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Adult Orthodontics Part 1: Special Considerations in Treatment

Abstract: Adult orthodontic demand in the UK has increased significantly in both private and National Health Service sectors, the reason being improvement in the availability of orthodontic services and an increased patient awareness towards orthodontics; in particular the desire for adults to have an aesthetic smile. There is also the role of orthodontics as an adjunct to restorative, periodontal and orthognathic treatment.

Clinical Relevance: Successful orthodontic treatment of adults depends on an understanding of the biological, mechanical, psychological and aesthetic needs of adult patients.

Ortho Update 2014; 7: 89–92

The demand for adult orthodontic treatment has increased during the last two decades. The reasons are most likely an improvement in the availability and accessibility of orthodontic services as well as an increased patient awareness. It has been reported in the USA that up to 25% of orthodontic patients are adults.[1] A Swedish survey by Salonen *et al*[2] showed that the prevalence of malocclusion, in the 920 surveyed adults aged more then 20 years, ranged from 17–53%. However, only 5% requested orthodontic treatment. Another study, in Holland, reported similar findings.[3] In the UK, the major orthodontic traits in adults seeking treatment were mal-alignment of the lower/upper arch and Class III malocclusion, while 90% of adult orthodontic treatments were provided using fixed appliances.[4]

More people are keeping their teeth longer owing to the improvement of the dental health services and awareness leading to an increase in the demand for orthodontic treatment for aesthetic reasons and also as adjunctive treatment to a restorative and/or periodontal treatment plans. Another reason for the increase in demand for adult orthodontics is recent advances in the treatment modalities which have been developed to address the desire for aesthetic treatment. These methods will be discussed in detail in the second part of this review.

Indications for orthodontic treatment in adults

Indications for orthodontic treatment in adults include:

- Addressing aesthetic and/or functional concerns;
- Re-treating previously failed orthodontic treatment;[4]
- Adjunctive to periodontal, restorative or prosthetic rehabilitation;
- Combined orthodontic/surgical treatment;
- Treatment of snoring and obstructive sleep apnoea.[5,6]

Considerations that may arise when treating adults

There are some considerations that may arise when treating adults and these will be considered in turn.

Relevant medical history

In general, the medical conditions that might affect orthodontic treatment are relatively few, although their prevalence is likely to increase with the age of the patient. Among these are pregnancy, diabetes mellitus, juvenile idiopathic arthritis or Still's disease, renal problems and osteoporosis. The uses of certain drugs have a bearing on orthodontic treatment, for example, history of treatment with bisphosphonates and their associated side-effects, especially with high dose and long period of intake.[7]

Previous orthodontics

Teeth may have root resorption associated with previous orthodontic treatment. The rate of root resorption with repeat treatment is reported to double.[8,9] The resorbed teeth need to be monitored carefully during treatment or the plan modified accordingly. Previous decalcification need not preclude further

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treatment assuming the dietary and oral hygiene problems have been addressed. However, close monitoring and daily sodium fluoride mouthwash (NaF) would be advisable to prevent further decalcification.[10]

Psychological considerations

It is reported that nearly 50% of adult patients will be dissatisfied with the final outcome of orthodontic treatment.[11] Body dysmorphic disorder is as common as 7.5% in adults; such patients may benefit from psychological counselling regarding their expectations before commencing any orthodontic treatment.[12]

Treatment motivation and co-operation

Treatment discontinuation has been shown to be age related, with a discontinuation rate of 20.2% in patients aged 10–14 years and 42.7% in patients older than 18 years, respectively.[13] This may be explained by adults being self-determinant in comparison to adolescents who may have external motivation from parents or a dental professional to continue their treatment.

Lack of growth

The lack of growth and the different metabolic activity between adults and adolescents may result in different orthodontic reponses and outcomes between younger and older patients.

