

LIMITATIONS OF ADULT ORTHODONTICS

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INTRODUCTION

Orthodontic treatment strategies have traditionally been targeted toward an adolescent or preadolescent age group in which a developing or newly formed malocclusion is present. Emphasis has been placed on altering growth and guiding eruption, to achieve the ideal goals of esthetics, function and stability. At the same time, orthodontic practices have come to include a higher proportion of non-growing adult patients. The several reasons for increased interest by orthodontists in adults as patients, as well as for increased interest shown by adults in orthodontic treatment include:

1. Improved appliance placement techniques^{1,2,3}.
2. More sophisticated and successful management of the symptoms associated with joint dysfunction^{4,5,6}.
3. More effective management of skeletal jaw dysplasias using advanced orthognathic surgical techniques^{7,8}.
4. Increased desire of patients and restorative dentists for treatment of dental mutilation problems, using tooth movement and fixed restorations rather than removable prostheses⁹.
5. Reduced vulnerability to periodontal breakdown as a result of improved tooth relationships and occlusal function^{10,11}.

The ideal goals that are routinely sought in adolescent treatment, often may not be realistic or necessary for all adult patients. Treatment in which adolescent goals are not achieved is not necessarily compromised; rather the mechanotherapy should satisfy the objective of providing the minimal dental

manipulation appropriate for the individual case. Many Class I occlusal goals can be considered overtreatment for patients who also require restorative dentistry, prosthetics, plastic surgery, and other multidisciplinary dentofacial corrections.

Grabner has enlisted ten additional orthodontic treatment objectives particularly useful for adult problems¹²;

1. Parallelism of abutment teeth.
2. Most favourable distribution of teeth.
3. Redistribution of occlusal & incisal forces.
4. Adequate embrasure space & proper tooth position.
5. Acceptable occlusal plane & potential for incisal guidance at satisfactory vertical dimension.
6. Adequate occlusal landmark relationships.
7. Better lip competency & support.
8. Improved crown-root ratio.
9. Improvement or self correction of mucogingival & osseous defects.
10. Improved self-maintenance of periodontal health.

LIMITATIONS OF ORTHODONTIC TREATMENT OF ADULT PATIENTS

Along with the marked increase in treatment of adult patients, several authors have drawn attention to the limitations of orthodontic treatment in adults. Most of the limitations are related to the differences that exist between adolescent & adult patients, and several authors have identified what they consider the major differences. According to Siede¹³, these limitations involved lack of patients co-operation

and the status of bone surrounding teeth. Baum¹⁴ was concerned that the alveolar process might not have the correct shape or sufficient width to allow desired tooth movements. Levitt¹⁵ offered that in adult patients, 'there is no growth, only tooth movement'. Barrer¹⁶ stated that the adult, unlike the child, "is a relentless patient who will not cover our deficiencies in skills or our errors in the use of mechanical procedures by helpful settling in post-treatment". Ackerman¹⁷ identified an important difference related to the rarity of interdisciplinary treatment in a child patient as opposed to adult patients. Chasens¹⁸ listed the following clinical situations in adults, where orthodontics should be avoided:

1. Uncontrolled infection & inflammation.
2. Lack of retention for stabilization of teeth in their new positions.
3. Inadequate space into which teeth can be moved.
4. Movement of teeth against occlusal opposition or into occlusal trauma.
5. Movement of teeth that will not improve periodontal health, function or esthetics.
6. Movement of teeth against inadequate anchorage.
7. Lack of patient motivation & co-operation.
8. Tooth movement in patients with systemic problems that cannot be treated or are difficult to control.

CLASSIFICATION OF LIMITATIONS RELATED TO ORTHODONTIC TREATMENT OF ADULTS

Melsen¹⁹ has classified the limitations as intrinsic limitations (i.e. of Biological nature) and Extrinsic limitations (i.e. a result of unsuitable biomechanical systems).

