Chapter

Interdisciplinary Periodontics

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Abstract

Evidence based periodontics has made us understand that most of the patients having various dental or medical treatment requirements require multidisciplinary approach rather than personalised periodontal approach. Periodontal disease may be evident in the periodontal tissue but its onset and progression could be affected by systemic condition also. The intercommunication and liaison between periodontics and endodontics, fixed prosthodontics, implant dentistry, Orthodontics, oral pathology, Aesthetic dentistry, oral & maxillofacial surgery, Paediatric dentistry, gerodontology, radiology, special needs dentistry and general medicine needs to be discussed. Increasing life expectancy, higher quality of Biomaterials used in dentistry and rapid evolution of clinical procedures has led to more demanding patient requests & more complicated treatment choices. It requires holistic management. In this chapter we have made a conscious effort to touch upon various fields of medical science and its relation to periodontics, by which we wish to create a healthy referral protocol, benefiting the general population.

Keywords: Interdisciplinary periodontics, Ortho- perio synergy, periodontal surgery

1. Introduction

The intercommunication and liaison between periodontal tissues/periodontal diseases and endodontics, fixed prosthodontics, implant dentistry,orthodontics, oral pathology, aesthetic dentistry, oral & maxillofacial surgery, paediatric dentistry, gerodontology, radiology, special needs dentistry and general medicine needs to be discussed [1]. Increasing life expectancy, higher quality of Biomaterials used in dentistry and rapid evolution of clinical procedures has led to more demanding patient requests & more complicated treatment choices. It requires holistic management, which frequently mandates clinicians to cooperate in a multidisciplinary approach, in order to fulfil therapeutic objectives and to provide successful treatment concerning functional rehabilitation and aesthetical enhancement [2]. So, clinicians should believe in 'merge to emerge' approach of interdisciplinary Periodontics.

Understanding these interrelationships can improve the clinicians' ability to establish the correct diagnosis, to evaluate the prognosis of affected tooth or teeth and to design and carry out an appropriate treatment according to biological and clinical evidence. Interdisciplinary dentistry can be described as the mutual permeation of various dental specialties accompanied by expansion of the scope of each. The term 'synergy' refers to two or more distinct influences or agents acting together to create an effect greater than that predicted by knowing only the separate

effects of the individual agents [3]. This definition is applicable to the classic relationships between various specialities in the dentistry that should go hand in hand for the complete well being of the patient. Within modern dentistry, periodontics share an intimate and inseparable relationship with endodontics, orthodontics, Prosthetic dentistry as well as other specialities in multiple aspects including treatment plan, procedure execution, outcome,achievement and maintenance.

Interdisciplinary team work in periodontics is a complex process in which different specialities staff work together to share expertise, knowledge and skills to impact on patient care. Thus the interdisciplinary periodontics can be interpreted as the interaction and interrelationship between periodontist and other dental specialists with harmonious setting & skills sharing common periodontal health goals and practicing concerted physical and mental effort in determining, planning and evaluating patient care [4].

This definition of interdisciplinary periodontics may be more optimistic and aspirational than realistic as it makes several assumptions about the characteristics that a team will possess.

The ten themes identified as the characteristics of a good interdisciplinary team are:

1. Leadership and management - Having a clear leader of the team like a periodontist with a clear direction and management.

2. Communication skill.

3. Personal rewards, training and development - seminar, workshop on interdisciplinary Periodontics.

4. Appropriate resources and procedures - Team members working from the same location, ensuring the appropriate procedures are in place.

5. Appropriate skill mix.

6. Climate - Team culture of trust, valuing contributions, nurturing consensus and need to create an interprofessional atmosphere.

7. Individual characteristics- knowledge, experience, initiatives, knowing strength and weakness etc.

8. Clarity of vision.

9. Quality and outcomes of care.

10. Respecting and understanding roles (**Figure 1**).

All phases of clinical dentistry are intimately related to a common objective. The preservation and maintenance of the natural dentition in health is of prime importance in an integrated interdisciplinary approach to periodontal care. It is logical that periodontal treatment precedes final restorative procedure. Hence, for successful oral rehabilitation of the patient the interdisciplinary approach is required where ideas can be exchanged for the sake of sound oral health [3].

The aim of this chapter is to focus the importance of periodontal examination and periodontist in clinical dental practice and referral in general dental practice. It also describes the intercommunication and liaison between periodontal tissues/

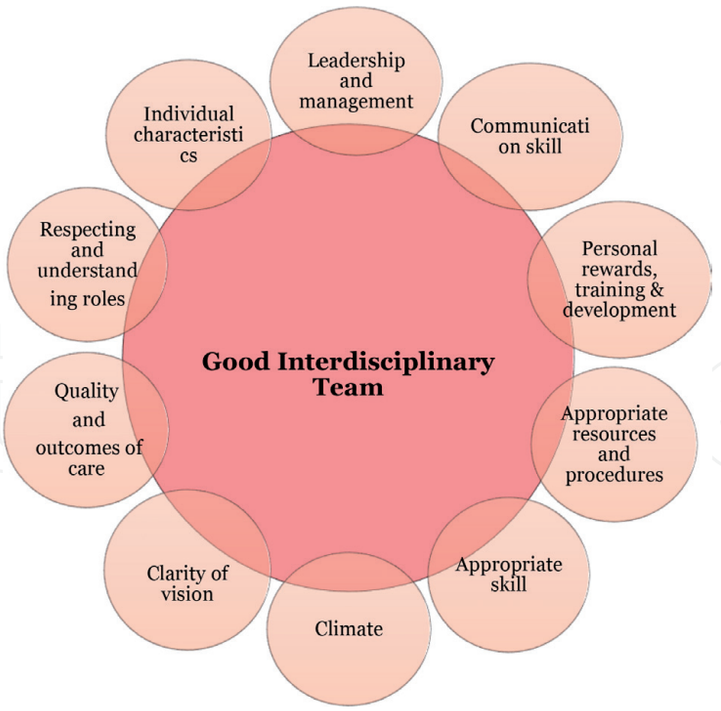

Figure 1.
Schematic diagram for interdisciplinary team.

periodontal diseases and endodontics, fixed prosthodontics, implant dentistry, orthodontics, oral pathology, aesthetic dentistry, oral and maxillofacial surgery, paediatric dentistry, gerodontology, radiology, special needs dentistry and general medicine.