Biological difference

Ageing is associated with decrease in the tissue's blood supply/cell turnover and may lead to slower tooth movement. This philosophy has been investigated in experimental[14,15] and human studies.[16] A recent study, using clear aligners, showed that orthodontic movement in males has more linear correlation with age than in females.[17]

Moreover, a lower risk of orthodontically induced iatrogenic root resorption is expected in a child or adolescent than adults. It is claimed that partially formed roots with open apices, as in the child or adolescent, may be less susceptible to orthodontic root resorption.[18,19]

Growth modification appliances

Growth modification is not generally used in the adult patient for obvious reasons, although recent randomized controlled studies have suggested that the skeletal influence of functional appliances is limited.[20–22] Moreover, the presence of growth during the orthodontic treatment of adolescents often enhances the dento-alveolar effect of the functional appliance, with faster overbite reduction, maxillary expansion, space closure, occlusal settling and even distalization of posterior teeth.[23] A non-surgical attempt to address a Class II skeletal discrepancy by Ruf and Pancherz[24] found no dento-alveolar differences in the use of a Herbst appliance in the treatment of moderate skeletal II malocclusions between adults and teenagers. However, where there is a moderate to severe skeletal discrepancy and where the patient has concerns about facial aesthetics, the status either has to be accepted or treated surgically.

Lack of vertical condylar growth

In adults, correcting the deep overbite by buccal segment extrusion carries a risk of worsening the pre-existent Class II profile owing to backward rotation of the mandible; the procedure is also considered unstable.[25,26] To avoid an increase in the vertical dimension, tooth intrusion is required, often using complex orthodontic mechanics such as a Rickett's utility arch or a segmented Burstone archwire.[27,28] However, the development of temporary anchorage devices (TADs) in the last decade has made this procedure easier and more efficient, if not necessarily more stable.[29]

The mid-palatal suture

The mid-palatal suture is essentially fused in adulthood and precludes any skeletal expansion of the maxillary arch without surgery,[30] while rapid maxillary expansion (RME) in adolescents is normally achievable without surgically splitting the midline suture.[31]

Mandibular dysfunction

More than half of adults are likely to suffer some effects of temporo-mandibular dysfunction (TMD) at some point in their life.[32,33] The BOS advice for the management of TMD suggested that the overlap between TMD and malocclusion is thought to be small and certainly orthodontic treatment in adults for the sole purpose of relieving TMD is not advised. Additionally, orthodontic treatment should not be initiated unless the TMD is stabilized.

Periodontal considerations

Periodontal tissue destruction in adolescents is relatively mild and localized to certain teeth;[34] there is, however, increasing loss of periodontal support with ageing. The periodontium is one of the factors involved in the equilibrium theory. Periodontal inflammation can cause destruction of the periodontal fibres and loss of alveolar bone. This then alters the equilibrium, leading to drifting, tilting or rotation of teeth.[35]

As an adjunct to periodontal treatment, successful orthodontic treatment can provide a more easily cleansable dentition for the patient. Intrusion of teeth in conjunction with periodontal treatment has been shown to improve periodontal conditions.[36] However, orthodontic treatment might further jeopardize the unstable and compromised periodontal condition.[37]

A common clinical observation in many adults on completion of fixed appliance therapy is the presence of unsightly triangular spaces in the interproximal region of the maxillary or mandibular anterior teeth near the cervical constriction.[38] The prevalence in an average adult orthodontic population is about 38%, while the causes include poor tooth positioning, loss and apical migration of the gingivae, as well as more incisally positioned contact points. This can be addressed by:

- Offset bonding of the bracket;
- Second order bends in the finishing archwire;
- Interproximal enamel reduction;
- Restorative camouflage; or
- A combination of the above.[39]

As a general rule, the periodontal condition should be fully evaluated and recorded before treatment, and any periodontal disease should be controlled and stabilized before orthodontic intervention. On occasion, adjunctive periodontal treatment should be performed before orthodontic treatment; for example, a gingival graft may be performed where thin gingival biofilm might lead to gingival recession during orthodontic tooth movement. Additionally, optimal oral hygiene and regular periodontal monitoring during orthodontic treatment should be undertaken.[40] As a method of ligation, the steel ligatures are considered more hygienic than elastics and one study, which looks at the bacterial load, favoured wire ligation and showed less bleeding on probing when compared to elastomeric ligation.[41]