In this article, we have broadly classified the differences & limitations of adult orthodontics as follows:

I. Psychological considerations

1. Patients Motivation
2. Appliance esthetics

II Intrinsic limitations:

1. Growth cessation
2. Age related changes in periodontium
3. Existing oral pathosis
 - Dental caries
 - Faulty restorations
 - Periodontal disease
 - Old extraction sites
 - Temporomandibular Dysfunction
4. Limited neuromuscular adaptability
5. Systemic health considerations

III Extrinsic Limitations:

1. Biomechanical considerations
2. Anchorage control
3. Retention & stability considerations

(I) Psychological considerations:

Patient Motivation:

In children and adolescents a major motivation is parents desire for treatment. Orthodontics is usually accepted as just another series of events that must be endured while growing up. In contrast, in adults it is important to explore why the patient wants treatment, and why now as opposed to some other time to avoid setting up a situation in which the patients expectations from treatment cannot possibly be met. A patient who is internally motivated is more likely to respond well psychologically than a patient whose motivation is the urging of others or the expected impact of treatment on other (External Motivation). Motivation of adults for achieving esthetic & functional changes is usually high and patients who are self-referred are usually more motivated compared with those who are referred by their dentist for adjunctive correction before reconstruction. Patient awareness & responsibility may lead to an attempt by the patient to control & direct the treatment to some extent. Adult patients more often demand esthetic or limited appliance treatment when it might be more efficient & beneficial to employ conventional appliance therapy. Adults, as a rule, are more likely to complain about pain after adjustments and about difficulties in speech, eating & tissue adaptation. Additional chair time to meet these demands should be anticipated²⁰.

Appliance selection:

Even highly motivated adults express some concern about the appearance of orthodontic appliances¹⁴. Plastic brackets, porcelain brackets, minibrackets such as the Hanson speed appliance, and lingual or invisible appliances have additional appeal to adult patients because of their more cosmetic appearance. However, plastic & porcelain brackets present significant mechanical disadvantages for certain types of tooth positioning problems^{21,22,23}. Lingual appliances, primarily because of the small inter-bracket span, also make control of complex tooth movements difficult²⁰.

From an analysis of the patients records, the orthodontist must determine whether the problem is treatable within the limitations imposed by the use of cosmetic appliance choices.

(II) Intrinsic Limitations:

Growth Cessation:

The most marked intrinsic limitation is the fact that the adult is no longer growing, and there is minimal skeletal adaptability, therefore surgical procedures are frequently necessary for moderate to severe skeletal disharmonies.

A loss of vertical control (i.e., an unintentional extrusion of teeth) is often related to orthodontic treatment with both removable & fixed appliances. In growing individuals, this may be acceptable because a continuous vertical development takes place, thus neutralizing the treatment produced eruption. However, in adults maintenance of vertical control of the dentition is imperative & all extrusive mechanics should be avoided.

Transverse discrepancies are more difficult to correct in adults than in adolescents. Expansion of a narrow maxillary arch in an adult can be accomplished orthodontically by dental expansion, if the transverse deficiency is small. However, for adults requiring skeletal correction, rapid maxillary expansion may not be feasible or predictable, because of the increased resistance of the calcified maxillary sutures. Surgically assisted RME may be an option for these patients. The disadvantage of

surgically assisted expansion, as with rapid expansion in adolescents, is the general inability to control movements of the maxillary halves to obtain differential versus symmetric expansion voluntarily²⁴.

As long as proper diagnostic procedures have been followed to establish pretreatment jaw relationships, planning treatment for adult patients can potentially be done more accurately than for growing patients, because the precision required in growth predication has been eliminated²⁴.

