Seven keys to optimising interdisciplinary orthodontics

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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 diagnostic basis seem to be diminishing in importance. Often, orthodontic treatment can be of significance in periodontally and restoratively compromised patients. The primary goal of orthodontic therapy in such clinical situations is to reduce or prevent excessive periodontal disease. 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 problem of the patient. The orthodontist should recognize the various elements of malocclusion contributing to the development of a problem.

Fig. 1: Diagnostic process.  
Fig. 2: Case history database. 
Fig. 3: Treatment execution.  
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) Orthodontic treatment to bring about differential forced eruption of teeth #11 and mean supra-alveolar connective tissue attachment of 1.07 mm. 
(D) Restorations are contoured palatally to create interocclusal space to facilitate vertical tooth movement. 
(E) Orthodontic movement of the teeth into areas of better bone support, parallelism of roots and differential vertical tooth movement.

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 define the nature of the problem to design a treatment strategy based on the specific problem of the patient.

Fig. 6A & B: Dental arch crowding as a major periodontal concern. 
(A) Laterally positioned mandibular right central incisor associated with gingival recession. 
(B) Teeth orthodontically moved 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 interocclusal space to facilitate vertical movement of incisors.
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 the less risk involved.

Since complex dentofacial 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 optimise 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 treatment is more likely to achieve successful local host response 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 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 materials, tissue and its margins. Biologic width is defined as the dimension of space that the healthy gingival tissue occupies coronal to the alveolar bone7. It is further elaborated as a total of supra-crestal fibres, functional epithelium and sulcus.8 This concept of existence of a specific width was first published by Garaci 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).

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.9 This means a total of 3 mm of supra-crestal connective tissue, 1 mm of functional epithelium and 1 mm of sulcular depth. Violation of this natural seal disrupts the gingival apparatus, making it susceptible to the ingress of oral microorganisms and consequently causing gingival disturbances such as inflammation, recession and alveolar bone loss.10 Thus, it is imperative to minimise violation to this zone. This measurement of 3.00 mm allows for optimum conformation of the mean value of 2.04 mm and provides clinical comfort when the margins are placed 0.50 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 controlled extrusion of a tooth, the optimal amount of hard and soft tissue may be required 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 0.7-1.5 mm and 0.12-1.86 mm in adolescents and adults, respectively.11

Therefore, lack of proper occlusion and unaesthetic situations in the anterior region may be common observations owing to jaw growth
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 cephalometric radiographs taken at an interval of six months (Fig. 8). Generally, the implant should be placed after completion of facial growth (around 10 years in females and 21 years in males).

Establish optimal implant space

Adapt 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 15-20 mm of space between the coronal diameter of the implant and the adjacent tooth for the development and maintenance of the papilla.

After the evaluation of coronaal space, it is important to radiographically evaluate the interradicular space.

The roots of the adjacent teeth should be parallel to slightly diverge, 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 3.00 mm, providing enough room for unroofed edentulous maxillary lateral incisor implant, leaving about 0.75 mm of space for the bone between the implant and adjacent tooth.

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 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 interarchosseal 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 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 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 restoration is to have an excellent alveolar ridge. It is a common clinical observation that unroofed edentulous maxillary lateral incisors 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 5% over a period of four years.

Orthodontic implant site development is a process involving root movement that creates adequate alveolar ridge width through stretching 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 width, a vertical bony defect at the site of 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 movements 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.

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Tooth size plays an important role in definitive vertical stop, which gradu- cians are often faced with disproportion- nate widths of anterior teeth in the day-to-day clinical practice. This tooth size discrepancy is commonly found in patients with peg-shaped lateral incisors. In spite of having the teeth perfectly aligned and the occlusal discrepan- cies completely resolved with or- thodontic treatment, the abnormal shape and smaller size of the lateral incisors pose aesthetic problems. This requires planned tooth move- ments for proper space distribution with orthodontics to restore the norm- mal width of the lateral incisors. If a lateral incisor is of normal shape, but only slightly narrower than normal, and the discrepancy is bilateral, it may not require any intervention. However, in the case of tooth size dis- crepancy and/or an expansion discrepancy is significant, it is imperative to restore the size of the malformed lateral in- cisors by means of orthodon- tric treatment for overall good treat- ment results (Figs. 16-19).