Restorative considerations

The presence of restorations may cause difficulty when placing an orthodontic appliance. It is possible to bond brackets to gold, amalgam or porcelain by sandblasting the surface of the restoration.[42] In addition, bond strengths to porcelain may be increased by etching with 9.6% hydrofluoric acid or

1.23% acidulated phosphate fluoride gel, together with silane primers and highly-filled composite resin.[43] Alternatively, teeth can be temporarily restored with composite, which makes bonding easier, or by simply using a band.

Adult patients often have a heavily restored dentition or endodontically treated teeth, which can complicate the treatment plan as the choice of orthodontic extractions may be forced. However, successful endodontically treated teeth can normally be moved orthodontically; it is suggested that they have more resistance to orthodontically induced iatrogenic root resorption.[44,45]

Aesthetic considerations

The use of ceramic brackets may overcome the problem of aesthetic concerns of the metallic appliances but have the potential for producing further problems which will be discussed in more detail in the second part of this article. Other alternatives are lingual orthodontic appliances or clear aligners, although the latter have limitations on what they can achieve.[46]

Treatment mechanics

The orthodontic forces used in the treatment of adult patients should be as low as possible with careful control of tooth movement. The loss of alveolar and periodontal support can result in teeth tipping easily, due to an altered moment-to-force ratio, and may reduce the anchorage value of affected teeth.[47] It is recommended (not evidence-based) to use thermo-elastic Nickel Titanium archwires in order to apply a gentle force to the periodontally compromised teeth.

Headgear is not favoured by adults for social reasons but it may be necessary to reinforce the anchorage by other means, such as palatal arches or TADs.[47] The time required to wear Class II elastics is reported to be significantly longer in adults than adolescents who undergo similar orthodontic treatment to achieve the same effect.[48–50]

In addition, space closure may respond more slowly in adults than in a growing patient, especially in the lower arch when the extraction is historical and the alveolus is 'necked'. Some reports recommend surgical-assisted space closure or an accelerated osteogenic orthodontics technique.[51,52] However, it might be preferable to consider prosthetic replacement for larger spaces or restorative camouflage of a small space as an alternative to space closure.[53]

Palatally impacted maxillary canines

There appears to be no significant time difference in the alignment of a maxillary palatally impacted canine in adults when compared to growing patients, but with a lower success rate. Almost one third of the maxillary impacted canine cases in adults failed to respond to orthodontic therapy.[54] Orthodontic traction in adults often results in little or no initial movement, and the clinician may diagnose the condition as an ankylosis. However, it has been said that patience in treating impacted canines in adults is required since it can take a few months for the peridodontium to be functional again under the influence of orthodontic force.[55,56]

Retention and stability

Permanent retention using multi-stranded wires that allow some physiological tooth movement but also retain their position are frequently recommended for adults.[57,58] Others use smooth round wire to reduce the risk of plaque accumulation.[59] There is some evidence that lower bonded retainers can help in reducing the risk of late lower incisor crowding.[60] Since orthodontic treatment may be adjunctive to other restorative treatment, it is important to take into consideration the previous teeth movement and the design of the adhesive or fixed bridgework, and plan the retention accordingly. There are many types of bonded retainers, mentioned comprehensively in the review article by Patel and Gill.[61]

Summary

Adult orthodontics has many aspects in common with treating children and adolescents but the clinician should have an understanding of the important differences from a biological and psychological standpoint. Since adult orthodontic demand has been increased in both the private and National Health Service, it is the responsibility of clinicians to appreciate and understand the continuing advances in orthodontic technology which are encouraging adults to undergo orthodontic treatment.

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