Review Article

JRAD Journal of Research and Advancement in Dentistry

J Res Adv Dent 2021;11:2:283-288.

Pain Management During Orthodontic Treatment

Dipali R. Mane[1*] Amit Handa[2] Shrinivas A. Shinde[3]

[1]PG Student, Department of Orthodontics and Dentofacial Orthopaedics, Aditya Dental College, Beed, Maharashtra, India.
[2]Reader, Department of Orthodontics and Dentofacial Orthopaedics, Aditya Dental College, Beed, Maharashtra, India.
[3]PG Student, Department of Prosthodontics, Crown and Bridge And Implantology, Aditya Dental College, Beed, Maharashtra, India.

ABSTRACT

Background: Pain is defined as an unpleasant sensory and emotional experience associated with actual or potential tissue damage or is described in terms of such damage. Pain and discomfort are a common complication during active orthodontic treatment. Pain, which includes sensations evoked by, and reactions to, noxious stimuli, is a complex experience and often accompanies orthodontic appointments. Orthodontic pain is part of an inflammatory reaction causing changes in blood flow following orthodontic force application. Orthodontic separators (brass wire, elastomeric, spring type steel separators, and latex elastics) results in a painful experience for almost all patients. Pain from arch wire placement can be worse in some patients and could even be more than that experienced after tooth extraction. Patients wearing fixed appliances reported higher values for intensities of pressure, tension, pain, and sensitivity to teeth. To date, numerous modalities have been invented to alleviate orthodontic pain in clinical practice, including pharmacological approaches, mechanical approaches, laser irradiation therapy and behavioral approaches. The objective of this study is to discuss conventional versus recently introduced treatment modalities used in pain management for orthodontic patients.

Keywords: Orthodontic, Pain management, Orthodontic pain, Analgesic, Discomfort.

INTRODUCTION

Pain is defined as an unpleasant sensory and emotional experience associated with actual or potential tissue damage or is described in terms of such damage. With no exception, orthodontic pain is perceived as discomfort, dull pain and hypersensitivity in affected teeth[1,2]. According to IASP (International Association For Study Of Pain) Pain is defined as, it is an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage.

Orthodontic tooth movement is a result of the application of forces to the teeth. The orthodontic forces promote tooth displacement in the periodontal ligament space, leading to the formation of areas of compression and traction. These stimuli trigger a series of tissue reactions that result in bone remodeling of the alveolus through the processes of bone resorption and apposition, thus permitting changes in tooth positioning[3].

These processes are accompanied by a stimulation of nerve endings in the periodontal ligament and an inflammatory process, which most often results in pain[4]. Orthodontic pain is commonly referred to as tooth discomfort induced by orthodontic tooth movement, whereas a broader definition of orthodontic pain refers to any painful sensation, for example, mucosal ulcer, tongue discomfort and gingival lesion, caused by orthodontic appliances[5,6]. The purpose of this review article is to throw a light on the various possible causes of orthodontic pain and to discuss the various management options for the orthodontic pain.

Received: Nov. 7, 2020: **Accepted**: Dec. 13, 2020
*Correspondence Dr. Dipali R. Mane.
Department of Orthodontics and Dentofacial Orthopaedics, Aditya Dental College, Beed, Maharashtra, India.
Email: manedipali1993@gmail.com

pISSN 2278-0076
eISSN 2321-9270

CAUSES OF ORTHODONTIC PAIN

The pain that patients experience in response to orthodontic forces is an inflammation type, resulting primarily from the action of peripheral nociceptors that respond to immediate stimuli as well as those that have been delayed[7]. Orthodontic pain is the result of compression of the periodontal ligament by the tooth resulting in an inflammatory response mediated by cytokines and prostaglandin. Thus, anti-inflammatory medication such as ibuprofen, have been suggested as the gold standard in decreasing post-operative orthodontic pain[4].