2. Periodontal office as a hub for interdisciplinary approach

2.1 Periodontics and referral in general medicine

The separation of medicine and dentistry is a peculiar historical artefact resulting in medicine being preoccupied with various systems of the body and dentistry being focused on disease and injury of the teeth and its supporting and surrounding structures, jaw and mouth. The professional boundaries are dutifully respected but the distinction has resulted in a poverty of cooperation, greatly inhibiting the synergistic potential. There are numerous diseases that produce both medical and dental complications like chronic kidney disease, cardiovascular disease, endocrine disorders and peripheral vascular disease. These chronic diseases capitulate a huge financial and social burden that necessitate medicine and dentistry to coordinate for achieving a more substantial delivery of care.

Poor oral health affects morbidity more than mortality [5]. Unfortunately, oral health has been a disregarded area of global health and has been registered as low on the sight of National policy makers. Link between oral/periodontal health and systemic health is an established fact now. Despite the awareness regarding the impact of oral health and the increasing attention within public policy, there are barriers preventing access to both basic & specialist dental care. The affordability of dental care and the economic hardships associated with its use presents one of the main barriers to care. The insurance system also determines the frequency with which individuals access dental care. Age is strongly associated with the interval between visits to dentists, despite having increased risk of periodontitis [6].

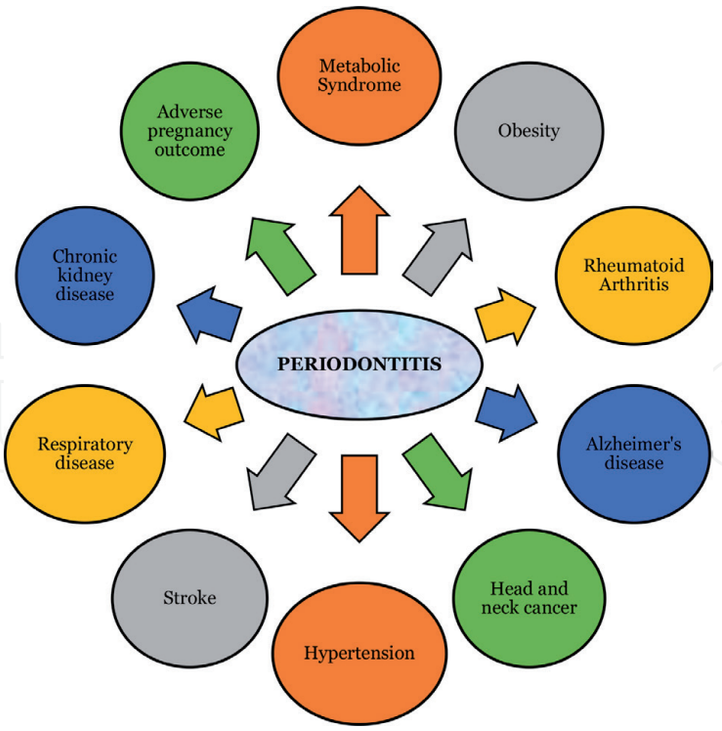

Figure 2.
Periodontitis and its relation to systemic condition.

The impact of periodontal health and the release of inflammatory mediators are not restricted to the cardiovascular and cerebrovascular systems. Periodontal infections influence the initiation and progression of chronic obstructive pulmonary disease and respiratory infections such as pneumonia [7]. Periodontal disease also have been associated with preterm birth and low birth weight baby [8]. Patients with periodontitis have been found to be at increased risk of being in dysmetabolic state,characterised by decreased serum level of high density lipoprotein and mild insulin resistance [9] (**Figure 2**).

There are various common risk factors that explains the link between periodontal diseases and systemic diseases such as age, gender, socio economic status, income, smoking, ethnicity. Therefore, physicians should be well aware of this fact and should identify these risk factors and refer accordingly. These facts should be strengthened in continuing medical education programmes for surgical & physician trainees as well as be put into action into the medical and dental student curriculum. Before referral, the doctor and the dentist should inform the patient why there is reason to be concerned and the importance of managing risk factors. The doctor and dentist should provide a letter of referral for the patient outlining the medical and dental history respectively. The dentist should outline the list of procedures carried out, their impression of prognosis as well as whether there is a requirement for follow-up appointments. Most medical departments should hold regular multidisciplinary team meetings and one possible suggestion would be to include a periodontist.

2.2 The connection between periodontics and oral pathology

The periodontium in health and biofilm induced periodontal infections are very familiar to all oral health professionals including general practitioners and periodontists. The gingiva and buccal mucosa are associated with numerous local and systemic diseases. There are certain rare pathologies that may manifest in soft or hard tissue components of periodontium can be deliberated by by periodontists

with oral pathologists and they should act cohesively in aconvenient way so that these pathological conditions are perfectly diagnosed and treated. Not all possible disease processes that affect the gum can be included but it will facilitate a structure to steer the investigations and treatment plan if something abnormal identified.

