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THE EXPANDING DOMAINS OF INTERDISCIPLINARY ORTHODONTICS: A REVIEW

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ABSTRACT

In the present era, increased awareness regarding facial esthetics has led to increase in the number of patients seeking orthodontic treatment. In majority of cases patients present with other dental problems also, which require interdisciplinary treatment. The interdisciplinary approach requires involvement and active communication of various specialists like Prosthodontist, Periodontist, Endodontist and Oral Surgeon with Orthodontist throughout treatment, from the diagnosis and treatment planning stage till the completion of active treatment and into retention phase, thereby greatly improving quality of care and treatment prognosis. Constant interaction, communication and integrated work by all the members of the interdisciplinary team at every level of treatment are the key to the success. So the

purpose of this article is to briefly describe various interdisciplinary treatment approaches for the management of complex dentofacial problems to achieve aesthetic and functional results.

Keywords: Interdisciplinary Orthodontics, Prosthodontist, Endodontist, Periodontist, Oral Surgeon, Orthodontic Treatment

INTRODUCTION

In the recent times, with the increasing expectations of the patients to an esthetically and functionally stable treatment result, the practice of dentistry is changing from a single specialist or general dentist practice to that of a team approach. This enables the best utilization of the skills and expertise of clinicians of different specialties for the best possible treatment outcome of the patient. Such joint care of a patient's dental needs is defined as interdisciplinary treatment **[1]**. Interdisciplinary approach is indispensable for patients with mutilated dentition. Patients with congenital defects can be best treated with such a team work only. It is also of utmost importance in adult patients presenting with severe jaw discrepancies, abraded or worn teeth, old failing restorations, tipped teeth, multiple edentulous spaces from previous tooth extraction, periodontal breakdown, recession, and many other periodontal and restorative problems **[2, 3, 4]**.

The role of orthodontist in such an interdisciplinary treatment approach can be primary or secondary. Primary as in a case wherein an orthodontic patient requires adjunctive treatment such as prosthetic replacement of missing teeth, tooth build-up to match a Bolton discrepancy, periodontal rehabilitation, surgical exposure of an impacted tooth, etc. Secondary as in cases where the orthodontic treatment rendered is an adjunct to other treatment planned, for example; in cases of space creation or tooth uprighting to facilitate prosthetic replacement of a missing tooth, etc.

The ultimate utilization of the expertise and skills in the various dental disciplines is called interdisciplinary dentofacial therapy (IDT). This interdisciplinary approach requires involvement and active communication of various specialists like Prosthodontist, Periodontist, Endodontist and Oral Surgeon with Orthodontist throughout treatment, from the diagnosis and treatment planning stage through to the completion of active treatment and into retention phase, thereby greatly improving quality of care and treatment prognosis. Therefore, contemporary clinicians attempts to achieve realistic treatment goals that aim to manage the objectives of both clinician and patient. This new concept of interdisciplinary collaboration **[Figure 1]** between orthodontics and other specialties

of dental medicine is best synthesized by the word TEAM (TOGETHER EVERYONE ACHIEVES MORE).