Initial stages of treatment:

The first step in fixed orthodontic mechano- therapy is creating space mesially and distally to teeth, which are to be banded. Orthodontic separator's placement results in a painful experience for almost all patients[4]. Pain associated with initial arch wire placement has been previously researched. Jones reported that pain is experienced by the majority of patients 4 hours after arch wire placement, which will peak at 24 hours and then decline[8]. Discomfort and pain caused in the initial stage of fixed orthodontic treatment can be moderate to severe and might last for more than 1 month. Generalized dentogingival discomfort is more prevalent than localized discomfort[6]. Although, Cioffiet al. found reduced pain response in their patients during initial wire placement when they used heat activated thermal nickel-titanium (Niti) as compared to superelastic Niti[9]. Johalet al. conducted a longitudinal study over a 3-month period, on pain experience and quality-of-life changes during fixed orthodontic treatment and concluded that initial stages of treatment results in subjective pain experience[10].

Intermaxillary elastics:

Intermaxillary elastics cause similar amounts of pain compared with initial archwire placement, but the pain of the elastics did not last as long as the pain felt after initial bonding[11].

Appliance activation:

Appliance activation causes disruption in the periodontal ligament creating areas of pressure and tension leading to discomfort to the patient[12]. Luppanapornlarpet al. evaluated the effect of force levels on the pain intensity and tooth movement and thus concluded that lower forces produced less pain as compared to higher forces with equally effective tooth movement[13]. An increase in pain 24 h after activation of appliance was observed by Treinet al. in their patients[14]. Ogura et al. compared the pain intensity among subjects with light and heavy force application and found that heavy forces cause greater biting pain few hours after the force application[15].

Insertion of temporary anchorage devices:

The study was conducted by **Chen et al.** to evaluate the pain experienced by the patients during placement of inter dental implants and was compared to the baseline value of discomfort during premolar extractions. They concluded that the placement of inter dental implants did not cause pain greater than that during traditional orthodontic treatment[16].

Debonding of orthodontic appliances:

Mangnallet al. conducted a multicenter trial and suggested that debonding of fixed appliances leads to pain experience in the patients. Furthermore, lower anteriors were reported to be most painful after debonding[17]. **Normandoet al**. compared two methods of debonding that is, a lift-off method and ligature cutting pliers and confirmed that lift-off method caused lesser pain to the patients during debonding[18].

MANAGEMENT OF ORTHODONTIC PAIN:

Pharmacological Management:

Analgesics have been largely prescribed for the alleviation of the symptoms which are felt by the patients who undergo orthodontic treatment. The drugs which are available for pain management belong to two major groups: the non-narcotic analgesics (e.g. NSAIDs) and the opioids (or narcotics) [19, 20]. Bradley et al. conducted a randomized control trial comparing the efficacy of paracetamol and ibuprofen in relieving pain due to separator placement. They suggested that patients taking ibuprofen reported discomfort on orthodontic separation[21].

A review by Possi and Gallelli described the role of ibuprofen in orthodontic pain management and the authors concluded that ibuprofen 400 mg, if taken one hour before, three hours after, and seven hours postoperatively, significantly reduced pain. However, additional doses of ibuprofen were suggested after the seven hour dose to maintain the benefits of the medication when pain peaks at 24 hours after intervention. Hence, it was considered a safe and effective drug compared to other NSAIDs and also had comparatively fewer adverse effects. Some clinicians supported that NSAIDs had no impact on tooth movements as they were administered in lower doses and for a shorter duration. Therefore, in healthy individuals they are cleared by the body before tooth movement occurs. On the contrary, other authors declared a delay in orthodontic tooth movements as a result of NSAID intake[22].

A report based on a literature review states that NSAIDs impede tooth movement and also increase the risk of root resorption. Therefore, paracetamol (acetaminophen) was considered the safest NSAID that had no influence on the range of tooth movements as well as root resorption and other adverse effects that might occur within the oral cavity[23].

Prostaglandins (PGs) are typical inflammatory and pain mediators which result from the degradation of arachidonic acid. COX iso enzymes (COX-1 and COX-2) mediate the formation of PGs. The expression of COX-2 is under the regulatory effect of environmental conditions whereas the constitutive COX-1 does not exhibit a dynamic regulation. Based on the hypothesis that a selective COX-2 inhibition would induce the desired anti-inflammatory effects without the undesirable side effects (particularly at the gastric level) which are associated with the COX-1 inhibition, drugs which are known as —coxibs or selective COX-2 inhibitors have been developed. Coxibs play a role in preservation of the COX-1 pathway as a consequence of their anti-inflammatory properties and thus allow the natural production of some useful PGs[19, 20].

