

TRAUMA TO THE SOFT TISSUES OF THE PERIODONTIUM: A REVIEW

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ABSTRACT

This review dealt only with trauma that can result from thermal, chemical or mechanical assault to the soft tissues of the periodontium, namely the gingiva and the periodontal ligaments. These forms of trauma may be accidental, iatrogenic or self-inflicted (factitious). When trauma is accidental and iatrogenic, the nature of the damage to the tissues is usually acute and self-limiting. However, it is more chronic when trauma is self-inflicted. This review is important to highlight potential non-plaque related sources of damage to the tooth supporting structures which may be unintended, unplanned or self-inflicted but nonetheless, of grave consequences.

Key words: Trauma, periodontium, accidental, iatrogenic, self-inflicted

Trauma to the gingiva

Thermal traumatic injuries (TTI) to the gingival tissue can be caused iatrogenically by the use of overheated handpieces and ultrasonic scalers. Ideally, no portion of the devices is expected touch the gingiva while in use. However, thermal burns have been documented as one of the possible adverse events that may be associated with the use of ultrasonic scalers (Athmarao and Rekha, 2015). TTI can also be self-inflicted through consumption of extremely hot or cold food or beverages. This form of injury is usually mild since it should be expected that any hot food accidentally ingested should be immediately expelled. However, severe forms of intraoral and laryngopharyngeal burn caused by hot foods or drinks have been reported in

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patients with psychiatric disorders (Iyama et al., 2016).

Chemical traumatic injuries (CTI) to the gingival tissue can be caused by topical contact with some drugs or chemical agents. The extent of the CTI is dependent on the such factors as the type, concentration, and quantity of the chemical as well as the duration of the contact of the injurious chemical agent with the soft tissue (Ozcelik, 2005; Dayakar, 2012). Some potentially injurious chemicals are used during restorative procedures as cavity varnish, dentine bonding agent, phosphoric etching solutions, astringent for gingival retraction, porcelain and metal etchant, root canal irrigants, and devitalizing agents (Girish, 2015). Some of these chemicals are used as antiseptics and mouthwashes (phenol, chromic acid, iodine, hydrogen peroxide) while some are medications such as analgesic (Aspirin) and antipsychotic agents (Chlorpromazine) (Girish, 2015).

Tetracycline hydrochloride was also reported to cause chemical burn of the gingiva and oral mucosa when used inappropriately (Dayakar, 2012). Recreation drugs, such as cocaine, can cause serious chemical trauma when rubbed on the gingiva (Girish, 2015).

Mechanical traumatic injuries (MTI) to the gingival tissue can result from accidents, assaults or falls during sports, play and seizures. Malocclusions such as deep bite or increased overbite have also been reported to cause trauma to the gingiva (Ustun, 2008; Gupta, 2012). Iatrogenic mechanical trauma can occur in cases of improperly fabricated dental appliances and defective dental restorations (Meeran, 2013; Asal and Abdel Fattah, 2017). MTI could also be self-inflicted during improper flossing or toothbrushing as well as in digit sucking or biting of fingernail and hard sharp objects (Dilsiz and Aydin, 2009).

The most widely documented self-inflicted MTI to the gingival tissue is referred to as gingivitis artefacta (Chalkoo *et al.*, 2016)). Both minor and major variants of gingivitis artefacta have been reported (Dilsiz and Aydin, 2009; Mazumdar *et al.*, 2011; Chalkoo *et al.*, 2016). Gingivitis artefacta minor is reported to be more common while gingivitis artefacta major is more severe, spreading to the deeper tissues of the periodontium (Mazumdar *et al.*, 2011). There is usually a preceding source of irritation such as finger biting habit or consumption of abrasive food in gingivitis artefacta minor. This makes the condition amenable to basic removal of underlying source of irritation. Gingivitis artefacta major on the other hand requires special treatment modalities because there may be some emotional and extraoral component of the condition (Mazumdar *et al.*, 2011). Injuries sustained from self-inflicted physical trauma to the gingiva were categorized by Stewart and Kernohan (1972) into three types: Type A- injuries superimposed upon a pre-existing lesion (or irritation) where the patient continues to

damage the site, Type B- injuries secondary to an established habit such as fingernail biting or finger sucking and Type C- injuries of unknown and/or complex aetiology which are usually based on some emotional disturbance.