These are the list of some abnormal lesions of gingiva that can be diagnosed & managed in a timely manner if interdisciplinary approach is followed between periodontist and oral pathologists [1]:

1. Gingival lesions of developmental/ genetic origin
   - Hereditary gingival fibromatosis
   - Ligneous gingivitis
   - Gingival hamartomas
2. Gingival lesions of traumatic origin
   - Peripheral giant cell lesions
   - Brown tumours of hyperparathyroidism
3. Gingival lesions of infectious origin
   - Herpes simplex virus infection
   - HIV infection
4. Gingival lesions considered to have an immunologic origin.
   - Lichen planus
   - Mucous membrane pemphigoid
   - Pemphigus vulgaris
   - Orofacial granulomatosis
   - Langerhans cell histiocytosis
5. Drug induced gingival lesions
   - Drug induced gingival enlargement
   - Drug induced xerostomia
6. Cysts, potentially neoplastic and neoplastic gingival lesions
   - Odontogenic cysts and neoplasms
   - Leukoplakia
   - Squamous cell carcinoma

- Lymphoma
- Peripheral Ameloblastoma
- Malignant melanoma

Lesions of the periodontium may be of a simple local nature or may be an indication of severe local or systemic disease. These patients with such lesions will be referred to periodontists, who will need to have a structured plan to follow when signs and symptoms of gingival pathology persists.

2.3 The interdisciplinary relationship between periodontics and oral and maxillofacial surgery

Oral and maxillofacial surgery and Periodontics are two surgically oriented specialities of dentistry. The education and practice is very contrasting in many countries where an oral and maxillofacial surgeon requires both dental and medical qualification. If restorative procedures limited to the dental hard tissues are excluded, the surgical procedures of the oral cavity include those performed on the oral mucosa, attached gingiva and bone are common to both specialities. The purpose of interdisciplinary approach between these two surgical branches is to highlight some areas of dentistry where patient management could be performed by either speciality and to present some examples where periodontists and oral and maxillofacial surgeons can work closely together to achieve the best possible outcome for the patient.

2.3.1 Surgical exposure of an impacted canine for orthodontics

Impacted maxillary canine can be successfully managed by periodontist as well as oral and maxillofacial surgeon. It mostly depends on the referral pattern of orthodontist and experience of surgeon. Irrespective of who does the treatment, follow up management of the patient is most important. A proper interdisciplinary approach and communication between referring dentist & orthodontist is vital in this. This follow up management for initial 2 to 3 months recall should be individually tailored to the patient.

2.3.2 Removal of mandibular tori

Mandibular lingual tori are common benign osseous growths that may require surgical removal when they are chronically traumatised, affect overall oral hygiene or for prosthodontic reasons. Mandibular tori have also been used as autogenous graft during dental implant surgery [10]. Many times surgeries involving structures close to the floor of the mouth are associated with the complications such as bleeding and airway obstruction [11]. Keeping in mind this complications which may require hospital admission,referral dentist may prefer an oral and maxillofacial surgeon rather than a periodontist.

2.3.3 Autogenous block bone grafting for dental implants

Stability of dental implant is always questionable where there is deficient bone quality and volume [12]. There are many methods of augmenting bone including autogenous onlay bone grafts. Intra oral donor sites for bone harvesting include mandibular ramus, symphysis, retromolar area and maxillary tuberosity. Oral

surgeons are more confident in dealing with open bony procedures of high complexity but some periodontists may still wish to continue with the implant treatment of their patient requiring a block bone graft.

Interdisciplinary referral between Periodontist and Oral and Maxillofacial surgeon may be influenced by availability of services in the area, patient preferences and the professional and personal relationships between clinicians. There are many instances where a proper interdisciplinary approach exists between oral and maxillofacial surgeon and periodontist. To identify and appreciate what other specialities have to offer is for the best interest of the patient.

Any patient planned for orthognathic surgery by oral surgeon should be referred to a periodontist for a detailed periodontal examination including assessment of width of keratinized gingiva and thickness of bone, otherwise there will be chances of gingival recession and there should be a close liaison between the restorative dentist and periodontist during the oral rehabilitation phase of any patient with dentofacial deformity.

Early removal of impacted mandibular third molars especially when angulated and in close proximity to the second molar is at increased risk of worsening probing depths and clinical attachment levels. To prevent periodontal defects following mandibular third molar surgery, oral surgeon should work with periodontists for immediate placement of bone graft with and without collagen membrane. When the patient is associated with significant medical problems, periodontist always wish to refer him/her to oral and maxillofacial surgeon. Because of increased risk of morbidity the patient may be best managed in a hospital setting by the oral and maxillofacial surgeon.

2.4 Paediatric dentistry and periodontic interface

It is evidence based that child oral health reflects overall health and also forecasts their condition of oral cavity in youth. Child oral health mostly emphasises on dental caries and is segregated from general health care. So, it has become very crucial to realise the condition of oral tissue and mainly the periodontium in health and disease to facilitate a long lasting oral health in youth.

According to American Academy of Paediatric dentistry, all adolescents and children should perform periodontal screening and recording during their regular dental check-up. It should include colour & shape of gingival margins, plaque visualisation with disclosing agent and height of interproximal bone on radiographs [13]. Regular screening (periodontal screening and recording) is adviced for child and young teens with deciduous and mixed dentition [14]. Such screening helps to find out prior signs and symptoms of destruction of periodontal tissue. With emerging branch of periodontal medicine and established evidence of link between general health and oral health, it has become more important for the physicians and paediatricians to use oral health screening tools, particularly those who do not wish to obtain oral health care facility. Paediatric dentistry and Periodontology should work cohesively to come up with proof, capability and endorsements to ensure that all health professionals will be able to recognise the oral health problems of children.