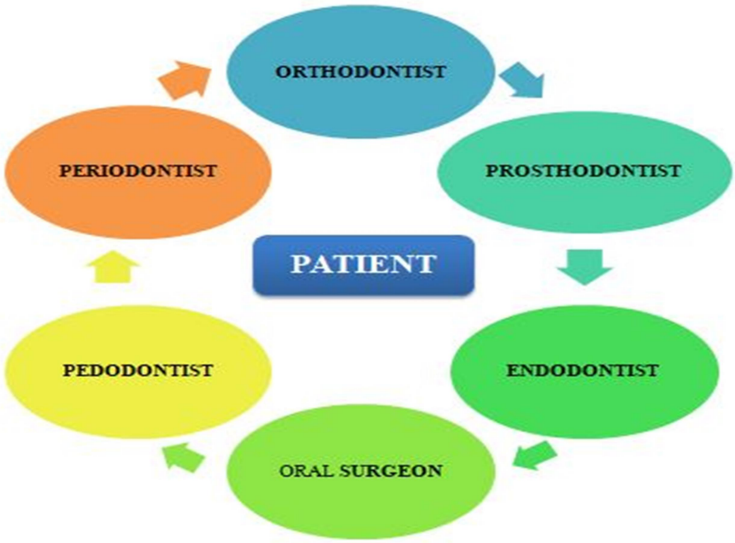

Figure 1: Showing Interdisciplinary Team

Ortho Perio Relationship: The main objective of periodontal therapy is to restore and maintain the health and integrity of the attachment apparatus of teeth. The interrelationship between orthodontics and periodontics often resembles symbiosis. In many cases, periodontal health is improved by orthodontic tooth movement, whereas in some cases orthodontic tooth movement is often facilitated by periodontal therapy. Periodontal conditions which requires orthodontic treatment includes; midline diastema and correction of black triangles **[5]**. Adult patients previously affected by periodontal disease often present with "black triangles" due to reduced interdental papillae height. By means of orthodontics, it is possible to correct teeth position and to improve soft tissue aesthetics. Pathological migration with infrabony defects are corrected by various orthodontic tooth movements such as intrusion, extrusion, rotation, and uprighting are needed to achieve an esthetically acceptable outcome **[6]**.

While establishing the treatment plan, it is important to define the treatment to be performed by the periodontist prior to starting orthodontic treatment as well as during and after orthodontic treatment which involve oral hygiene motivation, prophylaxis or therapy to control inflammation, surgery to eliminate deep pockets, augmentation of attached gingiva, frenectomy & frenotomy, elimination of gingival clefts, fibrotomy and curettage during forced eruption, clinical crown lengthening, gingivoplasty, root coverage etc.

Etiology of midline diastema is multifactorial, high frenum attachment is considered to be one of the cause for midline diastema. The labial frenum attachments have been classified as mucosal, gingival, papillary and papilla penetrating, by Placek *et al* (1974) **[7]**. The abnormal frenum prevents mesial migration of the central incisor which results in midline diastema and the aberrant fibre increasing the relapse tendency after orthodontic space closure. Surgical removal of the frenum is usually advised in these situations and it should be performed after completion of orthodontic treatment unless the frenum prevents space closure or become painful or traumatized **[Figure 2]**. The aberrant frenal attachment can be treated by frenectomy in which complete removal of the frenum, including its attachment to the underlying bone **[8]**.

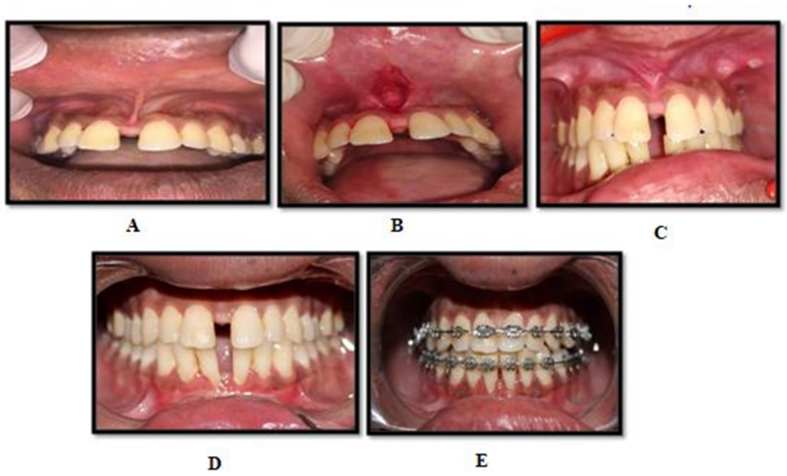

Figure 2: Correction of midline diastema by Ortho-Perio interdisciplinary approach

Ortho-Prostho Interrelationship: Often orthodontists can be of considerable assistance in prosthodontic treatment. Dental alignment of the arches can facilitate prosthodontic objectives, a strategy referred to as "facilitative orthodontics" **[9]**.

Two situations are well known and common: retained primary teeth and peg-shaped lateral incisors. Treatment option for congenitally missing lateral incisor include, Canine substitution, a tooth supported restoration, and a single-tooth implant [10]. The better choice for treating a peg-shaped lateral incisor is to restore the malformed tooth to its correct dimension. Compressed coil springs are placed between the central incisor, lateral incisor and canine to generate space. The gingival margins of the peg-shaped lateral should be aligned with the contralateral lateral incisor **[11]**.

Opening up the space for the prosthetic replacement of the missing lateral can be

accomplished by distalising the canine into Class I relationship with the opposing canine. Spear FM (1997) was in favor of the opinion that the ideal replacement for missing teeth is an implant provided all factors are favorable. The amount of space required for the implant placement is determined and created accordingly with orthodontic treatment. Space evaluation is of importance especially between the roots and at the level of the crowns to ensure successful crown placement. The implant is placed when the vertical growth of the patient is completed, usually 14-15 years of age in girls and 16-17years of age in boys **[12]**. Prosthetic replacement can also be planned with a Maryland bridge or a pontic on a retainer as convenient for the patient.