Another self-inflicted MTI to the oral soft tissues is oral piercing which is becoming a common form of body modification because of the increasing need for self-expression (Khalia *et al.*, 2013). A systematic review revealed that the prevalence of oral and peri-oral piercings in young adults varied from 0.8% to 12% (Hennequin-Hoenderdos *et al.*, 2012). In oral piercing, oral and peri-oral tissues are punctured to insert jewelries on different parts of the face such as the tongue, lips, cheek and labial frenum. Complications may however occur post-operatively (Bone *et al.*, 2008; Hickey *et al.*, 2010; Gill *et al.*, 2012; Hennequin-Hoenderdos *et al.*, 2012). The primary post-operative periodontal complications may include increased plaque and calculus formation and eventually, gingival inflammation (Gill *et al.*, 2012; Hennequin-Hoenderdos *et al.*, 2012). Secondary post-operative periodontal complications may result from chronic poor oral hygiene, especially in heavy smoking. It has also been reported that where the jewelry material is porous, there can be a shift in the bacteria population and the pathogenic potential of the periodontopathogenic bacteria becomes higher. These secondary post-operative periodontal complications may include gingival recession and gingiva enlargement, periodontitis, and periodontal abscesses (Gill *et al.*, 2012; Hennequin-Hoenderdos *et al.*, 2012). While the sole motivation for oral piercing may be to make a style statement, to identify with a group, to denote beauty or to demonstrate virility (Khalia *et al.*, 2013; Mishra *et al.*, 2015), other forms of self-inflicted MTI to the gingival tissue may be due to potentially harmful oral habits. These oral habits were classified into neuroses, occupational habits and

miscellaneous habits (Bathla *et al.*, 2011). Neuroses include lip biting, cheek biting, pencil/pen biting and fingernail biting, occupational habits include holding of nails in the mouth by upholsterers and carpenters and thread biting by tailors and miscellaneous include habits such as pipe or cigarette smoking, thumb sucking, mouth breathing and incorrect methods of toothbrushing (Bathla *et al.*, 2011). Iatrogenic trauma to the gingiva can result during any dental procedures that result in the violation of the biological width, the use of excessive digital force, improperly finished restoration margins or improperly fitted prosthesis/ appliance. Examples are the use of wrong dimension of gingival retraction cord for a wrong duration, the use of excessive digital force during impression taking, improper use of disks, burs and stones, unpolished and imperfect margins, Improper use of matrix band resulting into improperly contoured interdental contacts and gingival overhangs, Improperly designed denture clasps and ill-fitting orthodontic bands and wires (Shenoy and Rodrigues, 2007).

Clinical presentations and management of trauma to the gingiva

There are many possible clinical presentations because of the various aetiologies already outlined. The history elicited will differ from case to case depending on the peculiarities of each case. In patients with self-injurious behaviors, there may be history of persistent gingival irritation with resultant scratching or picking of the gingiva and history suggestive of emotional disturbance or psychological imbalance (Mazumdar *et al.*, 2011; Chalkoo *et al.*, 2016; Caliskan *et al.*, 2018). History taking may also reveal chronic habits such as finger nail biting, digit sucking, or sucking on potentially injurious objects, compulsive toothbrushing or contact with other mechanical, chemical and thermal injurious objects.

On examination, there may be painful burns, scalding and bleeding, extensive ulcerative lesion involving the gingival oral mucosa, lips and tongue (Chalkoo *et al.*, 2016). In some cases, the ulcer may present as coagulative necrosis covered by slough. In factitious injuries, nail marks may be seen on the gingival as well as bite marks on the lips (Mazumdar *et al.*, 2011). There may also be other self-inflicted injuries in the form of linear excoriations and areas of crusting in other parts of the body (Chalkoo *et al.*, 2016). There is usually gingival recession which may be severe and extensive, spanning across many teeth. There may be limitation of mouth opening and difficulty with food intake, depending on the affected site. There may be no radiologic or laboratory evidence of any underlying systemic disorder.

