Seven keys to optimising interdisciplinary orthodontics

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By Dr Ashok Karad

Introduction

Orthodontics has always been a discipline that sets the stage for dentofacial aesthetics. With the increasing desire for appeal and appearance, orthodontic treatment of adults has been the fastest growing area in the field of orthodontics. In addition to aesthetics, increased awareness of malocclusion, the functional benefits of orthodontic treatment, advances in materials, aesthetically pleasing and biomechanically sound appliances, and an interdisciplinary treatment philosophy have all played an important role in making orthodontic treatment popular in the adult population. However, in recent years, increased focus on simplified and rapid intervention has created compromises in treatment outcomes. Fundamental diagnosis and systematically sequenced treatment plans are being circumvented by technology and reliance on laboratory assistance. The diagnostic process, the essence of treatment planning, and biologic basis seem to be diminishing in importance. Often, orthodontic treatment can be of significant assistance in periodontally and restoratively compromised patients. The primary goal of orthodontic therapy in such clinical situations is to reduce or prevent excessive periodontal lesions. In patients with periodontally compromised teeth such as missing teeth, restored teeth, and they may have other problems, a comprehensive but concise list of the patient's problems and confusion, establishing an accurate diagnosis is the most important step. The goal of the diagnostic process in an interdisciplinary treatment is to produce a comprehensive but concise list of the patient's problems and to incorporate various treatment options into a plan that gives maximum benefit to the patient. The orthodontist should recognize the various elements of malocclusion contributing to the development of a problem.

To formulate a proper treatment plan and clarity of the final treatment, it explains existing orthodontic, periodontic, surgical and restorative techniques that provide the best possible solution to complex dentofacial problems. In clinical practice, orthodontic treatment of adults may be somewhat different from that of most adolescents. Compared with adolescents, adults are more likely to have dentition that has undergone some degree of damage over a period, and they may have other problems, such as missing teeth, restored teeth, periodontally compromised teeth and endodontically involved teeth, which demand some alterations in treatment strategy. In patients with periodontally compromised dentition with significant bone and attachment loss, a conventional approach to orthodontic tooth movement does not produce the desired results, as this may lead to increased tipping of teeth. Therefore, in such clinical situations, entirely different biomechanical strategies are required for efficient and desired tooth movement. Absence of growth potential in adults as opposed to growing patients is another factor that influences the orthodontic treatment strategy to resolve adult malocclusions.

1) Establish an organised approach to the diagnostic and treatment planning process

To formulate a proper treatment plan and clarity of the final treatment, it explains existing orthodontic, periodontic, surgical and restorative techniques that provide the best possible solution to complex dentofacial problems. In clinical practice, orthodontic treatment of adults may be somewhat different from that of most adolescents. Compared with adolescents, adults are more likely to have dentition that has undergone some degree of damage over a period, and they may have other problems, such as missing teeth, restored teeth, periodontally compromised teeth and endodontically involved teeth, which demand some alterations in treatment strategy. In patients with periodontally compromised dentition with significant bone and attachment loss, a conventional approach to orthodontic tooth movement does not produce the desired results, as this may lead to increased tipping of teeth. Therefore, in such clinical situations, entirely different biomechanical strategies are required for efficient and desired tooth movement. Absence of growth potential in adults as opposed to growing patients is another factor that influences the orthodontic treatment strategy to resolve adult malocclusions.

This can be achieved by developing a comprehensive but concise database of useful information derived from patient's history, clinical examination and analysis of diagnostic records (study models, full-mouth radiographs, and facial and intraoral photographs, Fig. 1). The orthodontist should have comprehensive knowledge of different disciplines of dentistry other than orthodontics to generate the pertinent data. Finally, the orthodontist should define the nature of the problem to design a treatment strategy based on the specification.
2) Define the treatment goals
In the management of a patient with multiple dental problems, it is extremely important for the clinician to define the finishing goals at the beginning of treatment and continue to focus on them until the finishing stage, in order to achieve them with a combination of appropriate orthodontic treatment mechanics, restorations and periodontal procedures. The treatment goals are mainly focused on establishing optimal oral health, aesthetics, good stomatognathic function and long-term stability.