In case of extracted or missing teeth, the adjacent teeth have drifted or tipped over the extraction site, orthodontic repositioning of those teeth may be necessary before any restorative or prosthetic replacement of the missing teeth is done. Tipped teeth may be included in the design of a partial prosthesis, but we should know that the tipped teeth are not the best abutment either for a fixed or a removable prosthesis on account of the occlusal forces which are not directed along the long axis of the tipped teeth and the three-walled bony defects often seen on the side of the tip. Also supra-eruption of teeth in the opposing arch along the edentulous site may interfere with an ideal prosthetic replacement of the missing teeth. The proposed treatment plan includes orthodontic treatment along with restorative treatment. Orthodontic correction of the axial inclination of the tipped teeth and intrusion of the opposing supra-erupted teeth, helps in improving the periodontal prognosis and the long term maintenance of the tooth. It provides the necessary space for the prosthesis. It also ensures achievement of ideal interproximal embrasure and cuspal relationship.

Occasionally, orthodontists and general dentists encounter a patient who has traumatically avulsed a maxillary central incisor or a patient with a geminated or fused maxillary central incisor that must be removed **[13]**.

Treatment alternatives for patients with two upper incisors missing.

1. Maintenance or recovery of the missing incisor space, followed by prosthetic reconstruction using fixed partial dentures or implants.
2. Space closure and establishment of Class II posterior relationships.
3. Space closure and extraction of two teeth, usually premolars or lateral incisors, in the lower arch and establishment of Class I posterior relationships.

Ortho-Endo Interrelationship:

Endodontist have a major role to play in the interdisciplinary treatment with the

combination of Orthodontist, the teeth movement largely changes the periapical environment of the teeth. Orthodontic treatment can enhance the outcome of endodontic treatment by improving access to teeth requiring endodontic treatment, usually which is gained by extrusion. Common indications are deep subgingival decay,infrabony fractures, lateral root perforations due to resorption or post preparation as well as situations where access preparation may be difficult. As the alveolar bone and gingiva usually follow the tooth occlusally periodontal surgery for crown lengthening is often a necessary procedure. With ortho-endo mutual treatment advice benefits can be received in following treatment modalities such as, treatment of ankylosed teeth with alveolar ridge defect and simultaneous apexification and active orthodontic movement. Endodontically treated teeth can be moved as readily and for the same distances as teeth with vital pulps since tooth movement is the response of the periodontal ligament, not the pulp **[14]**.

Lateral incisor agenesis presents a significant clinical challenge. Considerable improvement can be achieved in patients with missing lateral incisors by combining carefully detailed orthodontic space closure with techniques from esthetic and restorative dentistry. Such methods may include:

- Individualized extrusion and intrusion during mesial movement of the canine and first premolar, respectively, to obtain an optimum level for the marginal gingival contours of the anterior teeth.
- Careful correction of the crown torque of a mesially relocated canine to mirror the optimal crown torque of a lateral incisor, along with the provision of optimal torque for the mesially relocated maxillary first and second premolars.
- Esthetic recontouring of a mesially relocated canine to a more ideal lateral incisor shape and size with a combination of grinding and composite resin build-ups or porcelain veneers.
- Increasing the width and length of mesialized and intruded first premolars with composite resin build-ups and/or porcelain veneers to achieve optimal esthetics and functional occlusion.
- Intentional vital bleaching of a yellowish canine that has been moved mesially into the lateral incisor position.

A peg- shaped maxillary lateral incisor is an anomaly of tooth development characterized by an alteration in coronal morphology. A number of options are now

available to alter the morphology of such teeth including direct composite build-ups, indirect composite resin veneers, porcelain veneers and resin-bonded porcelain crowns. As a result, the extraction of peg-shaped lateral incisors as part of orthodontic treatment plan is less frequently indicated.

Ortho-Oral Surgery Interrelationship:

The interdisciplinary relation between the orthodontics and oral surgery is an important part of the orthodontic treatment planning and a deciding factor for considering a case to treat either with the simple camouflage or to treat with the surgical intervention.