Non-Pharmacological Management :

Anaesthetic Gels:

Anaesthetic gels are safer alternatives to analgesics in reducing the pain which results from orthodontic procedures. Keim et al., in their study, stated that they may be of use when orthodontic procedures are performed. The advantage offered by this system is its simple method of delivery which includes the introduction of gel into the gingival crevice and making it entirely painless[19, 24]. Keim described an anesthetic gel “oraqix” containing a combination of lidocaine and prilocaine in 1:1 ratio by weight. Such gels can be used when performing routine orthodontic procedures to relieve the patient’s discomfort40. Kwonget al. described the use of two anesthetic gels oraqix and TAC alternate for easy placement of temporary anchorage devices and showed that TAC alternate was more effective in reducing the local discomfort[19, 25].

Chewing gums:

Proffit et al., suggested chewing gums or plastic wafers during the first few hours of the appliance activation, in order to reduce the pain[26]. Aspergum, a weak analgesic chewing gum containing aspirin, proved to be of great help in relieving pain, after an orthodontic mechanotherapy[27]. Benson et al. conducted a randomized clinical trial on 57 patients and reported that the use of chewing gum significantly decreased both the impact and pain from the fixed appliances[28]. Farzaneganet al. conducted a randomized clinical trial on 50 patients to evaluate the efficacy of various measures to reduce pain after placement of initial archwires. They suggested that efficacy of chewing gums as a method to relieve pain caused due to such orthodontic procedures was comparable to that of analgesics[29].

Vibratory stimulation:

The use of vibratory stimulation to reduce orthodontic pain was first reported by Marie et al., but on detailed analysis, it was found that most of the patients were not able to tolerate the vibrations, once the discomfort sets in. Thus, if used, it is recommended that it should be used prior to the onset of pain. Based on their clinical study, Marie et al. have advised the use a vibratory apparatus by the patients to ameliorate the pain caused by

orthodontic treatment. Vibratory forces are effective when used before the development of pain as they improve and re-establish the blood supply in the pain-causing ischemic areas[30].

Bite wafers:

Mangnallet al. conducted a randomized clinical trial the results of which showed a reduction in pain during debonding procedures when the patients were made to bite on soft acrylic wafers[17]. Hwang et al. suggested the use of thera bite wafers in relieving pain after orthodontic procedures[12].

Medicated wax:

Kluemperet al. conducted a comparative study on subjects using wax to relieve the discomfort caused by fixed orthodontic appliances with those using wax containing slow releasing benzocaine. The patients using medicated wax reported of less pain as compared to the other group showing the analgesic properties of benzocaine containing wax[31].

Transcutaneous electrical nerve stimulation (TENS):

Roth and Thrash evaluated the effect of TENS in reducing periodontal pain after separator placement. Although it was able to reduce pain within a relatively short span of time of electrode placement, there is dearth of literature published on its use[4, 32].

Vibrating needle (VibrajectTM):

In orthodontic treatment sometimes we have to remove teeth for gaining space and other surgical procedure and that definitely need administration of local anesthesia. Various advancements have been made in anesthetic agents and techniques to get a pain free and comfortable anesthesia. Newer vibrotactile devices for pain control have been introduced such as Vibraject and Accupal[33].This is a newer concept used in dentistry for pain control. Vibraject is a battery-operated detachable device based on vibration and can be easily applied in routine local anesthesia procedures. Vibration provides interference stimulation and relieves pain. The concept is based on the gate-control theory[34].

Low level laser therapy:

Laser technology is used in dentistry since 1988 in the surgery of the soft tissues. This is the main of the reasons that suggest its application in orthodontics. Two types of laser are available one is obsorbed by thin surface layer of tissue (CO2, Er: YAG) , and other Penetrates into deeper tissue (Nd: YAG, He: Ne)[36]. Laser technology may improve the success of the therapy, diminish the discomfort of the patients, increase their cooperation, reduce the duration of the treatment and the pain produced by the devices[36].

