



## Enhancing Orthodontic Pain Management: A vision for Improved Patient Comfort

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### Article History

Received: 08 Oct 2023

Revised: 29 Nov 2023

Accepted: 02 Dec 2023

**Abstract:** Pain is a common concern in orthodontic treatment, resulting from inflammatory responses triggered by force application. This review explores the characteristics, mechanisms, causes, and management strategies for orthodontic pain. Patient-specific factors, including age, gender, and anxiety, contribute to pain perception. Pain typically peaks shortly after orthodontic procedures and diminishes gradually. Orthodontic Pain management encompasses pharmacological interventions (NSAIDs, analgesics), mechanical methods (chewing gum, laser therapy), and behavioral approaches (CBT, physical activity). Modifications in orthodontic procedures, such as using Ni-Ti wires and alternatives to traditional appliances, have been introduced to alleviate pain. These advances have transformed the

<p>CCLicense CC-BY-NC-SA 4.0</p>	<p>orthodontic experience, making it more tolerable and enhancing treatment outcomes. Overall, this review provides insights into orthodontic pain and its management, benefiting both patients and practitioners in achieving successful orthodontic treatment.</p> <p><b>Keywords:</b> Orthodontic Pain, Tooth movement, Pain Management, NSAIDS, Analgesics, Laser therapy, Anaesthetic gel, Discomfort</p>
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**Introduction:** Pain is characterized by a negative emotional and sensory experience correlated with actual or potential tissue damage or described in terms of such damage. Orthodontic pain is perceived as dull ache, discomfort and hypersensitivity in the teeth that are affected.<sup>[1-2]</sup> This is one of the most commonly mentioned adverse effect of Orthodontic treatment. As a result, it place the main factor in terminating orthodontic treatment, therefore it is considered as a major problem to patients as well as orthodontist.<sup>[3]</sup> Application of force leads to ischemia, edema, inflammation, and compression of the periodontal ligament. Any discomfort induced by orthodontic appliances, especially discomfort in the tongue, mucosal ulcers, and gingival lesions, is referred to as orthodontic pain.<sup>[4]</sup> The movement of teeth during orthodontic treatment, which causes pain, pressure, and tension in the afflicted teeth, is frequently referred to as the tooth discomfort. The majority of patients can withstand orthodontic pain and since people are aware that it is a common, unpleasant side effect of tooth movement.<sup>[5]</sup>

**Characteristic of Orthodontic pain:** Orofacial pain, which is induced by orthodontic tooth movement during the course of orthodontic treatment, is known as orthodontic pain.<sup>[6]</sup> Patients have pain and discomfort during all orthodontic treatments, including the initiation and activation of arch-wires, insertion of separators, activation of elastics, rapid expansion of the maxilla, placement of anchorage and removal of band or bracket. After 12 hours of orthodontic pressure on teeth, the pain will start, increase after 1 day, then progressively decrease over the next 3–7 days, and ultimately return to its original state after 1 month.<sup>[7]</sup> There is no doubt that fixed appliances cause greater pain and discomfort than removable or functional ones. The

amount of pain felt and the amount of applied force are not significantly correlated. Orthodontic pain negatively affects patients in a variety of ways, including by impairing their ability to speak and chew as well as their overall health-related quality of life.<sup>[8]</sup>

**Mechanism of orthodontic pain:** When orthodontic pressure is applied to teeth, the periodontium, including dental pulp and gingiva, reacts significantly. Orthodontic pain and tooth movement are ultimately caused by a series of self-limiting inflammatory reactions, comprising cellular, vascular, neurological, and immunological reactions. As a result, tooth movement and orthodontic pain are two physiological processes that are related and dependent on local inflammation as their mode of action.<sup>[6-8]</sup> Prostaglandin and bradykinin, which are components of inflammation, act on sensory endings and induce pain. As a result, periodontal inflammatory reactions, which carried by orthodontic force, are the mechanisms underlying orthodontic pain. It is obvious that all orthodontic treatments will result in zones of tension and compression in the PDL region, which will cause pain for the patients. The three aspects of the periodontal inflammatory response—cellular, vascular, and chemical events—interact to form a system.<sup>[9]</sup>