The clinician should be able to visualise the end result before implementing the definitive treatment plan. This requires clearly defined treatment goals that set the direction of the proposed treatment plan. Ideally, an interdisciplinary treatment plan should address the maximum number of highest priority problems, including the chief complaint, and optimise the treatment results with maximum benefit to the patient and less risk involved.

Since complex dental/periodontal abnormalities frequently present a multifaceted problem involving multiple disciplines of dentistry, it is important to address the patient’s main concern, whether the patient is seeking treatment for functional or aesthetic improvement or both. Finding a solution to each individual problem leads to the formulation of a definitive treatment plan. A well-structured and organised list of problems ensures that all areas have been evaluated in the diagnostic phase and serves as a valuable reference tool during the course of treatment. All specialists involved in formulating the treatment plan for the patient should provide possible solutions to individual problems based on their own areas of expertise, and no problem should be treated as less important. Provisional treatment plans are then compared with respect to their overall effects, and the plan that enhances the treatment and provides maximum benefit to the patient considering the patient’s chief complaint, is then regarded as the final and definitive treatment plan.

The treatment planning process almost always follows the same steps; however, the treatment sequence varies significantly from patient to patient owing to large variations in morphological configurations and treatment priorities. Here, it is critical to organise the sequence of various treatment procedures in such a way that each treatment procedure performed by one of the specialists from the interdisciplinary team facilitates the next in order (Fig. 3). Figure 4 illustrates an 11-point treatment protocol for interdisciplinary cases.

3) Recognise minor dental arch crowding as a major periodontal concern
Dental arch crowding presents narrow interproximal spaces, which may result in a constriction of the interproximal bone due to reduced interradicular distance (Fig. 5). This compromised bone as a result of periodontal disease is considered, which can significantly enhance local host resistance and improve the prognosis of compromised or infected teeth (Fig. 6). Other than the aesthetic reasons, the resolution of interproximal tissue constriction and faulty contact points and embrasures is the predominant periodontal reason to eliminate dental arch crowding.

This integrated orthodontic and periodontal approach as an interdisciplinary development exercise should be considered as the most compelling periodontal rationale for orthodontic therapy. Hence, it is important to recognise orthodontics as much more than simply an aesthetic domain.

4) Use orthodontic treatment in correction of biologic width violations
Restorative therapies essentially require a healthy and stable periodontium for long-term success. A gingival unit exhibits a constant interplay between gingival tissue and crown contours, restorative material, tissue and its margins. Biologic width is defined as the dimension of space that the healthy gingival tissue occupies coronal to the alveolar bone. It is further elaborated as “coined the term ‘biologic width’”

In 1977, Ingber et al. recommended coining the term “biologic width”. The significance of this width lies in the fact that makes it susceptible to gingival infections and consequently causing gingival recession. In 1999, Ingber et al. recommended keeping a minimum distance of 3 mm between the restorative margin and alveolar crest for adequate gingival health maintenance. This 3 mm consists of 1 mm of alveolar bone and 2 mm of epithelial connective tissue, 1 mm of junctional epithelium and 1 mm of subgingival depth. Viscation of this natural seal disrupts the dentogingival apparatus, making it susceptible to the progression of oral microorganisms and consequently causing gingival disturbances such as inflammation, recession and alveolar bone loss. Thus, it is imperative to maintain this zone. This measure of 3.00 mm allows for optimum conditions for long-term success. A ratio of forced eruption for implant site development in a compromised alveolus.

5) Improve implant site with orthodontics
This describes a very creative method of forced eruption for implant site development in a compromised alveolus. This method increases the dimensions of the local alveolus by controlling extrusion of the tooth, the optimal amount of hard and soft tissue may be created for placement of an implant.