Periodontal conditions that integrate Pedodontics and Periodontics focus in children:

2.4.1 Dental trauma

The periodontal complex is always prone to be affected by occlusal trauma that can lead to ischemic changes in periodontium. Following periodontal ligament

destruction adjoining to alveolar bone, ligament regeneration can occur, and repair-related resorption or resorption ankylosis have also been demonstrated. After occlusal/dental trauma in child and youth, it is important to assess the periodontal staus to have the proper diagnosis and treatment planning that will help to advise the children and their parents of the intended result [15].

2.4.2 Smoking and drug use in adolescence

US centres for disease control in 2012 report, on adulthood and tobacco use, disclosed that 9 out of 10 adult smokers started smoking before 18 years of age [16]. It produces a remarkable influence on risk of having periodontal disease. Therefore health professionals should utilise regular questioning and furnish particulars to the young patients regarding the bad effects of smoking on periodontal health. Regular Smoking corresponds with gingival inflammation and repeated bleeding on probing [17]. It is important to identify history of smoking and seek to reduce the risk of significant impact of smoking on periodontal health.

2.4.3 Overweight, obesity, metabolic syndrome and diabetes

Child and young adults with obesity, overweight and pre diabetic conditions have been reported to have increased prevalence of dental caries and periodontal disease [18].

2.4.4 Respiratory diseases

Recent reports advocate that bacteria from oral cavity can be accountable for many respiratory diseases like aspiration pneumonia [19]. There is a chance for Pedodontists and Periodontists to promote impressive and useful methods to prop up oral health in children and young people with chronic obstructive pulmonary disease (**Figure 3**).

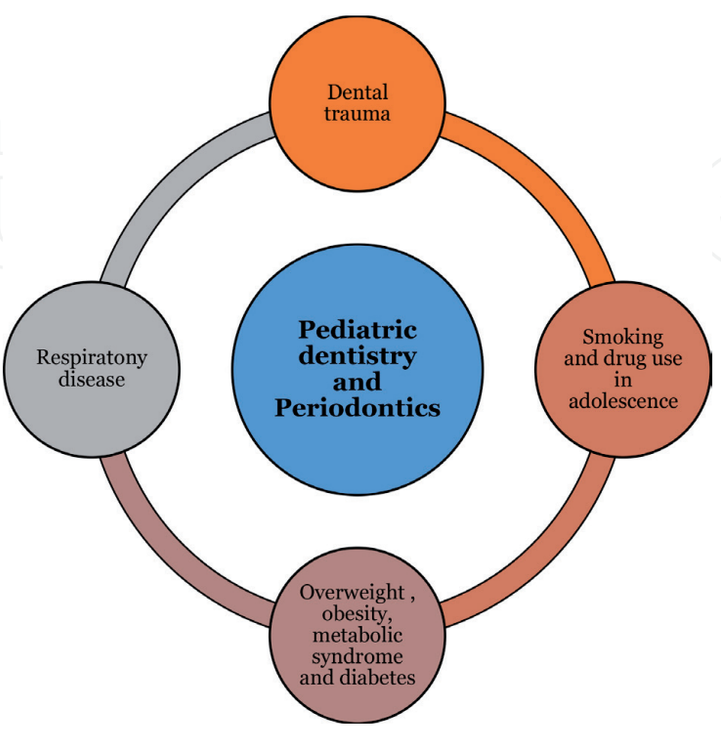

Figure 3.
Periodontal disease as a risk factor for systemic condition.

It is becoming more evident that there is a direct link between periodontal health and general health. Identifying oral health problems during early childhood would draw a preventive attention on periodontal tissues. Keeping this in mind pedodontist and periodontist can work cohesively to ameliorate durable oral health outcomes for children and adolescents.

2.5 Ortho–perio synergy

The term 'synergy' refers to two or more distinct influences or agents acting together to create an effect greater than that predicted by knowing only the separate effects of the individual agents. This definition is applicable to the classic relationship between orthodontics and periodontics specialities in treating patients [20, 21]. No matter how talented an orthodontist is, a magnificent orthodontic correction can be destroyed by a failure to recognise periodontal susceptibility.

The interrelationship between Orthodontics and Periodontics often resembles symbiosis [22]. In many cases, periodontal health is improved by orthodontic tooth movement, whereas orthodontic tooth movement is often facilitated by periodontal therapy. A multidisciplinary approach is often required for the correction of complex dentoalveolar problems in patients and this can be better explained by ortho-perio integration.

Periodontal disease is not necessarily a contraindication to orthodontic treatment provided that the condition has been stabilised; however loss of alveolar bone and soft tissue architecture may pose considerable challenges to oral rehabilitation. It has been suggested that adjunct orthodontic treatment may play an important role in developing the optimal base needed for re-establishing an aesthetic and functional dentition in these cases.

Orthodontic patients can be classified into three categories-

1. Patients with good oral health

2. Patients with periodontal disease and /or loss of permanent teeth.

3. Patients with severe skeletal discrepancies.

Patients belonging to the second category needs a multi-disciplinary approach requiring periodontist and orthodontist. For treating these type of patients both specialists should be called for during treatment planning and follow up management.

2.5.1 Evaluation of orthodontic patients for periodontal problem

Though bleeding on probing is usually a sign of active periodontal disease, on a practical note absence of bleeding on probing is a superior foresee criteria of periodontal health. In other way, even though there is presence of pocket depth, an absence of bleeding on probing can be used as a test of healthy gums. Bleeding on probing is usually checked by inserting a graduated metallic or plastic probe into gingival sulcus at an agreeable range of force between 10 to 20 gms. Patients requiring orthodontic treatment or under active orthodontic therapy should be informed of this persistent bleeding on probing and should be cautioned that they are at risk of periodontal disease and thus they need to consult a periodontist.