The treatment goals include complete re-epithelization of the gingival tissue, complete or significant coverage of the previously denuded roots and increase in the zone of attached gingiva (Griffin *et al.*, 2007). It is also important to prevent recurrence by removing any identified causative agent. Therefore, proper treatment starts with correction of any improper oral hygiene practices and removal of any potentially harmful agent. Gentle mechanical oral hygiene measure is professionally instituted to remove the accumulated plaque and this may be done with topical or local anesthetic agents, if necessary. Chemical plaque control may be prescribed as the only oral hygiene measure in the affected site while regular toothbrushing is maintained in the other parts. This is sustained until clinical improvement is observed. Chlorhexidine mouth rinses may be prescribed twice a day. Regular gargle with warm saline mouth wash and Betadine has also been found helpful (Girish *et al.*, 2015; Goncalves *et al.*, 2017).

Supportive and symptomatic treatment is given to maintain the general wellness of the patient and this include prescription of non-spicy soft

and cold diet as well as multivitamins and topical application of the triamcinolone acetate and benzocaine to reduce pain (Goncalves *et al.*, 2017). In cases of severe tissue damage, it has been recommended that the topical triamcinolone should be applied along with carboxymethyl cellulose (Girish *et al.*, 2015). Antibiotic therapy may be necessary to prevent the infection of the ulcerated area in very extensive cases (Girish *et al.*, 2015). Professional psychological care may be necessary in factitious cases and this may include the use of antidepressant and anti-anxiety drugs (Mazumdar *et al.*, 2011). Where gingival tissue loss is extensive, there may be a need to correct the defect with a free gingival graft (Dilsiz and Aydin, 2009). In all cases, regular recall visits are mandatory to institute maintenance therapy.

Trauma to periodontal ligaments

The other soft tissue component of the periodontium is the periodontal ligament. It is the soft complex, vascular, highly cellular and specialized connective tissue serving as an interface which joins the cementum covering the roots to the inner wall of the alveolar bone (Mc Culloch, 2000; Lindhe *et al.*, 2012). Conditions that cause excessive bilateral opposing vector forces may cause overextension and inflammation of the periodontal ligaments. This is referred to in some quarters as Sprained Tooth Syndrome (STS). STS can result when an individual accidentally bites on a hard object, in cases of underfilling or overfilling of a tooth, when there is drifting of teeth and in cases of common, sinusitis or allergies. The STS reported in upper respiratory tract infection has been attributed to the abnormal outward lateral pressure from the tongue to the teeth which creates temporary orthodontic pressure and outward movement outward, leading to abnormal tooth mobility. Accidental mechanical/traumatic injuries to the periodontal ligament can be classified based on

the extent of the injury into, concussion, subluxation, lateral luxation, intrusive luxation and extrusive luxation. Severe forms of extrusive luxation may result in avulsion of the tooth (Bakland and Andreasen, 2004; Brüllmann *et al.*, 2011). The clinical outcome of the management of accidental trauma to the periodontal ligament will depend on the emergency measures instituted both in and outside the dental office. The general populace must therefore be vast in emergency steps to take to improve the outcome of luxation injuries while dental practitioners must be vast in the various management options that may be required in the varying degrees of luxation injuries for favourable outcomes (Bakland and Andreasen, 2004; Brüllmann *et al.*, 2011).

Thermal injury to periodontal ligaments is also a possibility especially with the advent of ultrasonic devices and thermoplasticised obturation method used in endodontics effectively to remove fillings, paste, cements, posts, dislodged or broken instrument tips or any other obstructions from the root canal. (Gluskin *et al.*, 2005; Kwon *et al.*, 2013). This important use of ultrasonic devices can however lead to intraradicular heat transfer where cooling of the ultrasonic tip is not optimal (Gluskin *et al.*, 2005; Kwon *et al.*, 2013). These heat generating devices are more likely to generate more temperature increase in the periodontal ligament than the pulp because the supporting periodontal tissue is not limited by space and have a higher blood supply than the pulp (Kwon *et al.*, 2013).

Every effort must be made to avoid iatrogenic forms of trauma to the periodontal ligament because its attempts at healing may have unpredictable outcomes. Periodontal ligament may heal favourably without resorption or with repair related surface resorption and it can also heal unfavourably with osseous replacement resorption (ankylosis) or with inflammatory resorption (Goswami, 2011).

