



REVIEW ARTICLE

ETIOLOGY OF PATHOLOGICAL TOOTH MIGRATION RELATED TO PERIODONTAL DISEASES- A COMPREHENSIVE REVIEW

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ABSTRACT

Pathological tooth migration (PTM) is indisputably one of the dentoalveolar disorders that cause special concern to patients especially when occurring in the anterior segment. There appear to be multiple factors which are important in the expression of the tooth migration namely, bone loss, followed by tooth loss and gingival inflammation. Other factors that can be contributory to tooth migration include an aberrant frenal attachment, pressure from the cheek and tongue as well as that from the granulation tissue in the periodontal pockets, gingival overgrowth due to drugs occlusal factors such as missing or unreplaced teeth, shortened dental arches, excessive vertical overlap, posterior bite collapse, class II malocclusion and habits such as bruxism, tongue thrusting, finger sucking, pipe smoking, nail biting and playing wind instruments etc. The causes of tooth migration can be determined by a careful assessment and evaluation and a differential diagnosis can be made. Periodontal and radiographic examination will disclose any abnormal findings that could be valuable to formulate a logical treatment plan. To achieve the most essential and functional result, a careful determination of the contributory factors to PTM is critically important. This review provides an insight in to the etiological factors of PTM.

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INTRODUCTION

Teeth orientation in the jaws is determined by periodontal wellbeing and also by continuous presence of occlusal load and forces exerted by the cheek, lips and tongue musculature (Proffit *et al.*, 1978). Any disturbance in this natural equilibrium leads to alterations in the milieu of a tooth, or an entire arch, eliciting Pathological tooth migration (PTM). PTM is a common condition with complex and multifactorial etiology and very high rates of prevalence (Costa 2004). Bone loss by itself appears to be the key factor involved in PTM, or appears in combination with tooth loss, gingival inflammation and multitude of causative agents. If identified in initial stages, it gets resolved spontaneously.

Prevalence

Pathological migration is relatively common and may be an early sign of disease, or it may occur in association with gingival inflammation and pocket formation as the disease progresses.

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Among periodontal patients, the prevalence of PTM has been reported to range from 30.03% to 55.8%. About 30% of patients with moderate to severe periodontitis complain of tooth mobility and migration and approach the dental office for its elimination, (Brunsvold, 1997). In his study Towfighi *et al.* (1997) recorded facial flaring (90%) and diastema (88.6) as the most frequent kinds of PTM observed in patients with moderate to severe periodontitis. Thakur and Baburaj (2016) have verified that PTM prevalence was 35.41 % (85/240), most frequent type of migration in the study was facial flaring (53.84%) followed by diastema (42.30%) and extrusion (3.84%).

Clinical Manifestations

PTM may manifest itself as diastema, flaring, tipping or tilting of the teeth, proximal drifting, rotations, and extrusions. This alteration may occur in an individual tooth, or a segment of teeth or an entire arch. No matter what maybe the clinical picture, but the underlying cause is almost always a weakened periodontium as a result of moderate to severe periodontitis. Since periodontitis is a painless process, unless in severe stages, patients tend to ignore it and approach the clinicians occasionally for complaints of tooth mobility or migration.

Etiology

The loss of periodontal support

Forces that are tolerable to an intact periodontium become deleterious when periodontal support is reduced (Carranza *et al.*, 2006). Loss of periodontal support is the chief predisposing factor as it epitomizes reduction of a tooth resistance to impact of outer pressures. The weakened tooth is unable to sustain its normal position in the arch and tries to escape from opposing force by moving away.

Periodontal and Periapical inflammation

Sutton (1985) proposed a theory that hydrodynamic and hydrostatic forces within the blood vessels and inflamed tissues in the periodontal pocket may account for abnormal tooth migration. Subsequently, tooth movement occurs in a direction opposite to the deepest part of the pockets.

Gingival overgrowth

Gingival enlargement caused by drugs such as Phenytoin, Cyclosporin A and Calcium channel blockers is known to cause pathologic tooth migration. The onset of gingival overgrowth is generally 3 months after the commencement of the therapy (Kinane, Drummond and Chisholm 2006). This soft tissue enlargement occurs due to an increase in ground substance secreted by gingival fibroblasts, when stimulated by gingival inflammation, following plaque accumulation. It has been known to create a force, which pushes the tooth aside. The extent of the overgrowth is related to the serum concentration of the drug, as much as the presence of plaque.

Pressure from oral musculature

Pressure from soft tissues like forces of cheek, lips and tongue, together with the forces of the periodontal tissues, can move the teeth, particularly those with weakened periodontal support (Brunsvold, 2005, Proffit *et al.*, 1978). Since these forces act continually over a prolonged period of time, they pose more risks for PTM compared to forces of shorter length like occlusal contacts, deglutition and speech. Lingual aspect of mandibular anterior teeth bears pronounced alteration during oral functions, leading to greater likelihood of malocclusion in this area.

Malpositioned Maxillary Labial Frenum

A midline diastema is more likely to occur if the frenal attachment is deeper down into the tissues and in close proximity to incisive papilla. Frenum can be deemed aberrant when it is abnormally widened with loss of attached gingiva at the midline and the interdental papilla shifts or elicits ischemia on stretching the upper lip (Miller 1985).

Occlusal factors

Posterior bite collapse: Occurs as a result of loss of posterior teeth which are not subsequently replaced, and eventually results in flaring of anterior teeth (Shifman *et al.*, 1998).