Age-Related changes in periodontium

Valiathan et al²⁵ reviewed the age related changes in the periodontium:

Gingiva:

- Decreased keratinisation
- Decreased or unchanged stippling
- Decreased connective tissue cellularity
- Decreased thickness of the oral epithelium
- Increased width of the attached gingival
- Increased keratinisation of cheek and lip

Periodontal ligament:

- Decreased vascularity
- Decreased collagen fibres, fibrocytes
- Decrease in mucopolysaccharides
- Increase in the elastic fibres
- Increase or decrease in width depending upon functional demand

Alveolar bone:

- Decreased vascularity
- Decreased healing capacity
- Decreased metabolism
- Decreased bone formation
- Increased resorptive activity
- Alveolar bone osteoporosis

Cementum:

- Increased cementum deposition.

Orthodontic considerations²⁶

- Collagen turnover plays a role in tooth eruption, migration or accommodation to new

mechanical forces. Therefore, reduced turnover might affect response to orthodontic forces.

- Proteoglycan constituents may change leading to decreased ability of periodontal ligament, to capture and retain water, and withstand mechanical forces.
- Decreased vascularity leads to insufficient source of progenitor cells and hence delayed response to mechanical stimulus.
- With increasing age, the negative bone balance may lead to thin trabeculae, which may be perforated by osteoclastic resorption. This is responsible for age & sex-related bone loss.
- With marginal bone loss, the center of resistance of the tooth is displaced apically, which leads to unfavourable crown-root ratio.
- Sharpey's fibres will not attach to roots that are denuded of viable cementocytes; this contributes to unfavourable crown-root ratio.
- Effect of age on root resorption is unclear. Evidence suggests that adult patients are at no greater risk for root resorption, but the patterns of root resorption may be more severe than in adolescents. The mean root resorption for the 6 maxillary teeth in an adult sample was reported as 0.35mm to 0.94mm²⁷.

Existing oral pathosis:

Comparison between adolescents & adults:¹²

	Adolescents	Adult
i. Dental Caries	More likely to have simple limited carious lesions, but more susceptible to caries.	More likely to have recurrent decay, restorative failures, root decay & pulpal pathosis.
ii. Periodontal Disease.	More resistant to bone loss, but highly susceptible to gingival inflammation.	Higher susceptibility to periodontal bone loss.
iii. Faulty restorations	Few significant restorative problems.	Frequent restorative problems with economic & treatment planning implications.
iv. TMJ adaptability	Small percentage with symptoms because of high degree of TMJ adaptability, infrequent symptoms.	Frequent occurrence of symptoms with dysfunction.
v. Occlusal awareness	Infrequent cause of problem.	Heightened, may lead to accelerated enamel wear with adverse change in supporting tissues.

Orthodontic treatment implications:

1. Treatment sequencing:

A comprehensive treatment plan should be developed.

Stage 1 : Disease control

Stage 2 : Establish occlusion

Stage 3 : Definitive periodontal/restorative treatment.

Stage 4 : Maintenance

2. Caries/faulty restorations:

- Appliance placement & orthodontic movement of existing bridgework is possible but difficult.
- For total correction of occlusal relationship, existing bridges and anterior crowns frequently require replacement.
- Before any tooth movement, active caries & pulpal pathology must be eliminated, using extractions, restorative procedures, and pulpal or apical treatment as necessary.
- According to Proffit²⁰, prior to orthodontics, teeth should be restored with well-placed amalgams or composite resins. Restorations requiring detailed occlusal anatomy should

not be placed until any adjunctive orthodontic treatment has been completed, because the occlusal relationship will inevitably be changed by orthodontics tooth movement and this could necessitate remaking crowns, bridges or RPDS.

- If provisional restorations are necessary, they must follow original axial inclinations of the tooth, so that the bracket position and ultimate tooth changes will be accurate.

- The positioning of damaged, worn or abraded teeth during comprehensive orthodontics, must be done with the eventual restorative plan in mind.