Pre-restorative orthodontic move- ments are primarily determined by the type of restoration planned for execution. The main objective of tooth repositioning is to assist in ac- complishment of predictable resto- rations. A classical case constitutes a mutilated dentition (often with par- afunitional dental lesions, such as atrophy or abrasion) usually along with presence of old restorations, which may frequently be functionally and esthetically compromised, possibly resulting in partial or complete collapse of maxillary and mandibular arches in the verti- cal, sagittal and/or transverse planes. The presence of either upright or retroclined anterior teeth causes im- proper anterior guidance without a definitive vertical stop, which gradu- ally leads to supra-eruption and subsequent creation of a deep bite. Pathological migration disrupts in- terproximal contacts, leading to the possibility of multiple interdental caries incipiently. In the absence of timely dental intervention, deter-
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noration of the dentition advances significantly. Adjacent teeth drift into crowded spaces to seal off the bre"
ken continuity and increase the arch width, producing sagittal discrepancy and loss of vertical dimension. Such teeth typically present with tipped roots, which are not parallel to each other and have non-uniform interarch spaces. Rehabilitation of such a dental architecture involves intense interdisciplinary planning with the restorative den-
tist. Treatment thus planned should involve strategic sequence of procedures adhering to the holistic final restorative objectives, ensuring pre-
dictability at every stage. Establishment of an appropriate interarch relationship with suitable anterior guidance, parallelism of roots and evenly spaced interarch architectural alignment, with well coordinated upper and lower arches, forms the foremost objective of pre-restorative orthodontic treatment. This creates a reliable foundation for predictable distribution of occlusal forces.

Restorations can thereafter be fabri-
cated for long-term functional and aesthetic stability. Fine tuning of tooth positions during the finish-
ing stage of orthodontic treatment can be completed with valuable insights from the restorative dentist in accordance with the proposed restoration. Likewise, removal of or-
thodontic appliances can be timed along with restorative interventions to ensure avoidance of any untov-
toward tooth movements. Proficient synchronisation between orthodontic and restorative strategies is the funda-
mental aspect for interdisciplinary treatment success.

7) Use customised orthodontic tooth movements to max-
imise aesthetics

Contrary to traditional orthodontics, which is focused solely on improve-
ment of static and dynamic occlusal relationships, contemporary ortho-
dontics encompasses treatment objectives that aim at achieving good occlusal results in conjunction with enhancement of the entire dentogingival apparatus, including prime emphasis on aesthetic outcome. In a cosmetically concerned society, aesthetics forms an integral part of patient expectations. This directly mandates orthodontic profession-
als to systematically explore various factors that promote optimal aesthetics. Adhering to principles of structural balance and functional ef-
ciency, 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 poten-
tial.

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, whereas in others, gingival display is evident. For optimum bio-
logic health, functional perfection of treatment is inevitable, while gingi-
val refections subjected to purely cosmetic procedures may not augment towards health. Thus, height of the
overlying gingival pattern. There-
fore, asymmetries in gingival levels will result. Orthodontically, these clinical situations can be modified by intrusion or extrusion of teeth (Fig. 20).

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 managing complex clinical situations is a High-
ly sophisticated treatment modality and requires excellent communica-
tion and coordination among the team members. The goal is to sim-
plify 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 regu-
larly, this collaborative approach re-
sults in very efficient protocols and execution that patients appreciate and benefi t from. The author has, since its initial days of orthodontic practice, enjoyed professional collab-
orisation 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 ap-
proach to managing complex clinical pro-
blems will inspire readers to engage in their own interdisciplinary collaboration, and advance the prac-
tice of dentistry for the benefi t of patient and community at large.

White and pink harmony

Well-fi nished orthodontic realign-
ment of teeth constitutes perfection of the aesthetic within a smile. However, an ideal aesthetic smile
health is a harmonious balance of both white and pink components. Colour, contour and health of gingi-
val architecture in concert with the pink components, which provide the background framework of a smile. Completed orthodontic treatment with appropriatelypositioned teeth, but neglected gingival contours, such as loss of papillae or an asymmetrical gingival pat-
tern, causes white-pink disharmony, leading to an unesthetic smile.

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

The multi-disciplinary nature of such a dental architecture
requires a harmonious balance of white aesthetics within a smile. According to ideal aesthetic param-
eters, the free gingival margins of the maxillary central incisors and can-
aries are at the same level and those of the lateral incisors are placed slightly coronal. These margins should have contours that resemble the concomitant external function.
The gingival zenith is the most apical point of the labio-lingual contour for the maxillary incisors and canines, it is located just distal to the long axis of the tooth and is parallel to the long axis of 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 labio-lingual height of the tooth. The gingival zenith of each tooth is located at the central one-third of the length of the tooth along the long axis of the tooth, and for the maxillary central incisors and canines.

Periodontal assembly follows the eruptive tooth path. Margins of asymmetrical tooth eruption will alter the underlying crestal bone levels, which provide support to the overlying gingival pattern. There-
fore, asymmetries in gingival levels will result. Orthodontically, these clinical situations can be modified by intrusion or extrusion of teeth (Fig. 20).

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