Arch integrity: Interproximal contacts distribute occlusal forces evenly throughout the dental arches. Factors capable of

destroying interproximal contacts include tooth loss, proximal dental caries, defective restorations, and severe attrition. Destruction of these contacts leads to disruption of arch integrity and tooth migration (Brunsvold, 2005).

Class II Malocclusion: PTM is most commonly associated with Class II malocclusions. A maxillary molar that may be in an end-on relation with the mandibular molar, may migrate forward, under occlusal load, due to absence of the proximal tooth, thus establishing a dental Class II situation.

Occlusal interferences: Often occlusal interferences arise as a result of faulty restorative procedures or may be present in natural teeth as well. These interferences may cause the mandibular teeth to deflect forward in to the maxillary dentition and subsequently cause PTM (Watkinson and Hathorn 1986). Elongation of anterior teeth is a consistent finding which is diagonally opposite to teeth causing occlusal interferences (Thielemann, 1971).

Anterior component of force: A portion of occlusal forces is projected anteriorly during normal occlusal functions and has been designated as the anterior component of force (Brunsvold 2005). It causes axial inclination of posterior teeth during occlusal functions. In the absence of a proper arch integrity and sound interproximal contacts, it is difficult to withstand this force which results in malposition. Most commonly found among bruxers and people who clench their teeth.

Protrusive pattern of mastication: The phenomenon can be identified in patients who have anterior attrition with minimal posterior occlusal wear, in the absence of oral habits. Anterior teeth flaring are the commonest manifestation with increased overjet and greater angulation of the lower incisors to the mandibular plane (Yaffe *et al.*, 1992).

Shortened dental arches: Dental arches are shortened due to absence of posterior teeth thus; only anteriors and premolars are existing to withstand occlusal forces and mastication. These few teeth undergo additional wear compared to those in an intact dentition. Loss of molar support leads to increased occlusal load on the left over teeth and resultant spacing owing to occlusal instability (Stern and Brayer 1975).

Para functional habits: For PTM to occur, duration of force is more important than extent of force. Persistent forces of bruxism surpass forces of normal mastication and act as adverse orthodontic forces that cause PTM (Brunsvold, 2005). Habits like tongue thrusting and lingual interposition related to swallowing pattern direct an abnormal pressure on anterior teeth and subsequently cause flaring.

Changes in the forces exerted on the teeth: *Un-replaced missing teeth*-Teeth tend to drift in to the spaces formed by unreplaced missing teeth. Drifting, though not a pathology by itself, usually creates situations that lead to periodontal disease and thus, the early tooth movement is aggravated by loss of periodontal support (Carranza, 2006). Drifting generally occurs in a mesial direction, along with tilting or extrusions beyond the plane of occlusion. The premolars frequently drift distally. *Failure to replace first molar* - Failure to replace missing first

molars leads to a chain of events; where the second and third molars tip, causing a decrease in a vertical dimension, the premolars drift distally and the mandibular incisors tip lingually. As the anterior overbite increases, the mandibular incisors collide with the maxillary incisors near gingiva on the palatal aspect thereby injuring it. The maxillary incisors span out anteriorly and laterally. The anterior teeth appears extruded since incisal apposition ceases to exist. Spacing is formed in anterior teeth by their drifting (Carranza, 2006).

Trauma from occlusion: When occlusal forces exceed the adaptive capacity of the tissues, tissue injury results, the resultant injury is termed "Trauma from Occlusion"- (Orban 1928, Gottliebe 1931) Under the impact of excessive occlusal forces, vascular stasis and vasodilation, occur in the periodontium in a very short time span giving rise to pain. Subsequently the bone along the socket is lost with a resultant widened periodontal ligament. Angular bone defects without periodontal pockets are created and the tooth loosens and moves away or intrudes in the jaw. These changed tooth positions produce occlusal imbalances; magnifying injuries to the supporting tissues of the periodontium, rendering them weak. This further brings about teeth migration as periodontal support is reduced (Carranza, 2006).

Pathogenesis of PTM

PTM occurs as a result of two interlinked mechanisms occurring simultaneously; first being occlusal changes associated with non-replacement of missing or lost teeth and second is from the pressure applied by the inflamed tissue from periodontal pocket, upon the teeth. Both the mechanisms contribute towards reduced periodontal support (Hirschfeld 1933). Tissue inflammation causes an increase in fluid filtration from capillaries to interstitium. A rise in interstitial hydraulic pressure occurs as a consequence of the fluid extravasation into interstitial tissue. Vascular permeability and blood flow of the gingiva, eventually pushing the tooth to a new position (Sutton 1985). This theory is further supported by reports of spontaneous correction of tooth migration after treatment of periodontal inflammation. Another belief states that as periodontal disease sets in, the normally firmly adapted gingival soft tissues lose their tonicity and swell due to increased ground substance which produces a continuous light pressure on the tooth surface. When loss of attachment apparatus is combined with a non-periodontal related condition such as excessive occlusal force, a progressive migration of tooth may occur. Other studies indicate that the transseptal fibers, participate in manifestation of PTM. These fibers form a chain from tooth to tooth and help maintain contacts between teeth throughout the dental arch. If the continuity of this chain is weakened by periodontal disease, the balance of forces is disrupted and tooth displacement can occur (Moss *et al.*, 1974).

Summary and Conclusion

PTM if diagnosed in initial stages stands a better chance for favorable therapeutic outcomes. Extensive research has made it possible to treat several cases of PTM through early identification and management of periodontal diseases, orthodontic tooth movement, and prosthetic treatment, thereby changing the prognosis of the pathologically migrated teeth.

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