### **Cause of Orthodontic pain**

**Placement of separator:** Creating space in the proximal surface of the teeth is the first step of fixed orthodontic mechanotherapy. That space will be banded by the insertion of orthodontic separators such as spring-type steel separators, latex elastics, elastomeric, and brass wire, which results in a painful experience. In the process of orthodontic separation, the pain commences around 4 hours after its installation, reaching a high point on day 2 that might endure for 7 days.<sup>[10]</sup>

**Insertion and activation of archwire:** Most of patients experiences pain 4 hours after the archwire is placed and reaches a higher point at 24 hours and then decreases. As patients utilize their anterior teeth more frequently for biting than their posterior teeth, they usually experience more pain in their anterior teeth.<sup>[10]</sup> Additionally, these teeth had tiny root surface areas and required more involve during leveling and alignment. In conclusion, the insertion and activation of the archwire will both cause pain, which may interfere with the patients' normal diet and exercise routine.<sup>[11]</sup>

**Orthodontic appliances:** Discomfort from Functional and Fixed appliances was more intense than from Removable ones. Patients wearing fixed orthodontic appliances experienced increased levels of pain, pressure, tension, and tooth sensitivity.<sup>[11]</sup>

**Orthopaedic forces and Rapid maxillary expansion:** Craniofacial orthopaedics frequently imposes high-magnitude mechanical stresses or forces, which are taken in and supplied to the craniofacial complex. These pressures induce a chain of events that include tissue movement, internal stress generation, and deformation. Due to the process of inflammation, the patient feels pain and discomfort, which frequently affects the entire craniofacial region.<sup>[12]</sup>

Following the implementation of the expansive force of Rapid maxillary expansion, a painful experience was shown. Children who undergo Rapid maxillary expansion may have pain, especially at first, although this eliminates over time. Patients frequently experience discomfort 24 hours after wearing the headgear, and after 3 days, the discomfort quickly subsides.<sup>[11-12]</sup>

**Debonding:** Force application and tooth mobility were the two key element that affects a patient's discomfort threshold level when it was evaluated at debonding. Comparatively to forces applied in a lingual, extrusive, mesial, facial, or distal orientation, intrusive forces at debonding cause less pain.<sup>[12]</sup>

### **Factor affecting Orthodontic pain response**

**Age:** Older patients experience more pain, have higher pain sensitivity, and have poorer pain tolerance.<sup>[12]</sup>

**Gender:** Females are known to be more sensitive to pain than males, which can be explained by the fact that Males are tougher and can withstand more pain than females since they are more "fragile" and sensitive to it.<sup>[11-12]</sup>

**Anxiety and Fear:** It has been demonstrated that dental anxiety can lower the pain threshold, cause people to perceive normally painless stimuli as painful, and that a high level of dental anxiety has a strong correlation with a dread of both specific and general unpleasant things and conditions.<sup>[13]</sup>

**Management:** One of the most crucial aspects of orthodontic treatment should be pain management. To alleviate orthodontic pain, a number of procedures have been used, including pharmacological approaches, low level laser therapy, mechanical approaches, and behavioral approaches.

**Pharmacological approach:** The medications available for pain management fall into two categories:-Non-narcotic analgesics (such as NSAIDs) and Narcotics (such as opioids). For decades, NSAIDs (Non-steroidal anti-inflammatory drugs) have been the most popular form of pain management during orthodontic treatment.<sup>[1]</sup> These are not consistently used to treat pain in orthodontic practice because of their negative effects on tooth mobility, which is currently under question despite their usefulness in alleviating orthodontic pain.<sup>[2]</sup> Prostaglandin is a pro-inflammatory mediator that binds to sensory nerve endings to produce uncomfortable sensations like pain and stimulates bone remodeling to encourage tooth movement.<sup>[3]</sup> It has been documented that COX enzymes mediate prostaglandin production and that NSAIDs interfere with COX enzyme activity. As a result, NSAIDs could reduce orthodontic pain by preventing production of prostaglandin.<sup>[4]</sup> Reduced prostaglandin levels after taking NSAID may inhibit osteoclasts and slow tooth movement because prostaglandin increases local inflammation and bone remodeling.<sup>[5]</sup>