Researches have indicated the gravity of complete periodontal examination with a graduated periodontal probe, 6 sites per tooth for an extensive interpretation of periodontal status mostly bleeding on probing and probing pocket depth in orthodontic patients [23, 24].

2.5.2 Orthodontic treatment and its effect on periodontium

It has been widely believed that appropriately applied orthodontic forces do not damage the periodontium. However, insufficient width of attached gingiva is widely believed to be a predisposing factor for gingival recession. Orthodontic treatment and retention phase may be a risk factor for labial gingival recession. After orthodontic treatment with fixed appliance, the incidence increases from 7% at the end of treatment to 20% at 2 yrs. after treatment and to 38% at 5 years after treatment [25]. Alveolar bone dehiscence is also a predisposing factor for gingival recession.

Steiner et al. suggested that tension in the marginal tissue created by the orthodontic forces could be an important factor in causing gingival recession. Thickness of gingival tissue (Gingival biotype) at pressure side is an indicator of possible gingival recession [26].

Greenbaum et al. studied the effects of slow and rapid maxillary expansion on periodontium. They concluded that patients subjected to rapid maxillary expansion showed significantly lesser bone relative to the cementoenamel junction when compared to patients treated with slow expansion [27].

Erkan et al. observed that gingival margin and mucogingival junction moved in the same direction along with teeth when orthodontic intrusion is done. Extrusion also produces gingival margin and mucogingival junction movement in same direction as the extruded teeth resulting in reduction of sulcus depth without reduction in the width of attached gingiva [28].

2.5.3 Orthodontic treatment as an adjunct to periodontal therapy

Various orthodontic treatments such as up righting, intrusion and rotation are performed to correct pathologically migrated teeth that control further periodontal breakdown, improve oral function and provide acceptable aesthetics. These procedures should be performed only after stabilising active periodontal disease.

Despite of inconsistent relation between malocclusion and periodontal disease, connection of crowded or malposed teeth permit the patient better access to clean all the surfaces of his/her teeth. Food impactions are also reduced or eliminated by the creation of proper arch form and proximal contact [29, 30].

Orthodontic uprighting of the tilted molars has several advantages: the distal movement of teeth allows the deposition of alveolar bone on the mesial defect, thereby eliminating the gingival folding and plaque retentive area on mesial side [31].

Orthodontic extrusion of teeth may be indicated for shallowing out intraosseous defects and for increasing the clinical crown length of single rooted teeth. Orthodontic intrusion has been recommended for teeth with horizontal bony defect or infrabony pockets [32].

The hemiseptal defects or one wall defect can be eliminated using uprighting, extrusion and levelling of the bone defect [31]. Bodily movement of the tooth into an intrabony defect has been believed to carry the bone along with the tooth, that results in improvement of defect. This will ameliorate neighbouring tooth position prior to placing implant or replacing the tooth. If the tooth is supraerupted with osseous defect, intrusion and levelling of the bony defect can help to eliminate these problems.

Deepa outlined the utility of orthodontic soft aligners in relocating a periodontally compormised tooth. Light and intermittent forces generated by the soft aligner allow regeneration of tissue during tooth movement [33].

Complaisance of patient, encouragement and oral hygiene maintenance will facilitate to identify the perfect time to initiate adjunctive orthodontic treatment.

If enough confirmation of complete resolve of inflammation is achieved then orthodontic treatment can be started six months after active periodontal therapy.

2.5.4 Periodontics as an adjunct to orthodontic treatment

In many instances a consistent and aesthetically appreciable result may not be accomplished with orthodontic therapy without concomitant periodontal treatment. For example, a papilla or papilla penetrating type of frenal attachment is thought to be an etiologic factor of midline diastema. Frenectomy is performed for them because the fibres are thought to obstruct the mesial migration of incisors. However, when to perform frenectomy has been a debatable issue.

Vanarsdall pointed out that, excision of a maxillary labial frenum should be hold up until after orthodontic treatment unless it obstructs space closure or associated with pain or trauma. The best time to do frenectomy is after your orthodontist has closed the space & before placing the retainer. Scar tissue that forms between the teeth as a result of surgery might actually make the space harder to close during treatment and force the teeth back apart afterwards [34].

Miller's technique of frenectomy is best suited for orthodontic cases. Post operatively on healing, there is a continuous collagenous band of gingiva across the midline that gives a bracing effect than the 'scar' tissue, thus preventing an orthodontic relapse. The transseptal fibres are not disrupted surgically and so there is no loss of interdental papilla [35]. Retention of orthodontically achieved tooth rotation is a problem that has always plagued orthodontist. Circumferential supracrestal fibrotomy (CSF) or Pericision is a procedure that is frequently used to enhance post treatment stability [36].

It is suggested that some cases of potential or actual mucogingival problems may be improved by tooth movement. Since orthodontic and conservative periodontal therapy may induce changes in the character and level of attached gingiva, soft tissue grafts may be unnecessary. However if periodontal biotype is thin, soft tissue grafts may be required before orthodontic treatment, otherwise orthodontic tooth movement may result in gingival recession.

In case of angular defects, regenerative procedures may be performed after orthodontic treatment except in cases where the remaining bone support is not sufficient for anchorage. Bony topography may improve after orthodontic treatment and the osseous grafts placed may be displaced during orthodontic tooth movement. If osseous grafts are to be placed prior to orthodontic treatment then 6–8 months of waiting period is necessary to start orthodontic treatment.