CONCLUSION

Orthodontic pain, an inflammatory pain, shares many similar features with common inflammation, but it has specific hallmarks. The exact molecular mechanisms of the pathogenesis of orthodontic pain are still poorly understood. Although the sensory pathways have been well documented, its collateral pathways, including those related to emotion, memory and cognition, are largely unknown. Orthodontists must be aware of the various factors that might cause discomfort to the patients and should be able to manage such episodes to improve the compliance of patients with the orthodontic therapy. By far, the most commonly used method is administration of analgesics, orthodontists must be aware of the pharmacological action as well as the pros and cons related to each drug. A maximum recommended dose should be taken into consideration for each patient. Patients with special conditions such as psychological pain or trigeminal neuralgia often require collaboration with their specialists and advanced care management.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

REFERENCES

1. Asiry MA, Albarakati SF, Al-Marwan MS et al. Perception of pain and discomfort from elastomeric separators in Saudi adolescents. Saudi Med J 2014; 35(5): 504–507.

2. Kavaliauskiene A, Smailiene D, Buskiene I et al. Pain and discomfort perception among patients undergoing orthodontic treatment: results from one

month followup study. Stomatologija 2012; 14(4): 118–125.

3. Krishnan V, Davidovitch Z. Cellular, molecular, and tissue-level reactions to orthodontic force. Am J Orthod Dentofacial Orthop. 2006;129(4):469.e1–32.

4. Krishnan V. Orthodontic pain: from causes to management – a review.Eur J Orthod. 2007;29(2):170–179.

5.Rennick LA, Campbell PM, Naidu A et al. Effectiveness of a novel topical powder on the treatment of traumatic oral ulcers in orthodontic patients: a randomized controlled trial. Angle Orthod 2016; 86(3): 351–357.

6.Rakhshan H, Rakhshan V. Pain and discomfort perceived during the initial stage of active fixed orthodontic treatment. Saudi Dent J 2015; 27(2): 81–87.

7. Sylvie legris. Managing pain and discomfort in orthodontics. J Dentofacial Anom Orthod 2011;14:109.

8. Jones ML. An investigation into the initial discomfort caused by placement of an archwire. European Journal of Orthodontics 1984;6:48-54.

9. Campos MJ, Raposo NR, Ferreira AP, Vitral RW. Salivary alpha-amylase activity: A possible indicator of pain-induced stress in orthodontic patients. Pain Med 2011;12:1162-6.

10. Johal A, Fleming PS, Al Jawad FA. A prospective longitudinal controlled assessment of pain experience and oral health-related quality of life in adolescents undergoing fixed appliance treatment. OrthodCraniofac Res 2014;17:178-86.

11. Tuncer Z, Ozsoy FS, Polat-Ozsoy O. Self-reported pain associated with the use of intermaxillary elastics compared to pain experienced after initial archwire placement. Angle Orthod 2011;81:807-11.

12. Naim MA, Hasan MI, Nahar L, Nasrin T, Naznin S, Ghosh R. Causes of Orthodontic Pain & its treatment: an overview. Updat Dent. Coll .j 2016;6(1):43-51

13. Luppanapornlarp S, Kajii TS, Surarit R, Iida J. Interleukin-1beta levels, pain intensity, and tooth movement using two different magnitudes of continuous orthodontic force. Eur J Orthod 2010;32:596-601.

14. Trein MP, Mundstock KS, Maciel L, Rachor J, Gameiro GH. Pain, masticatoryperformance and swallowing threshold in orthodontic patients. Dental Press J Orthod 2013;18:117-23.

15. Ogura M, Kamimura H, Al-Kalaly A, Nagayama K, Taira K, Nagata J, et al. Pain intensity during the first 7 days following the application of light and heavy continuous forces. Eur J Orthod 2009;31:314-9.

16. Chen CM, Chang CS, Tseng YC, Hsu KR, Lee KT, Lee HE. The perception of pain following interdental microimplant treatment for skeletal anchorage: A retrospective study. Odontology 2011;99:88-91.