There are numerous NSAIDs, including as Acetaminophen, Ibuprofen, flurbiprofen, Celecoxib, Meloxicam, Naproxan-sodium, Tenoxicam, valecoxib and recently introduced Cox-2inhibitor, Rofecoxib available.<sup>[7]</sup> Almost all NSAIDs are beneficial at reducing orthodontic pain and discomfort caused by orthodontic appliances, although additional research is required to confirm how these medications affect how quickly the teeth shift. Analgesics are often recommended after the treatment is completed, although administering them beforehand has been found to be helpful for several orthodontic procedures.<sup>[5]</sup>

**Acetaminophen/Paracetamol:** Orthodontic pain is commonly treated with Acetaminophen/Paracetamol prescriptions.<sup>[4]</sup> Acetaminophen is an internationally recognized analgesic that lacks the antiinflammatory effects of NSAIDs additionally, it does not impede tooth movement. Therefore, it should be the first-line medication for orthodontic pain. After orthodontic separator placement and immediately following appointments if the patient experiences pain, Paracetamol 650mg must be taken twice daily for efficient pain management. It

is safer to use paracetamol during pregnancy. Therapeutic dosages of Acetaminophen, whether single or repeated, have no adverse effects on the respiratory, cardiovascular or coagulation systems.<sup>[11]</sup>

**Ibuprofen:** Ibuprofen effectively relieves pain in the early phases of treatment. It is a safe and effective medication with few negative effects, such as minimizing orthodontic tooth movement.<sup>[11]</sup> A 400mg dose of pre-emptive ibuprofen taken one hour prior to the placement of the separator causes a significant reduction in chewing pain 2 hours later. If a patient has any systemic issues like cardiovascular disorder, it is preferable to avoid using Ibuprofen. Paracetamol and ibuprofen do not significantly differ from one another in how they treat pain.<sup>[12]</sup>

**Flurbiprofen:** A preoperative and one postoperative, i.e. 6 hours after bonding, dosage of 100 mg flurbiprofen was also used to manage orthodontic pain.<sup>[14]</sup>

**Naproxan:** The effects of pre-operatively provided doses of Naproxan sodium 550mg and Ibuprofen 400mg on the placement of an arch-wire and discovered that Naproxan sodium was superior to Ibuprofen at the 2 and 6 hour, as well as at night, after arch-wire placement. After orthodontic appointments, a minimum of one or two post-surgical doses must be given in addition to the pre-surgical dose to provide comprehensive pain management.<sup>[6]</sup>

**Tenoxicam:** Tenoxicam is a long-acting analgesic that has been used for decades with excellent patient acceptance and a longer elimination half-life; thus, it must be taken once a day.<sup>[9]</sup> It has demonstrated high effectiveness at alleviating acute pain of mild to moderate severity, such as pain arising from orthodontic activation, with no major negative effects.<sup>[3]</sup>

**Meloxicam:** In terms of pain relief, Meloxicam 7.5mg is almost as effective as Paracetamol 650 mg.<sup>[4]</sup> Meloxicam has better effectiveness, tolerance and safety as an anti-inflammatory analgesic. However, it is not frequently given because of its few side effects such as hypertension and oedema.<sup>[11]</sup>

**Cox-2 inhibitor:** The Cox-2 inhibitor Rofecoxib has been reported to be safe for use during orthodontic mechanotherapy and to have no impact on PGE 1 levels.<sup>[4]</sup>

**Valecoxib:** Before the procedure, valecoxib will be given to reduce pain from the initial arch-wire placement.<sup>[5]</sup>