2.5.5 Periodontally accelerated osteogenic orthodontics or Wilkodontics

The biology behind Periodontally accelerated osteogenic orthodontics is the regional acceleratory phenomenon (RAP). It has several advantages such as reduction of treatment time, facilitates expansion of dental arch, produces less root resorption rate compared to normal tooth movement, improved post orthodontic stability and slower relapse tendency [37].

It is a corticotomy facilitated technique which involves a full thickness labial and lingual flap elevation accompanied by selective corticomy followed by placement of bone graft material, surgical closure and orthodontic force application.

Piezosurgery assisted orthodontics is a new minimally invasive surgical procedure, in which microincisions are performed on buccal/labial gingiva that allows the piezoelectric knife to give osseous cuts to the buccal cortical plate and initiate RAP. This procedure also maintains the clinical benefit of the bone or soft tissue grafting along with tunnel approach. Compared to classical corticotomy procedure,

piezocision has added advantage of being minimally invasive, safe and less traumatic to the patient. In the recent years, because of the increased number of adults seeking orthodontic treatment, orthodontists frequently face patients with periodontal disease. Adult patient must undergo regular oral hygiene performance and periodontal maintenance in order to maintain healthy gingival tissue during active orthodontic therapy. Since orthodontic therapy and.

periodontal health shares a close relation, an understanding of the ortho-perio relationship helps in executing the best possible outcomes in needy patients.

2.6 Prostho - perio interrelationship - PROSPER

Periodontics and Prosthodontics hold one of the powerful & close connections of all disciplines of modern dentistry. Healthy periodontium is vital for long term success of restorations, on the other hand defect in prosthesis may give rise to progression of periodontal disease [38].

2.6.1 Restorative consideration that impact the periodontium

The relationship between periodontal health and restoration of teeth is intimate and inseparable. For restoration to survive long term, the periodontium must remain healthy so that the teeth are maintained [39]. Following considerations are to be taken care:

1. Restoration contour and contact areas

2. Margin adaptation and defects

3. Location of margin

4. Role of Provisional restoration

5. Design of fixed and removable partial dentures

6. Occlusal function

7. Prosthetic and restorative materials and alloy hypersensitivity

8. Iatrogenic damage from restorative procedures

Clinical longevity of any prosthesis is directly related to achieving proper restorative contours [40]. It is the function of the axial form of teeth to afford protection and stimulation to marginal periodontium. Schluger et al. felt that cervical bulge (>0.5 mm than cementoenamel junction) overprotects the microbial plaque. They advocated flat contours, not fat contours [41]. Overcontouring is potentially more detrimental to periodontium than undercontouring.

Scientific data indicates that even clinically successful crowns have margins that are open and average opening is about 100 nm, which tends to accumulate bacterial plaque [42]. Roughness of the tooth-restoration interface forms scratches on the surface of carefully polished acrylic and ceramic crowns. Inadequate marginal fit of the restoration, dissolution and disintegration of the luting material causes crater formation between the preparation and restoration and inflammation of gingiva [43].

Eissman et.al's design criteria for fixed partial dentures state that crown margins should be placed on tooth surfaces that are fully exposed to cleansing action,

preferably supragingival or slightly into sulcus [44]. Vigorous tooth brushing was effective upto 0.7 mm below the gingival margin, suggesting that the submarginal extension of restoration should be limited to no more than this distance. Restorative requirements frequently necessitate subgingival margin placement in order to gain resistance or retention form to alter tooth contour, subgingival caries, furcation involvement, to hide the tooth restoration interface or have contacts that need to be lengthened apically to avoid black triangles.

Current trends favour equigingival margin over older concepts of subgingival margin for crowns, which are kinder to periodontium. Furthermore, advances with emerging materials like translucent restorative materials, adhesive dentistry and resin cements promote polished margins that aesthetically blend with the tooth for a healthy tooth-restorative interface even when placed equigingivally [45].

Provisional restorations are needed to protect the prepared teeth to reduce the sensitivity of the vital abutments and to prevent tooth migration. Provisionals should have good marginal fit and polish. This prevents plaque accumulation and related inflammatory gingival overgrowth or recession.

A bridge should be designed to minimise the accumulation of dental plaque and food debris and to maximise access for cleansing by patient. It should also provide embrasures for the passage of food and protection of gingival crevices [46]. Stein concluded that pontic design is more important than the material used in pontic construction [47]. The undersurface of pontics in fixed bridges should barely touch the mucosa. The 'modified ridge lap' pontic has pinpoint, pressure free contact on the facial slope of ridge and all surfaces should be convex, smooth and highly glazed or polished. The sanitary pontic is most hygienic but ovate pontic combines both aesthetic and hygiene. Crowns that are placed on upper molars that have undergone root resection must be contoured in a specific way to ensure that the patient has access to oral hygiene measures. The gingival embrasure form created in the restoration must be fluted into these areas so that the surfaces can be accessed by an interdental brush, a knife edge or chamfer margin is indicated.

Occlusal discrepancies in a restoration appear to be a significant risk factor that contributes to more rapid periodontal destruction. Cantilever design often result in fracture of casting and periodontal inflammation around abutment tooth.

2.6.2 The impacts of periodontal/implant health on prosthetic therapy

Prior to treatment plan, tooth prognosis should be addressed both on individual tooth and the overall dentition. While assessing individual tooth prognosis it is important to identify the etiologic factors for periodontal disease which will specify the possibility of tooth sustainability in short term and long term. Identification of individual tooth prognosis is an integral part of dental practice as it allows for an interdisciplinary approach in treatment strategies. Overall prognosis is advantageous for communication between patient and professionals.