3. Old extraction sites:

Closure in adults is likely to be difficult. Resorption produces decrease in vertical height of the bone, and remodeling produces buccolingual narrowing of the alveolar process. When this has happened, closing the extraction space requires a reshaping of the cortical bone, and this response is significantly slower. The involvement of cortical bone tends to produce a reciprocal space closure, no matter what the apparent anchorage situation is; therefore anterior teeth may be retracted more than anticipated or desired. Implants for anchorage are useful in such situations. Generally, it is unwise to move a tooth into an area where bone has been destroyed by periodontal disease, because of the risk that normal bone formation will not occur as the tooth moves into the defect. It is preferable to move teeth away from such an area, in preparation for prosthetic replacement. When tooth replacement by implants is planned, the orthodontist must be careful to position the roots of the adjacent teeth so that there is enough room between the roots at the base of the implant.

4. Periodontal considerations:

Successful adult orthodontic treatment depends on:

- Periodontal preparation before treatment
- Maintenance of periodontal health throughout all phases of mechanotherapy.

Elimination of all gingival inflammation is imperative. Movement of teeth for periodontally susceptible patients, in the presence of inflammation, can result in increased loss of attachment and/or irreversible crestal bone loss. If a minimal zone of attached gingiva exists, particularly on abutment teeth, it is prudent to place free gingival grafts before orthodontic treatment begins. Treatment procedures like osseous recontouring or repositioned flaps are best deferred until the final occlusal relationships have been established. The occlusion also must be controlled during periods of stress & severe bruxism throughout orthodontic treatment, so that occlusal trauma & excessive tooth mobility will be prevented²⁸. Jiggling occlusal forces can aggravate active periodontitis, accelerate loss of connective

tissue, and diminish gain in reattachment after periodontal treatment. Occlusal splints or bite planes are helpful for disarticulation, to minimize occlusal trauma.

5) Treatment considerations in patients with Temporomandibular disorders:

Acrylic splints may prove useful for neuromuscular deprogramming, to reduce joint inflammation, pain & parafunction and to avoid occlusal trauma or treatment-induced TMJ symptoms. Prolonged use of Class II & Class III elastics may not be well-tolerated in adults who have had TMD problems, and should be avoided.

Systemic health considerations²⁹:

Orthodontic treatment should be avoided in patients with poorly controlled Insulin-Dependent Diabetes Mellitus (IDDM) as these individuals are particularly susceptible to periodontal breakdown. Even in well-controlled diabetics, there is more gingival inflammation, probably due to the impaired neutrophil function. During treatment, the orthodontist should monitor the periodontal condition of patients with diabetes. Lengthy orthodontic appointments should be arranged in the morning, following the patient's insulin injection and a normal breakfast.

For patients presenting with renal problems, if the patient's disease is well controlled, orthodontic treatment can be considered in patients with chronic renal failure who are not dialysis-dependent. If the patient is on dialysis, discussion with the patient's physician is important, though there is no major contraindication to treatment. In patients who have received kidney transplant, immunosuppressant drugs may create drug-induced gingival overgrowth. Treatment should not commence until oral hygiene is very good and excessive gingival tissue has been surgically removed. Also, treatment time should be kept to a minimum.

For patients at risk of developing infective endocarditis, the American Heart Association recommends that antibiotic prophylaxis should be

given at the initial placement of orthodontic bands, but not orthodontic brackets.

(III) Extrinsic limitations:

Biomechanical considerations:

The limitation in the movement of teeth in adults is almost invariably of extrinsic nature i.e., it is caused by an inability to adapt the force system to produce the desired stimulus¹⁹. All of the mechanical differences as applied to the biologic environment, point toward application of smaller forces in the adult, especially at the start of treatment²⁴. In addition, apical migration of attachment levels also causes an apical movement of the tooth's center of resistance. Therefore, a retraction force, for example, applied at a bracket bonded to the crown of a periodontally compromised tooth, causes a greater tendency for the tooth to tip than it would have if the periodontium had been intact. Because the distance between the applied force and the center of resistance is increased, the moment created by the force is greater than in an otherwise healthy tooth. Force levels should be decreased but the magnitude of the couple applied to counteract the tendency to tip should not be decreased proportionally. Moment-to-force ratios must therefore be greater in periodontally involved teeth²⁴.