Surgical procedures are performed to improve the facial profile and enhance aesthetics which are mainly focused on the correction of disproportions of underlying jaws and their alignment are collectively grouped as orthognathic surgery. The surgical procedures may be undertaken on either of the jaws [one jaw] or both the jaws independently or in addition to surgery of the craniofacial structures which may include the orbits, zygoma and the cranium. The following are the stages in an ideal surgical –orthodontics treatment case;

1. Pre orthodontics preparatory phase
2. Pre surgical orthodontics treatment phase
3. Surgical phase
4. Post surgical orthodontic phase
5. Prosthodontist treatment phase rehabilitation of occlusion and aesthetic
6. Dentistry.
7. Follow up and retention

The role of an orthodontist in Surgical Orthodontics is dental decompensation using fixed mechanotherapy prior surgery and postsurgical establishment of functional occlusion **[15]**.

Impacted teeth are often encountered during the diagnosis and correction of malocclusions in adolescent orthodontic patients. Maxillary canine with an incidence of 1% to 3%,is the second most common impacted tooth which varies based on the ethnicity of the sample population **[16, 17]**.

Management of palatally impacted canine:

There are numerous surgical methods for exposing the impacted canine and bringing it to the line of occlusion. The most commonly used methods are:

1. Surgical exposure, allowing natural eruption to occur
2. Surgical exposure with the placement of an auxiliary

Absolute anchorage systems have stormed the world of orthodontics over the past two decades with its ability to produce skeletal anchorage, converting borderline surgical cases into non-surgical and extraction cases into non-extraction or even bringing about the esthetic impact which was difficult to achieve by conventional mechanics. An orthodontist in association with an oral surgeon can greatly enhance the anchorage

by using IZC and BSS. Among the skeletal anchorage systems, the most popular being – miniimplants or micro-screws which have an intra-radicular site of placement. Their greatest advantage being the ease and minimally invasive methods of placement and the commonest disadvantage being early loosening during the course of treatment. A more rigid alternative was then introduced called as the SAS -Skeletal Anchorage Systems (I-plate, Y-plate etc) with its extra-radicular site of placement, which did overcome the high failure rates of a regular mini-implant but then their placement required raising of flaps and extensive surgical intervention. More recently an apt balance was achieved with the advent of the -Orthodontic Bone Screws (OBS) which not only had an extra-radicular site of placement in the infra-zygomatic crest of the maxilla and the buccal shelf area of the mandible, with significantly less failure rates than regular mini-implants **[18]**.

The surgeon can also aid the orthodontist by providing other services such as: treatment of cleft lip & palate, maxillary and mandibular deformities, in procedures like distraction osteogenesis.

Ortho-Pedo Interrelationship: Oral trauma in children and adolescents remains a significant health issue th coordinating care, maintaining constant communication, and sharing decision-making in order to maximize available treatment options and attain an optimal health result **[19]**.

Pediatric dentists and general dentists are usually the first to detect a child's malocclusion. Some well-accepted benefits of early orthodontic treatment are that it can eliminate or reduce the severity of a developing malocclusion, and reduce the length and complexity of future orthodontic treatment. Early management includes preventive and interceptive orthodontic therapies which includes space maintainer in primary teeth and serial extraction to eliminate the severity of developing malocclusion.

The pediatric or adolescent patient with a history of dental trauma adds a level of complexity to the orthodontist's plan of treatment already challenged with traditional issues of home care, caries risk status, and patient willingness or ability to comply. All of these considerations necessitate the need for coordinated patient care between pediatric and orthodontic specialties in order to achieve safer and more effective care.

Interdisciplinary Management Of Cleft Lip & Palate: The American Cleft Palate-Craniofacial Association was established in 1943 to promote a team approach and to serve as an advocate for patients with cleft lip and/or palate and their families. The association defined orthodontist's role on a cleft palate team and recognized a team

approach as the most appropriate method to manage the care of patients with orofacial clefts. The care of cleft lip & palate patient requires a team of specialists including psychologists & social workers to provide a comprehensive treatment from birth to childhood. During initial days, the feeding specialist, orthodontist, neonatologist and the cleft surgeon take the leading role immediately after birth. After the first year, issues with middle ear infections, hearing and speech therapy are more relevant and important affairs to deal with. Similarly, during the late mixed dentition stage orthodontist would need greater gratification and at adulthood plastic surgeons would play an important role in the correction of secondary deformities of nose and lip. Rapid maxillary expansion appliances are enabled by orthodontists to secure the proper space in upper arch. A prosthodontist may be necessitate to rehabilitate missing teeth and for aesthetic treatment of the dentition **[Table 1]**.