The signs of active periodontal disease are bleeding on probing, pocket formation, suppuration and colour changes in gingiva. Without giving proper attention to it and not controlling the active periodontal inflammation, underlying periodontal disease may aggravate further leading to bone loss and loss of teeth. So, it is very important to eliminate active periodontal/peri implant disease prior to prosthetic constructions. In other words, long term prognosis of the prosthesis will be compromised if periodontal disease remain uncontrolled after delivery. Furthermore, untreated periodontal inflammation gives rise to soft tissue changes like colour, size, texture and consistency of gingiva which leads to impaired aesthetic outcome by collapsing the harmony between periodontium and prosthesis [38]. Periodontists play a significant role in managing hard and soft tissue around the prepared sites for

successful and long term prosthesis. Bone augmentation, soft tissue augmentation, correction of existing ridge deformities and sinus lifting can be well handled by a periodontist for future implant sites.

Regular periodontal maintenance is a key to reduce the incidence of tooth or implant loss following prosthetic therapy.

2.6.3 The impact of prosthetic factors on periodontal/peri-implant health

Prosthodontist should properly design the prosthesis in consonance with the surrounding periodontium for long term maintenance of periodontal/peri implant health. Faulty restoration tends to accumulate plaque and food debris, thereby increasing periodontal disease progression. Violation of biologic width also result in periodontal inflammation.

2.6.4 Concept of biologic width and its applications in placement of margin

Understanding and clinically managing the concept of biological width is the key to creating gingival harmony with dental restoration. The dimension of dentogingival complex, called biological width is a cuff like barrier that acts as a protective physiological seal around natural teeth. It is defined as the dimension of space occupied by the soft tissues above the alveolar crest, so now the terminology of biological width is replaced by "Supracrestal attachment" in 2017 classification of periodontal disease. The connective tissue attachment occupied 1.07 mm above the level of the crestal bone, junctional epithelium attachment below the base of the gingival sulcus to be 0.97 mm. Encroachment on the biologic width by tooth preparation, caries, fracture, restorative materials or orthodontic devices can lead to bacterial accumulation, persistent gingival inflammation eventually resulting in increased probing depths, gingival recession or periodontal pocket formation [48].

2.6.5 Assessment of biologic width

Wilson and Maynard have described the concept of intra-crevicular restorative dentistry [49]. The restorative dentist must be able to determine the base of sulcus for intracrevicular margin location. Kois et al. suggested that the restorative dentist must be able to determine the total distance from the gingival crest to the alveoral crest. This procedure can be performed by bone sounding or transgingival probing. Based on the measurement during bone sounding three categories of biologic width can be described [50]:

1. Normal crest- Biologic width 3 mm, crown margin 0.5 mm subgingival.

2. High crest- Biologic width < 3 mm, does not allow subgingival margin placement without bone removal.

3. Low Crest-Biologic width > 3 mm, susceptible to recession if margin placed subgingivally.

2.6.6 Correction of violation of biologic width

To restore gingival health, it is necessary to re-establish the space clinically between alveolar bone and the gingival margin. For this either, surgery with or without bone alteration or orthodontic treatment to move the restorative margin away from bone level is done.

2.6.7 Margin placement guidelines

Rule-1: If the sulcus probes 1.5 mm or less, place to restoration margin 0.5 mm below the gingival tissue crest.

Rule 2: If the sulcus probes more than 1.5 mm, place the margin one half the depth of the sulcus below the tissue crest.

Rule-3: If the sulcus probes >2 mm especially on the facial aspect of the tooth, then evaluate to see whether gingivectomy could be performed to lengthen the crown and create a 1.5 mm sulcus. Then patient can be treated as mentioned in Rule-1 [51].

2.6.8 Current trends in periodontal aspects of restorative dentistry

- Supragingival placement of margins of restorations.
- Avoidance of over contoured restoration and minimal concern with lack of contour
- Occlusal stability through precise occlusal adjustment and accurate
- reconstruction of occlusal anatomy in single restorations.
- Restricted indication for splinting of mobile teeth.
- Hemisection with fixed bridges in cases of extensive furcation involvement.

2.6.9 Periodontal therapy before prosthodontic procedures

- A thorough periodontal evaluation is indicated on the planning stages prior to fabrication of the prosthesis. Selection of abutment teeth is based on prosthodontic and periodontal considerations, including bone support and architecture, width of attached gingiva, tooth mobility, root anatomy and tooth position.
- controlling or eliminating periodontal disease with cause related therapy and surgical therapy to eliminate pockets
- correction of gingival architecture that may favour disease, impair aesthetics or impede placement of prosthesis with preprosthetic surgery
- periodontal maintenance and motivation for oral hygiene should be given during treatment and interim periods.

An interdisciplinary approach requiring coordinated efforts by the Prosthodontist and Periodontist is the need of the hour. Close attention paid to both soft and hard tissues around teeth and implants before, during and after restorative procedure produces a successful outcome. It also gives the patient the benefit of comprehensive treatment with precise and long lasting restorations.

2.7 Interrelationship between endodontics and periodontics

The pulp periodontal interrelationship is a unique one and consider them as a single continuous system or as one biologic unit in which there are so many paths of communication [52]. The intricacy of endo-perio lesions (EPL) throws back the intimate relationship between the periodontal complex and endodontics [53].

The EPL terminology was first instituted in 1998 in the American association of endodontic, Glossary of endodontic terms. Later on American academy of Periodontology accepted this terminology and defined EPL to be localised infection beginning from pulpal or periodontal tissue [54]. Endo perio lesions are mostly anaerobic infections and polymicrobial in nature. The aetiology of EPL lesion is due to concurrent inflammation of variable magnitude of periodontal complex and endodontics. Causative factors are mostly bacterial origin. Dental malformations, history of trauma, iatrogenic perforations, external or internal root resorptions are also responsible for the endo-perio lesion. The existence of active tooth decay, furcation defect, anatomical grooves and porcelain fused to metal crowns are regarded as liability factors in the existence of EPL.