Determine the timing of implant placement
Facial growth is the determinant of the age for implant placement in adolescent patients. The osseointegrated implant’s lack of eruptive potential makes it behave like an ankylosed tooth, often causing a discrepancy in the occlusal plane due to continuous eruption of the adjacent tooth. Therefore, early implant placement poses a greater risk of compromised aesthetics in the long term. Several studies on young adults treated with implant-supported restorations to replace missing teeth have observed discrepancy between implants and adjacent teeth. In a study that followed the vertical changes of maxillary incisors adjacent to implants in a group of adolescents between 15 and 20 years of age, and adults between 40 and 50 years of age demonstrated infraocclusion of the implant-supported restorations, with a vertical step of 0.07-2.65 mm and 0.12-1.86 mm in adolescents and adults, respectively. Therefore, lack of proper occlusion and unsatisfactory situations in the anterior region may be common observations owing to jaw growth.
After the evaluation of coronal space, and maintenance of the papillae.14 In patients with implant-supported restorations even if the implants are successfully integrated. The best method to determine the status of facial growth is to superimpose sequential lateral cephalograms radiographs taken at an interval of six months (Fig. 8). Generally, the implants should be placed after completion of facial growth (around 10 years in females and 2 years in males.)

Establish optimal implant space
Adequate space gained for restoration of the normal width of a missing lateral incisor based on aesthetic and occlusion will determine the appropriate size of the implant to be placed. When selecting the size of the implant, it is important to have 1.5–2.0 mm of space between the coronal diameter of the implant and the adjacent teeth for the development and maintenance of the papilla.15 After the evaluation of coronal space, it is important to radiographically evaluate the interradicular space.

The roots of the adjacent teeth should be parallel to slightly divergent, with adequate space between the roots for implant placement (Figs. 9A & B).

Once the optimal space has been gained with appropriate treatment mechanics, an acrylic tooth of proper size and shade can be bracketed and attached to the archwire for aesthetic purposes (Fig. 10). If the space gained for the lateral incisor is in excess, the bracketed acrylic tooth can be used as a template, which will help determine the residual space closure. Clinical evaluation of the edentulous space and radiographic evaluation of the root position of the adjacent teeth should precede appliance removal. The final implant restoration is significantly influenced by the position and angulation of implant placement. For proper placement of an implant, the minimum space between the adjacent teeth roots is usually 5–10 mm, providing enough room for bone height needs and soft tissue which may be inadequate for esthetics and implants.16

Position adjacent teeth to facilitate restorative treatment
It is a common observation that, when an orthodontist is opening up space for a missing lateral incisor, as the force is applied on the crowns of the central incisors and canines, the roots are tipped into the lateral incisor region. This leads to inadequate crown space, but the space between the adjacent roots is reduced, making it impossible for the surgeon to place an implant (Fig. 11). It is equally important to take sufficient care to ensure that there is adequate interocclusal space for the implant restoration. It is therefore critical to establish optimal intraradicular and interradicular space, evaluated both clinically and radiographically (Fig. 12), for proper implant placement and long-term predictable restoration.

It is best to place an implant during the finishing stage of orthodontic treatment to allow finer manipulation of space, maintenance of space and sufficient time for osseointegration by the time the appliances are removed. However, if the implant placement procedure is planned after the removal of orthodontic appliances, the gained space should be maintained during the retention phase. Consider biologic augmentation
One of the prerequisites for placing an implant and subsequent good soft-tissue integration for more aesthetic implant integration is to have an excellent alveolar ridge. It is a common clinical observation that unesthetic bone deficient-areas typically exhibit compromised bone levels due to alveolar bone atrophy. Studies have shown that, if maxillary anterior teeth are extracted, the alveolar ridge will narrow by 1.5% over a period of five years.17 However, these findings related to the alveolar resorptive change do not hold true in cases where the edentulous span has been created by orthodontic tooth movement. Another study that evaluated the long-term width of the alveolar ridge after the recent extraction of 4 upper central incisors for missing maxillary lateral incisors in adolescent orthodontic patients revealed that the amount of bone loss as result of resorptive changes was less than 1% over a period of four years.18

Orthodontic implant site development is a process involving root movement that creates adequate alveolar ridge width through stretch of the periodontal ligament fibers prior to the implant placement. This can be accomplished in any part of the alveolar ridge. In addition to the compromised alveolar ridge vertical bone loss by the bony defect of the site implant placement can be influenced by controlled vertical root movement to generate osteoblastic activity before implant placement (Figs. 13–15). The goal is to create an ideal implant site by establishing adequate alveolar ridge width and height for a predictable and more aesthetic implant restoration.