Current orthodontic technology is focused on pre-surgical analgesic therapy to reduce post-surgical pain and discomfort. Pre-emptive analgesics, which inhibit afferent nerve impulses before they reach the central nervous system, will stop the progression of central sensitization.<sup>[11]</sup>

**Topical anaesthetic gel:** Other approaches have been tested in addition to analgesics to alleviate the pain associated with orthodontic practices. 'Oraqix', a topical anesthetic gel, is a 1:1 weight ratio of Prilocaine and Lidocaine, may be helpful while performing orthodontic treatment such as initiation and activation of arch-wire, band placement, cementation and bracket or band removal.<sup>[4]</sup>The advantage of this technology is its painless administration procedure, which merely delivers the gel into the gingival crevice.<sup>[7]</sup>

**Mechanical approach:** chewing gum, Acupuncture, plastic wafers and Vibration are all mechanical methods for pain alleviation during orthodontic treatment. Vibration is delivered to the teeth of patients using a vibrating device that is inserted in their mouths. Aspergum, a mild analgesic chewing gum containing aspirin, was shown to be extremely effective in pain alleviation following orthodontic mechanotherapy.<sup>[15]</sup> In order to relieve pain during the first stage of orthodontic treatment, several studies recommended chewing gum or plastic wafers.<sup>[14]</sup>

**Low level laser therapy:** In both Dental and Medical set-up, low-level laser treatment is frequently utilized to treat pain.<sup>[15]</sup> The entire dental arch is exposed to laser radiation during low-level laser therapy. During orthodontic treatment, local carbon dioxide laser irradiation alleviated pain without compromising tooth movement.<sup>[11]</sup>

**Behavioral approach:** Different behavioral management includes physical activity, cognitive behavioral therapy (CBT) and music therapy. It was beneficial for alleviating pain throughout the early phases of orthodontic therapy.<sup>[13]</sup>

### **Modification in Orthodontic procedures for less pain perception by patient**

**Pain due to separator placement and banding of tooth:** Nowadays, bonding of buccal tubes is preferred over banding of molars, eliminating the need for tooth separation, which is the most painful phase.<sup>[2]</sup>

**Pain due to initial arch-wire placement:** Thermal Ni-Ti and copper Ni-Ti wires are the first wires used for alignment and leveling because they have low load deflection, provide very low

level forces, and lessen patient discomfort and pain. After insertion, the patient is instructed to rinse their mouth with cold or freezing water to relieve any pain as these wires become inactive at low temperatures.<sup>[4]</sup>

**Pain due to retraction mechanics:** Retractions were previously accomplished using sliding mechanics, and force was applied using head gears and J-hooks. As technology advanced, these were replaced with Ni-Ti coil springs, which provide low continuous forces. The best tooth movements were carried out with less force and less pain for the patient with the introduction of loops produced by TMA wires, such as T Loop and KSIR arch wire.<sup>[6]</sup>

**Pain due to extra-oral appliances:** For anchorage preservation, patient compliance, and the application of orthopedic stresses, all extra oral appliances were used. These days, absolute anchorage devices like orthodontic implants are primarily used to replace them. It provides ease of retraction without burdening anchorage.<sup>[5]</sup>

**Pain due expansion of maxilla:** Orthopedic devices like rapid maxillary expander's separate the two halves of the maxilla and its a painful procedure. The most recent developments are Ni-Ti palatal expander's, which are less painful and exert low level force over a period of 3–6 months.<sup>[3]</sup>

**Conclusion:** In orthodontics, force is used to move teeth effectively by causing inflammation. Patient experiences this inflammation as pain. Both phenomena are interrelated, and neither can be eliminated. However, due to modifications in mechanical therapy and pharmacological therapy as well as more recent developments, the patient now perceives less pain and can still benefit from an effective course of orthodontic treatment. This review aims to identify the root causes of orthodontic pain and gives a general overview of the current management approaches used to treat it. This aids in enhancing not only our patients' pain comfort levels but also more efficient practice management. Thus, the unpleasant experience is turned into a pleasant one.

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