Burstone¹⁹ indicated a number of examples related to fixed appliances, that lead to loss of vertical control or untoward extrusive effects:

- Tipback bend
- Incorrect bracket positioning
- Anterior root correction
- Excessive forces for intrusion.

Therefore, considerable care should be exercised in the use of the above.

Anchorage considerations:

In periodontally involved adults, anchorage is likely to be compromised, and careful stabilization of anchor units is especially important.

Useful adjuncts:-

- Soldered lingual arches

- Bonded splint¹⁹
- According to Melsen¹⁹, minor tooth movements are produced by a wire that does not fit passively, and these can reduce the efficiency of the anchorage unit. She advocates that passivity can be ensured if the brackets are ligated to a large stiff passive wire before bonding, and the total anchor segment is bonded to the teeth simultaneously.

Headgear to control anchorage is probably less reliable than it might be in a younger patient. Options include two-step space closure with friction less mechanics or use of implants for anchorage.

Retention and stability considerations:

According to Melsen¹⁹, the time for formation of mineralizing bone increases with advancing age; thus it is important to consolidate teeth after movement and prolong the retention period. When planning retention in adult patients, special precautions should be made³⁰.

- Root parallelism must be verified.
- Coincidence of centric relation & habitual occlusion should be evaluated clinically.
- Incisal guidance should be controlled clinically or with mounted models.
- Joint symptoms should be assessed clinically, and therapy should be provided.
- Excursions should be examined clinically or with models.
- Periodontal control obtained.
- Tooth-Size discrepancies should be reevaluated to resolve restoratively.
- Timing of retention & restorative treatment should be coordinated.
- Original malocclusion should be reassessed to determine specific retention needs.

Retention in adults should include 3 associated components: maintenance of tooth position, overall dental status and periodontal status³⁰. Thus, it can be divided into: Biologic Retention and Mechanical Retention. Biologic retention includes

the measures necessary in order to maintain an optimal periodontal support. This can be ensured through: a) Optimal hygiene, b) Regular periodontal control, and c) an occlusion that transfers occlusal forces in a vector passing as close to the center of resistance as possible in order to avoid occlusal trauma. All existing teeth should be included in the occlusion because lack of force to a tooth will result in dystrophy of the surrounding bone.

Mechanical retention must be planned with due consideration of the biologic retention. Duration of retention period varies according to the original anomaly, amount and type of treatment, treatment result, periodontal & general dental conditions, interdisciplinary treatment plan, and etiologic factors.

Anomaly specific & Treatment specific Retention³⁰:

(1) After realignment of incisor migration:

The teeth must be splinted to prevent spontaneous migration resulting from unconscious periods of excessive occlusal forces.

(2) After rotation:

Relapse of rotated teeth is common in adult patient. Circumferential supracrestal fiberotomy is recommended for all previously rotated teeth to minimize relapse. This procedure should be carried out at least 6 weeks before the appliances are removed.

(3) After orthodontic space closure:

Bonded flexible thin wire retainers may be used. Zachrisson, in the posterior sections over extraction sites, usually places bonded retainers on the labial side.

(4) After space regaining and root uprighting for restorative procedures:

After uprighting of tipped molars, a conventional removable retainer should be worn by the patient immediately after debonding and debanding, and final restoration is initiated after 6 months of retention.

CONCLUSION

Biomechanical modifications made to accommodate orthodontic treatment of adult dentitions are generally minor and adhere to the basic laws of physics as they apply to orthodontic tooth movement. Some adult presentations necessitate changes in treatment strategy from what would otherwise be employed in adolescent patients to achieve similar goals. In other cases, objectives themselves may need to be modified because of lack of growth potential, constraints of treatment mandates by the patient or the presence of multiple missing or compromised teeth.

By planning treatment and mechanotherapy, taking into account the individual circumstances that may affect the patients biological response to treatment, realistic goals of orthodontics can be mutually recognized and agreed on by both the provider and the patient, before therapy is initiated, resulting in a rewarding outcome.

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