Seven keys to optimising interdisciplinary orthodontics

**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 compromised patients. The primary goal of orthodontic therapy in such clinical situations is to reduce or prevent excessive periodontal bone and attachment loss, a consequence of periodontal disease.3 Absence of growth potential in adults as opposed to growing patients is another factor that influences the orthodontic treatment strategy to resolve adult malocclusions.

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 dental anomalies that have 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.1 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 and to prevent any complications 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 recognise the various elements of malocclusion contributing to the development of a problem.

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 specific needs of the individual patient.

Fig. 3: Treatment execution

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

Fig. 4: Eleven-point interdisciplinary treatment protocol.

Fig. 5A–E: Tooth position and periodontal health.
(A) Gingival impingement due to deep bite caused a direct periodontal lesion.
(B) Dental crowding led to accumulation plaque that caused an indirect periodontal lesion.
(C) Labially positioned mandibular right central incisor associated with gingival recession.
(D) Teeth orthodontically moved into areas of better bone support show partial attachment gain.
(E) Orthodontic movement of the teeth into areas of better bone support show partial attachment gain.

Fig. 7A–D: Biologic width and its clinical significance.
(A) Pre-treatment photograph showing anterior restorations violating biologic width, which is seen clinically as gingival inflammation and recession.
(B) Illustration showing biologic width and its components. Total attachment of 2.04 mm is essential for the preservation of periodontal health. Its components include a mean gingival sulcular depth of 0.69 mm, junctional epithelium measuring 0.97 mm and mean supra-alveolar connective tissue attachment of 1.07 mm.
(C) Orthodontic treatment to bring about differential forced eruption of teeth #11 and #12.
(D) Restorations are contoured palatally to create intraocclusal space to facilitate vertical movement of incisors.
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 definitive treatment plan. 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 septal constriction can be a challenge for both periodontists and prosthodontists. De-crowding of the dentition by orthodontic tooth alignment widens the interproximal bone, 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.9

This integrated orthodontic and periodontal approach as an alveolar 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 with 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, and its margins. Biologic width is defined as the dimension of space that the healthy gingival tissue occupies coronal to the alveolar bone.10 It is further elaborated as a total of supra-cemental fibres, functional epithelium and sulcus.10 This concept of existence of a specific width was first published by Gargiulo et al. in 1961 through cadaveric experiments that revealed a mean measurement of a total of epithelial attachment plus connective tissue attachment of 2.04 mm (Fig. 7).10

D Walter Cohen is credited with creating the term ‘biologic width’. The significance of this width lies in the fact that it prevents penetration of microbes into the periodontium. In 1977, Ingber et al. recommended keeping a minimum distance of 3 mm between the restorative margin and alveolar crest for adequate gingival health maintenance.11 This dimension consists of 1 mm of supra-alveolar connective tissue, 1 mm of functional epithelium and 1 mm of subgingival depth. Violation of this natural seal disrupts the dentogingival apparatus, making it susceptible to the ingress of oral microorganisms and consequently causing gingival disturbances such as inflammation, recession and alveolar bone loss.10,11 Thus, it is imperative to minimise violation to this zone. This measure of 3.0 mm allows for optimum conservation of the mean value of 2.04 mm and provides clinical comfort even when the margins are placed 0.10 mm within the sulcus.

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 de-crowding extrusion of a tooth, the optimal amount of hard and soft tissue may be created for placement of an implant.

Determine the timing of implant placement
Figure 5 illustrates an 11-point treatment protocol for interdisciplinary cases.

Facial growth is the determinant of the age for implant placement in adolescent patients. The oesoin- grafted implant's lack of eruptive potential makes it behave like an ankyllosed tooth, often causing a discrepancy in the osseous plane due to continuous eruption of the adjacent teeth. 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 0.07–0.15 mm and 0.12–0.18 mm in adolescents and adults, respectively.12

Therefore, lack of proper occlusion and unsatisfactory situations in the anterior region may be common observations owing to jaw growth

**Fig. 4** Lateral cephalometric superimposition to determine the status of facial growth

**Fig. 8** Lateral cephalometric superimposition to determine the status of facial growth

**Fig. 10A–C:** (A & B) Optimal space gained with appropriate orthodontic mechanics for implant placement. (C) Pocket depth of 6 mm in the lateral incisor region, indicating facial bone loss.

**Fig. 13A–C:** (A) Orthodontic mechanics to open the space. (B) Adequate intraradicular space. (C) Inadequate space between the roots for implant placement. (A) Pre-treatment. (B & C) Mid-treatment.
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 1.5–2.0 mm of space between the coronal and apical surfaces. A sufficient distance between the roots of the adjacent teeth is required to place the implant. For proper placement of the implant, the minimum space between the adjacent teeth roots is usually 1.50 mm, providing enough room for a presurgical orthodontic treatment.

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 adequate crown size, 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 intracoronal and interradicular space, evaluated both clinically and radiographically (Fig. 12), for proper implant placement and long-term predictable restorations.

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 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 restorations is to have an excellent alveolar ridge. It is a common clinical observation that unreconstructed edentulous 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 35% over a period of five years.

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 required space was created 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 mm over a period of four years.

Position adjacent teeth to facilitate restorative treatment

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7) Use customised orthodontic tooth movements to maximise aesthetics

Contrary to traditional orthodontics, which is focused solely on improving the static and dynamic occlusal relationships, contemporary orthodontics encompasses treatment modalities that aim at achieving good occlusal results in conjunction with enhancement of the entire dental and gingival apparatus, including primary emphasis on aesthetic outcome. In a cosmetically concerned society, aesthetics forms an integral part of patient expectations. This directly mandates orthodontic professionals to systematically explore various factors that promote optimal aesthetics. Adhering to principles of structural balance and functional efficiency, treatment planning should 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.

The amount of gingiva seen depends upon the upper lip line in an active smile. In some individuals, the upper lip does not display any gingiva on smiling, while in others, gingival display is evident. For optimum bio-logic health, functional perfection of the gingiva and aesthetics, gingival margins should have contours that resemble the long axis of the tooth. The gingival zenith is the most apical point of the lingual-gingival contour for the maxillary incisor and canine, it is located just distal to the long axis of the tooth and for the lower 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 lingual-gingival height of the tooth, forming the pink architecture of the smile.

Conclusion

An interdisciplinary orthodontic treatment presents a philosophy and treatment strategy that involves a group of professionals from other disciplines of dentistry as a cohesive team. This approach to manage complex clinical situations is a highly sophisticated treatment modality and requires excellent communication and coordination among the team members. The goal is to simplify and individualise the treatment plan by providing solutions to a variety of clinical situations, which improves the overall treatment prognosis and enhances the treatment results.

Initially, this approach may seem to be out of reach of most practitioners, however, when implemented rigorously, this collaborative approach results in very efficient protocols and execution that patients appreciate and benefit from. The author has, since its initial days of orthodontic practice, enjoyed professional collaboration with specialists from other disciplines of dentistry in a fruitful career and continues to maintain professional enthusiasm with them. It is hoped that this particular approach to managing complex clinical problems will inspire readers to engage in their own interdisciplinary collaboration, and advance the practice of dentistry for the benefit of patients and community at large.

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References