17. Mangnall LA, Dietrich T, Scholey JM. A randomized controlled trial to assess the pain associated with the debond of orthodontic fixed appliances. J Orthod 2013;40:188-96.

18. Normando TS, Calçada FS, Ursi WJ, Normando D. Patients' report of discomfort and pain during debonding of orthodontic brackets: A comparative study of two methods. World J Orthod 2010;11:e29-34.

19. Shenoy N, Shetty S, Ahmed J, Shenoy AK. The pain management in Orthodontics. Journal of Clinical and Diagnostic Research 2013;7:1258-1260.

20. Williams OL, Bishara SE. Patient discomfort levels at the time of debonding. A pilot study. American Journal of Orthodontics and Dentofacial Orthopedics 1992;101: 313-317.

21. Bradley RL, Ellis PE, Thomas P, Bellis H, Ireland AJ, Sandy JR.A randomized clinical trial comparing the efficacy of ibuprofen and paracetamol in the control of orthodontic pain. Am J OrthodDentofacialOrthop 2007;132:511-7.

22. Romero-Reyes M, Uyanik JM. Orofacial pain management: Current perspectives. J Pain Res 2014; 7: 99-115.

23. Krasny M, Zadurska M, Cessak G, Fiedor P. Analysis of effect of NSAID's drugs on teeth and oral tissues during orthodontic treatment. Report based on literature. Acta Pol Pharm 2013; 70(3): 573-7.

24. Turhani D, Scheriau M, Kapral D, Benesch T, Jonke E, Bantleon HP. Pain relief by single low-level laser irradiation in orthodontic patients undergoing fixed appliance therapy. American Journal of Orthodontics and Dentofacial Orthopedics 2006;130:371-377.

25. Kwong TS, Kusnoto B, Viana G, Evans CA, Watanabe K. The effectiveness of Oraqix versus TAC (a) for placement of orthodontic temporary anchorage devices. Angle Orthod 2011;81:754-9.

26. Proffit W R Contemporary orthodontics, 3rd edn. The CV Mosby Company, St Louis 2000.

27. White LW Pain and cooperation in orthodontic treatment. Journal of Clinical Orthodontics 1984;18:572-75.

28. Benson PE, Razi RM, Al-Bloushi RJ. The effect of chewing gum on the impact, pain and breakages associated with fixed orthodontic appliances: A randomized clinical trial. OrthodCraniofac Res 2012;15:178-87.

29. Farzanegan F, Zebarjad SM, Alizadeh S, Ahrari F. Pain reduction after initial archwire placement in orthodontic patients: A randomized clinical trial. Am J OrthodDentofacialOrthop 2012;141:169-73.

30. Marie SS, Powers M, Sheridan JJ. Vibratory stimulation as a method of reducing pain after orthodontic appliance adjustment. Journal of Clinical Orthodontics 2003;37:205-208.

31. Kluemper GT, Hiser DG, Rayens MK, Jay MJ.Efficacy of a wax containing benzocaine in the relief of oral mucosal pain caused by orthodontic appliances. Am J OrthodDentofacialOrthop 2002;122:359-65.

32. Roth PM, Thrash WJ. Effect of transcutaneous electrical nerve stimulation for controlling pain associated with orthodontic tooth movement. American Journal of Orthodontics and Dentofacial Orthopedics 1986;90:132-138.

33. Singh N, Agarwal S, Bhagchandani J, Chandra P, Gaur A. Painless anesthesia: A new approach. J DentofacSci 2013;2:49-55.

34. Melzack R, Wall PD. Pain mechanisms: a new theory. Science 1965;150:971-9.

35. Domínguez A, Velásquez SA. Effect of low-level laser therapy on pain following activation of orthodontic final archwires: A randomized controlled clinical trial. Photomed Laser Surg 2013;31:36-40.

36. Fornaini C , Merigo E , Vescovi P , Lagori G and Rocca JP . Use of laser in orthodontics: applications and perspectives. Laser Therapy 22.2: 115-124.