Table 1: Treatment Schedule for Cleft Lip & Cleft Palate

BIRTH	Initial assessment Pre-surgical assessment
3 MONTH	Primary lip repair
9-18 MONTH	Palate repair
2 YEAR	Speech assessment
3-5 YEAR	Lip revision surgery
8-9 MONTH	Initial interventional Orthodontics Preparation for alveolar bone grafting
10 YEAR	Alveolar bone graft
12-14 YEAR	Definite Orthodontics
16 YEAR	Nasal revision surgery
17-20 YEAR	Orthognathic surgery

Recent Updates

For the success of the treatment of cleft lip and palate respectively, combined efforts and co-operation of team is required in a certain way. Contribution of nasoalveolar molding has significantly altered and improved the prognosis and outcome of cleft treatment. Patients who are given the benefit of NAM have better form and shape of nose and facial aesthetics compared to the patients devoid of it. The NAM appliance has two crucial components—the nasal (nasal stents) and the oral (molding plate). Clinical techniques constantly will be improving with time which setteles the clinician to provide the enriched care while striving to reach the point of excellent facial aesthetics in patients of clefts **[20]**.

ORTHODONTICS AND MISCELLANEOUS

Orthodontics & Speech

Since there is a dynamic relationship between normal sound production and the oral cavity, the orthodontist should endow the ability and quality to recognize and

determine how dental anomalies are related to orthodontic treatment and sound production. This provides refined patient care through upgraded treatment planning and appropriate referrals to speech pathologists for patients whose malocclusion affects sound and speech production. In the various types of cross-bite, underbite, overbite, medial-open-bite etc., the speech difficulty is generally found in those articulatory movements which produces hissing, or so-called friction noises. The normal production of these sounds is characterized by following structures, firstly a pocket reservoir of air above and behind the radix of the tongue, secondly a varied series of narrow openings between the apex of the tongue and the hard structures of the palate and upper teeth, and thirdly forceful expulsion of the air and sound against the lower front teeth as far. While speech is a performed function of the central nervous system, abnormalities in the peripheral speech organs, of course, counter against development, of normal language. These disorders are the main meeting agenda of the orthodontist and the speech therapist. There are certain abnormalities which frequently require an orthodontic treatment prior to adequate speech correction work **[21]**.

Relation of speech and malocclusion **[22]**:

1. Features of malocclusion are associated with difficullty in producing speech and sound.
2. The severity of malocclusion is directly proportional to speech sound error.
3. Open bite, even as less as 2 mm, it is associated with sound production errors.
4. Bilateral crossbite and open bite were more significant in affecting sound production rather than Angle's classification.
5. Production of the /s/ and /t/ sounds is most affected by an open-bite malocclusion.
6. Auditory and visual distortions combined (typically called a sound error) occurred in 17% of the subjects.
7. Although visual inaccuracy is itself not considered as sound error but it occurred with the most frequency (80%), meanwhile it may inadvertently be viewed as such because of the lingual protrusion.

Orthodontist and Endocrinologist

The endocrine system is an intricate network that is regulated metabolic processes throughout the body, controlling the growth and differentiation of various parts of the skeleton. Hence, disruption of any part of this system may lead to widespread alterations of the human physiology, resulting in metabolic, anatomical, and/or growth-related disturbances. Although a disturbance in virtually any part of the endocrine system

would be expected to have orthodontic implications; disorders of the pituitary, thyroid, parathyroid, and pancreas are of particular interest to the orthodontist **[23]**.

Certain hormones like estrogen & androgen decreases the rate of bone resorption which result in decreased orthodontic tooth movement whereas other hormones like relaxin, thyroid and parathyroid increases the rate of bone resorption which results in increased orthodontic tooth movement.

Orthodontist and Psychiatrist

A majority of patients attending an orthodontic clinic are children and young adults at with rapid and drastic changes at various stages of maturation, taking place, both in their minds and bodies. The psychiatric disorders most commonly encountered by the orthodontist are either major depressive disorder (MDD) or attention deficit hyperactivity disorder (ADHD) **[24].**

CONCLUSION

The interdisciplinary team creates a network of shared skills and expertise, open communication, and trust. The ultimate goal is to create and perpetuate an ideal treatment environment in which the patient feels comfortable and doctors can work effectively the ability to change. Within the period of dentistry, the use of interdisciplinary approach has been found to be of remarkably important in achieving treatment success for individuals with adverse and unfit oral health conditions & medical or behavioral challenges "Constant interaction" & communication among the members & the patients at all level of treatment are the keys to the success of the interdisciplinary treatment.

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