2.7.1 Pathways of EPL

There are several pathways of communication of infectious substances from pulp to periodontal tissue and vice versa. This in combination with the existing polymicrobial anaerobic infection leads to development of EPL [55].

The apical foramina and lateral canals link the pulpo-perio complex. Deep periodontal pocket reaching beyond the apical third of tooth can be connected to endodontic system through apical foramen. Lateral canals which are found all along the root surface give out a more accessible pathway for micro-organisms to travel from one tissue to other.

Any endodontic infection in the root apex can move up through periodontal ligament reaching the marginal gingiva and can increase periodontal disease severity by increasing pocket depth. This was termed as retrograde periodontitis [56]. Inversely microorganisms and noxious irritants can invade through dentinal tubules to the pulpal complex after the gradual loss of attached periodontal tissue.

1. There are certain treatment errors which can lead to combined EPL: Tooth decay on outer root surface beneath CEJ and improperly placed restoration

2. Root cracks resulting from high forces exerted during biomechanical preparation of rot canals.

3. Accidental perforation during endodontic treatment.

2.7.2 Classification system

Recent classification system of periodontal conditions, combined EPL are placed in the “periodontal manifestations of systemic diseases and developmental and acquired conditions” section and “other periodontal conditions” subsection.

Classification of EPLs modified from Simon et al.:

1. Primary endodontic lesions

2. Primary endodontic lesions with secondary periodontal involvement

3. Primary periodontal lesions

4. Primary periodontal lesions with secondary endodontic involvement

5. True combined lesions (**Table 1**)

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Tests	Primary endodontic lesion	Primary periodontal lesion	Primary endodontic secondary periodontal	Primary periodontal secondary endodontic	True Combined lesions
Visual	Presence of decay/incorrect restorations/ erosion/ abrasion	Inflammation /gingival recession Presence of plaque/ calculus Intact teeth	Plaque/ Calculus at the gingival margin Root perforation/ fracture	Plaque/ Calculus and swelling around multiple teeth Pus+Exudate	Periodontitis around single or multiple teeth Pus+Exudate
Pain	Sharp	Usually dull ache	Usually sharp	Usually dull ache	Usually dull ache,sharp only in acute condition
Palpation	Not conclusive	Pain on palpation	Pain on palpation	Pain on palpation	Pain on palpation
Percussion	Normally tender	Tender on percussion	Tender on percussion	Tender on percussion	Tender on percussion
Mobility	Present only in fractured or traumatised teeth	Localised/ generalised mobility	Localised mobility	Generalised mobility	Generalised higher grade mobility on involved tooth
Pulp vitality	Lingering or no response	Positive	Negative	Positive	Usually negative
Pocket probing	Solitary narrow pocket	Multiple wide and deep pockets	Solitary wide pockets	Multiple wide and deep pockets	Typical conic periodontal type of probing
Sinus tracing	Radiograph with gutta-percha points to apex/ furcation	At lateral aspect of the root	Mainly at the apex/ furcation	At lateral aspect of the root	Difficult to trace
X-rays	Periapical radiolucency	Vertical bone loss Wider bone loss	Wide based apical radiolucency	Angular bone loss in multiple teeth	Similar to a vertically fractured tooth
Cracked tooth Testing	Painful when chewing	No symptoms	Painful when chewing	No symptoms	Painful when chewing

Table 1.
Diagnostic examinations used to classify EPL adapted from Parolia et al. 2013 [57].

2.7.3 Treatment options

Correct diagnosis is key to management and prognosis of EPL. The most vital parameters to be considered while planning the treatment should be pulp vitality and extent of periodontal lesion. The prognosis of primary endodontic lesion is usually good if proper irrigation protocol is followed during cleaning and shaping and they heal with proper endodontic treatment [58].

Primary periodontal lesions can be treated by periodontal therapy only. Removing entire etiologic elements that can induce or promote epithelial down-growth followed by periodontal surgery is the best treatment modality in these cases [59].

True combined lesions are challenges that necessitate endodontic and peri-odontic regenerative treatment. As an initial step, true combined EPL should be treated endodontically first followed by other etiological factor management including periodontal management. If root resection or hemisection of molar teeth is planned, clinician must think of multiple factors like tooth restorability, regeneration of bone around sound root structure and concurrence of the patient. Prognosis of teeth can be ameliorated by osseous regeneration and Guided Tissue Regeneration (GTR). Endo-perio lesions are threat to dentists as multidisciplinary approach is required to acquire a positive result.

3. Conclusions

Interdisciplinary approach in periodontics includes a structured collaboration between periodontist and other specialists including allied health professionals involved in patient treatment. Furthermore, there is a common working knowledge between all. Now it is evidence based that Periodontics cannot be practised in isolation because for almost every case, there are multiple treatment plans that will provide both clinical predictability and patient satisfaction in achieving a higher level of success. In the field of Periodontics and Implantology, it is well understood that to manage the demand of rehabilitation of function and satisfying the patients aesthetic demand, the clinicians should practise interdisciplinary approach. Interdisciplinary approach develops a classic relationship within various specialities of dentistry that should go hand in hand for the complete well being of the patient. In day-to-day dental practice, clinical periodontal practice share an intimate and inseparable relationship with endodontics, orthodontics and prosthetic dentistry as well as other specialities in multiple aspects including treatment plan, procedure execution, outcome achievement and maintenance. All phases of clinical dentistry are intimately related to a common objective. The preservation and maintenance of the natural dentition in health is of prime importance in an integrated interdisci-plinary approach to periodontal care.

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