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Original Article

PAIN CONTROL DURING ORTHODONTIC TREATMENT: A CLINICIAN PROSPECTIVE

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Abstract

Orthodontic tooth movement is facilitated by remodelling of the paradental tissues in response to mechanical forces. Osteoclast and osteoblast cells mediate bone resorption and opposition, which eventually produces tooth movement. Patients undergoing orthodontic treatment can experience hyperalgesia due to the release of noxious agents from nerve endings. NSAIDs remain the most preferred method for pain control during orthodontics. The objective of this review is to outline the mechanism of action and effects of these drugs on orthodontic tooth movement. This is considered essential in order for the orthodontist to take into account all factors related to the therapy and to select the best therapeutic strategy in every individual patient keeping the mechanics as simple as possible and follow an appropriate protocol for administration of these drugs.

Key words

Orthodontic tooth movement, osteoclast, osteoblast, hyperalgesia, NSAIDs.

INTRODUCTION

Orthodontics is based on the original discovery by Celsus that pressure applied to a tooth will cause it to change its position.1 As defined by Profitt, orthodontic tooth movement is the result of a biological response to interference in the physiological equilibrium in the dentofacial complex by an externally applied force.2 The sequence of events occurring as part of the tooth movement process involves synthesis, release, as well as the role of various inflammatory mediators, neurotransmitters, growth factors and other cytokines in response to applied mechanical forces.3 These endogenous molecules play important roles in the initiation, maintenance and cessation of tooth movement. Some of these factors can also cause undesirable side effects, such as pain and root resorption.4 Control of this pain is of interest to both clinician and patients. The aim of this overview is to update clinician concerning the mechanism of action; effects of some commonly used pharmaceutical products that control pain during orthodontic treatment.

DISCUSSION

Pain is an unpleasant, sensory and emotional experience associated with an actual or potential damage or described in terms of such damage.5 Orthodontic tooth movement basically involves the coupling effect of bone
remodelling – resorption and deposition resulting in a painful experience for the patients.6 Orthodontic procedures resulting in pain are orthodontic separation, appliance therapy, activation of arch wires, orthopaedic forces and debonding. Pain associated with orthodontic treatment usually begins 2 hours after the insertion or activation of an appliance and lasts for approximately 5 days7. Initial type of pain after appliance activation is due to the compression of the periodontal ligament followed by release of prostaglandins causing hyperalgesia due to release of noxious agents such as histamine, bradykinin, serotonin, acetylcholine and substance P from nerve endings both peripherally and centrally 6.

The non-steroidal anti-inflammatory drugs (NSAIDs) are the most frequently used and the drug of choice for the control of pain following mechanical force application to teeth. They act primarily on peripheral pain mechanisms but also in CNS to raise pain threshold, by inhibiting the enzyme cyclo-oxygenase (COX), which modulates the transformation of prostaglandins (PGs) from arachidonic acid in the cellular plasma membrane. These drugs are classified as:

a) Non selective COX inhibitors (traditional NSAIDs)
1) Salicylates: Aspirin
2) Propionic acid derivatives: Ibuprofen, naproxen
3) Anthranilic acid derivative: Mephenamic acid
4) Aryl-acetic acid derivatives: Diclofenac, Aceclofenac
5) Oxicam derivatives: Piroxicam, Tenoxicam
6) Pyrrolo-pyrrole derivative: Ketorolac
7) Indole derivative: Indomethacin
8) Pyrazolone derivatives: Phenylbutazone, Oxyphenbutazone
b) Preferential COX-2 inhibitors
Nimesulide, Meloxicam, Nabumetone
c) Selective COX-2 inhibitors

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Celecoxib, Parecoxib
d) Analgesic-antipyretics with poor anti-inflammatory action

1) Paraaminophenol derivative: Paracetomol (Acetaminophen)
2) Pyrazolone derivatives: Metamizol
3) Benzoxazocine derivative: Nefopam.5

NSAIDs reduce the pain and discomfort caused by orthodontic tooth movement but these drugs may also effect the sequence of tooth movement by inhibiting or at least reducing the associated inflammatory and bone resorption process.8 Because prostaglandins appear to be important in the process of tooth movement, it has been suggested that the use of over-the -counter NSAIDs by orthodontic patients can significantly alter the efficacy of tooth movement.9

Amongst the earliest studies carried out Chumbley et al evaluated the effect of indomethacin (an aspirin like drug) and recommended that aspirin like drugs not to be administered to patients undergoing orthodontic treatment as it may extend the treatment time.10 Kehoe et al had proven that acetaminophen remains an appropriate alternative to NSAID'S which did not affect orthodontic tooth movement. But in a recent study Bradley et al compared ibuprofen and paracetamol for the control of pain and found that pre-operative and post-operative ibuprofen to be more effective than paracetamol.11

Other alternative is the use of selective cox-2 inhibitors, also called coxibs. In comparison to NSAID's, Cox-2 inhibitors have longer dose intervals, different side effect profile, similar onset of action and similar analgesic effect. These drugs selectively block the COX-2 enzyme, and impede the production of the chemical messengers (PGs) that cause pain and swelling. Because these drugs selectively block the COX-2 enzyme and not the COX-1 enzyme, these drugs are uniquely different from traditional NSAIDs. 12 Carlos et al evaluated orthodontic tooth movement after different coxib therapies and concluded that celecoxib and parecoxib but not rofecoxib, seem appropriate for discomfort and pain relief while avoiding interference during tooth movement.13

Gameiro et al evaluated the effects of short and long term celecoxib on orthodontic tooth movement and concluded that although celecoxib, administration did not effect the number of osteoclasts, the osteoclasts activity might be reduced which could explain the inhibition of tooth movement observed.13 According to a recent report nabumetone, a drug belonging to the NSAID group reduces the amount of root resorption along with the control of pain from intrusive orthodontic forces, without affecting the pace of tooth movement.14

The current trend is directed towards use of preemptive or pre-operative analgesics, which are administered at least one hour before every orthodontic procedure. Preemptive analgesic administration to decrease post-operative pain has become the focus of recent research in orthodontics. Pre-emptive analgesia will block the afferent nerve impulses before they reach the central nervous system, abolishing the process of central sensitization. 15 Acetaminophen, which does not have a significant influence on the rate of tooth movement, can be recommended for controlling pain during orthodontic treatment.8

Apart from analgesics, other approaches have been tested to reduce pain from orthodontic procedures. Chewing gum or a plastic wafer during first few hours of appliance activation in order to reduce pain has been suggested. This will temporarily displace the teeth sufficiently to allow blood to flow through compressed areas preventing a build up of metabolic products.3

CONCLUSION:

Pain is common during orthodontic therapy and is largely unavoidable due to the nature of the tissue reaction to the physiology of tooth movement and the soft tissue insult resulting from the contemporary appliances. Analgesics that are commonly recommended have been shown to effect tooth movement to a degree. Improved clinical technique, limiting the forces and careful adjustments all contribute to reducing the pain experience as well as providing information about the anticipated or ongoing treatment can give a sense of controlZ

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