6) Optimise pre-restorative orthodontics
Offers, management of adult patients necessitates modification of the usual treatment approach owing to anatomical disfigurements displayed commonly in their dentition caused by previous pathological episodes. Interdisciplinary treatment required for the holistic rehabilitation of these individuals may involve management through periodontic, endodontic, restorative, orthodontic and surgical specialties, among others. Orthodontic therapy may play a vital role in repositioning of teeth for subsequently planned restorative procedures. Such movement may include elaborate alteration of tooth positions to resist occlusal forces, coordination of upper and lower arch forms, appropriate distribution of interdental spaces or simplified movements as guided by localised restorative requirements, such as to improve the crown-root ratio and achieve parallelism of abutment teeth.

Tooth size plays an important role in implant-supported restorations. Depending on the type of implant-supported prosthesis, the adjacent teeth may be fixed, cantilevered or telescopic, and can result in compromised esthetics. Therefore, a multi-disciplinary approach is suggested. The ideal treatment is to correct the problem with 2D orthodontics and then place the implant. However, additional options are available to optimise pre-restorative orthodontics:

1) Optimise pre-restorative orthodontics

Orthodontic treatment to redistribute interproximal space, correct deep bite and retract maxillary incisors.
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+971 528423659 | p.mollov@cappmea.com
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Along with restorative interventions to ensure avoidance of any untoward tooth movements, proficient synchronisation between orthodontic and restorative strategies is the fundamental aspect for interdiscipli- nary treatment success.

7) Use customised orthod-on tic tooth movements to max- imise aesthetics

Contrary to traditional orthodontics, which is focused solely on improve- ment of static and dynamic occlusal relationships, contemporary orthodontics encompasses treatment needs and possibilities that aim at achieving good occlusal results in conjunction with enhancement of the entire dentogingival apparatus, including prime emphasis on aesthetic outcome. In a concerned, aesthetic society, aesthetics forms an integral part of patient expectations. This directly mandates orthodontic professional implications to systemically explore various factors that promote optimal aesthetics. Attaching to principles of structural balance and functional ef- ficiency, treatment planning should be diligently incorporate distinctly defined and customised aesthetic objectives. Various procedures from other disciplines of dentistry can be amalgamated with orthodontic treatment to refine aesthetic potential.

White and pink harmony

Well-finished orthodontic realign- ment of teeth constitutes perfection of the aesthetics within a smile. However, an ideal aesthetic smile hinges on a harmonious balance of both white and pink components. Colour, contour and health of gingival architecture constitute the pink components, which provide the background framework of a smile. Completed orthodontic treatment with appropriately repositioned teeth, but neglected gingival contours, such as loss of papillae or an asymmetrical gingival pattern, causes white–pink disharmony, leading to an unaesthetic smile.

Two significant factors related to gingival architecture that need to be considered are the gingival levels and the gingival marginal contour or gingival zenith.

The amount of gingiva seen depends upon the upper lip line in an active smile. In some individuals, the upper lip line does not display any gingiva, while in others, gingival display is evident. For optimum bio- logic health, functional perfection of treatment is inevitable, while gingival health and contour function subjectively exerted are purely cosmetic procedures, which may not augment towards health. Thus, cases with noticeable gingival display in an active smile do not require corrective treatment. Alternatively, cases with noticeable gingival display require corrective measures for achieving white and pink balance within the smile.

According to ideal aesthetic parameters, the gingival zeniths of the maxillary central incisors and canines are at the same level and those of the lateral incisors are placed slightly coronal. These margins should have contours that resemble the cemento-enamel junction. The gingival zenith is the most apical point of the lateral-gingival contour for the maxillary central incisor and canine, it is located just distal to the long axis of the tooth, and for the lateral incisor, its location coincides with the long axis of the tooth.

The papillary tip of the gingiva should extend halfway between the incisal edge and the lateral-gingival height. A gingival zenith should have contours that resemble the cemento-enamel junction. The gingival zenith is the most apical point of the lateral-gingival contour for the maxillary central incisor and canine, it is located just distal to the long axis of the tooth, and for the lateral incisor, its location coincides with the long axis of the tooth.

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