Clinical presentations and management of trauma to the periodontal ligament

In sprained tooth syndrome, there may be history of bruxism, nail biting, recent defective dental procedures, tooth infection, trauma from small objects, such as bone and sinus problems, such as allergies or a cold (Anthony, 2018). The initial symptom of excessive force on periodontal ligament is pain which can be dull or sharp and localised to a tooth (Mortazavi and Baharv, 2016)

The treatment of sprained tooth is essentially based on correction of opposing vector forces that brought about the strain (Anthony, 2018). However, a sprained tooth can wait a few days to see if it heals on its own. The treatment of a sprained tooth involves rest because putting the affected tooth under function, such as chewing and speaking, increases the pain from the tooth. There may be a need to prescribe analgesic for the pain as well as to place ice stick in the affected part. A protective mouth guard may be needed in cases of bruxism.

The clinical presentation of traumatic injuries to periodontal ligament is essentially varying degree of mobility of the affected tooth or teeth. In concussion, the injury may not result to increased mobility or displacement but there will be marked tenderness to percussion of the affected tooth or teeth, subluxation presents with increased mobility without marked displacement of the tooth, lateral luxation may have displacement of tooth labially, lingually, mesially or distally, extrusive luxation presents with increased mobility in the coronal direction while in intrusion, the apical displacement of the tooth is accompanied with fracture of the alveolar bone (Bakland and Andreasen, 2004; Brüllmann *et al.*, 2011). In avulsion, a bleeding socket will be seen and there may also be damage to local soft tissues (My Hanh *et al.*, 2018). Radiographic assessment may reveal thickening or increase of the periodontal ligament space in many cases of traumatic injury

to the periodontal ligament but there may also be a complete absence of periodontal space (Panzarini *et al.*, 2008). Fracture of alveolar bone and periapical radiolucency are also common radiographic features (Panzarini *et al.*, 2008).

The treatment plan for the management of intrusive luxation should include radiographic examination, tooth repositioning, surgical or orthodontic extrusion of the affected tooth, splinting, occlusal adjustment, antibiotic therapy, endodontic treatment and follow up (Pedrini *et al.*, 2011). Lateral luxation and extrusive luxation will also require all the above except extrusion of the tooth. Subluxation will require only radiographic examination, splinting and follow up while concussion will require only radiographic evaluation and follow up to observe the tooth over time (Pedrini *et al.*, 2011). An avulsed tooth may be reimplantable only if there is no contamination and if transportation and storage of the tooth was good enough to ensure the viability of the periodontal ligaments. Reimplantation will be followed by immobilization of the tooth, adjunctive antibiotic and anti-tetanus therapy and eventually, a root canal treatment of the tooth (Trope, 1995).

The harmful effects of increased temperature on periodontal ligament have been documented (Özkoçak *et al.*, 2015). Thermal injury to periodontal diseases may give rise to clinical features suggestive of protein denaturation in periodontal ligaments, interruption of blood supply to the periodontal ligament as well as tooth ankylosis (Gluskin *et al.*, 2005; Özkoçak *et al.*, 2015). The management of thermal injuries are largely preventive. Clinical guidelines have been formulated to reduce the occurrence of thermal injuries during dental procedures and these include using sufficient cooling water for tooth preparation or where dry cutting is needed, using light pressure and limiting the bur-contact time to less than 20 seconds at a time, using a 2-step curing or ramp curing

technique for light curing composite resin, using the refrigerated putty matrix as a heat sink in the fabrication of provisional crowns, limiting exposure to the heat source for thermoplasticised root canal obturation to 3seconds and the contact time for the tip of ultrasonic devices must be limited to 6seconds (Kwon *et al.*, 2013).

Conclusion

There is a possibility of the soft tissues of the periodontium to be damaged accidentally, iatrogenically and factitiously and this can lead to greater and undesirable periodontal destruction. Patients should therefore be educated to discourage self-inflicted injuries among them. More importantly, dentist should be more aware on possible management options for accidental injuries and also always put necessary precautions in place to avoid iatrogenic injuries as much as possible.

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