibular arch, cannot be altered permanently by appliance therapy.
10. Theorem 10. Many treated malocclusions require permanent retaining devices.

Raleigh Williams, in JCO, 1985 six treatment keys have emerged as essential if lower retention is to be eliminated.

I Key: The incisal edge of the lower incisor should be placed on the A-P line or I mm in front of it.

II Key: The lower incisor apices should be spread distally to the crowns more than is generally considered appropriate and the apices of the lower lateral incisors must be spread more than those of the central incisors.

III Key: The apex of the lower cuspid should be positioned distal to the crown. The occlusal plane, rather than the mandibular plane, should be used as a positioning guide.

IV Key: All four lower incisor apices must be in the same labiolingual plane.

V Key: The lower cuspid root apex must be positioned slightly buccal to the crown apex.

VI Key: The lower incisors should be slenderized as needed after treatment. Lower incisors that have sustained no proximal wear have round small contact points, which are accentuated if the apices have been spread for stability.

TWELVE KEYS TO STABILITY:-

By John C.Gorman

I Key: Whenever possible, allow the lower incisors to align themselves either through serial extraction or the use of a lip bumper in the early mixed dentition.

II Key:. Overcorrect lower incisor rotations as early in treatment as possible.

III Key:. Reproximation of incisors early in treatment and again at retention enhances stability.

IV Key: Avoid increasing the intercanine width during active treatment.

V Key: Extract bicuspids in cases where mandibular arch discrepancy is 4mm or greater, except where facial aesthetics dictates otherwise.

VI Key: Recongnize that the more a tooth is moved, the more, likely it is to relapse, and overcorrect accordingly.

VII Key: Upright lower incisors to at least 90º whenever the profile permits.

VIII Key: Create a flat occlusal plane during treatment, and overcorrect the overbite.

IX Key: Prescribe supracrestal fibrotomy for severely rotated teeth.

X Key: Retain the lower arch until all growth is complete.

XI Key: Place retainers the same day appliances are removed .

XXI Key: Recognize that compromise is often necessary in the interest of facial aesthetics and that sometimes lifetime retention is necessary.

Summary:-

There is no question That stability be one of our major objectives in successfully treating an orthodontic pt. To reach this goal the orthodontist must have a realistic awareness of stability.

Stability of orthodontically treated dentitions is multifactorial. Hence attempts it to simple goals, rules, and treatment techniques that guarantee stability are misguided. It however, really begins with the first clinical examination and includes a good data base and treatment plan.

Every Orthodontist should think “THE RETENTION” is a continuation of treatment planning, and it requires the same kind of analytical thinking that is used to establish specific treatment objectives at the beginning of the case.