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Role of NSAIDS in Dentistry- A Narrative Review

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INTRODUCTION:

Nonsteroidal Anti-Inflammatory Drugs are referred to as NSAIDs. These drugs belong to a class that is frequently used to treat fever, lessen inflammation, and relieve pain. [1]

Common Uses of NSAIDs:

Pain Relief: Headaches, toothaches, muscle aches, menstrual cramps, arthritis pain, etc.

Reduction of Inflammation: Arthritis, bursitis, tendinitis, and other inflammatory conditions.

Fever Reduction: Helping to bring down a high temperature.

Mechanism of action of NSAIDs

NSAIDs function by preventing the body from producing prostaglandins, which are molecules that are involved in fever, inflammation, and pain [2]. NSAIDs work by inhibiting cyclooxygenase (COX), a protein that prevents arachidonic acid from being converted into prostaglandins that cause inflammation. NSAIDs lessen pain and inflammation following oral surgery or in cases of mucositis and periodontitis. While there are two isoforms of COX (COX-1 and COX-2), COX-2 is mostly involved in proinflammatory effects, whereas COX-1 primarily serves physiological purposes. Consequently, the majority of NSAID side effects, such as gastrointestinal distress, liver damage, or cardiovascular problems, are linked to COX-1 inhibition. [3-6] Because of their strong analgesic, anti-inflammatory, and antipyretic properties, NSAID medications are employed. The mechanism of action of NSAIDs is inhibition of the cyclooxygenase (COX) enzyme, which is involved in the manufacture of prostaglandins (PGs) and thromboxane (TX). [7]

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The Role of Prostaglandins:

Prostaglandins are hormone-like chemicals produced by the body in response to injury or irritation. They play a crucial role in various physiological processes, including:

Pain perception: Prostaglandins sensitize nerve endings, amplifying pain signals to the brain.

Inflammation: They promote inflammation by triggering processes like blood vessel dilation, redness, swelling, and heat.

Fever: Prostaglandins act on the hypothalamus, the body's thermostat, to elevate body temperature.

How NSAIDs Block Prostaglandin Production:

There are two main COX enzymes: COX-1 and COX-2.

Enzyme that comes in the cyclooxygenase-1 and cyclooxygenase-2 isoforms. Cyclooxygenase-1 is constitutive and controls numerous organs' regular functions. Inducible inflammatory cells express cyclooxygenase-2, which mediates inflammatory reactions. Nonsteroidal anti-inflammatory medications (NSAIDs) target the two cyclooxygenase isoforms, COX-1 and COX-2. Both COXs' competing active sites are inhibited by these medications. Despite the fact that both COXs are homodimers, substrate binding only uses one partner at a time. To stop prostanoid production, NSAIDs only need to attach to and inactivate the COX site at one of the COX dimer's monomers. It seems that the other monomer has an allosteric role. NSAIDs have no effect on either protein's ability to peroxidase. [9] While COX-2 is an induced enzyme, COX-1 is constitutively produced in many tissues and is essential for normal cell function.[10] Both play crucial roles in a number of physiological and pathological processes, including cancer and inflammation. Furthermore, these proteins generate prostaglandin E2 (PGE2), an inflammatory mediator implicated in a wide range of actions, including vasodilation, pain potentiation, and nociceptive responses.[11]

While using COX-1 may cause negative reactions, inhibiting COX-2 is linked to anti-inflammatory effects. In order to lessen potential negative effects, new generation selective COX-2 inhibitors have been created. These novel anti-inflammatory medications have been utilised recently to treat a range of inflammatory conditions. In the meantime, COX-2 inhibitors seem to hold promise for managing tooth discomfort and providing supportive care for inflammatory periodontal disorders.[12]

COX-1: This enzyme is present in most tissues and is responsible for the production of prostaglandins involved in normal physiological functions like stomach lining protection and kidney function.

COX-2: This enzyme is primarily produced at sites of injury or inflammation and is responsible for the synthesis of "inflammatory" prostaglandins.

Depending on the specific NSAID, the mechanism of action can differ:

Non-selective NSAIDs: These drugs inhibit both COX-1 and COX-2 enzymes. Examples include ibuprofen, naproxen, and aspirin (at higher doses). Blocking COX-1 can lead to side effects like stomach upset and heartburn.

COX-2 selective NSAIDs: These newer drugs primarily target COX-2, aiming to minimize side effects related to COX-1 inhibition. Examples include celecoxib and etoricoxib.

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Classification of NSAIDs :

NSAIDs (Nonsteroidal Anti-Inflammatory Drugs) can be classified in several ways, with the two most common methods focusing on their chemical structure and their selectivity for cyclooxygenase (COX) enzymes. Here's a breakdown of these classifications with

I. Classification by Chemical Structure: [13-17]

This classification groups NSAIDs based on their chemical makeup, which can influence some of their properties and potential side effects.

A).Salicylates: The oldest class of NSAIDs, with aspirin (acetylsalicylic acid) being the most well-known example.

B).Propionic acids: This group includes commonly used drugs like ibuprofen, naproxen, and ketoprofen.

C).Acetic acids: Indomethacin is a prominent example in this category.

D).Oxicams: Piroxicam is an example belonging to this class.

E).Fenamates: Mefenamic acid and flufenamic acid are examples in this less commonly used category.

F).Sulfonanilides: This class includes some newer NSAIDs, such as celecoxib.

II.Classification by COX Selectivity:

This classification focuses on how NSAIDs interact with the two main cyclooxygenase (COX) enzymes: COX-1 and COX-2.

A).Non-selective NSAIDs: These drugs inhibit both COX-1 and COX-2 enzymes. Examples include ibuprofen, naproxen, and most commonly used OTC NSAIDs. Blocking COX-1 can lead to side effects like stomach upset and heartburn. [18]

B).COX-2 selective NSAIDs: These newer drugs primarily target COX-2, aiming to minimize side effects related to COX-1 inhibition. Examples include celecoxib and etoricoxib. While they may offer a lower risk of gastrointestinal side effects, they can be associated with an increased risk of cardiovascular events.[19]

Name commonly used NSAID s in dentistry?

Over-the-Counter (OTC) NSAIDs:

Ibuprofen : A widely used pain reliever and anti-inflammatory medication effective for mild to moderate pain and inflammation following dental procedures.

Naproxen Sodium : Another popular OTC NSAID with analgesic and anti-inflammatory properties, helpful for managing pain and inflammation after dental work.

While dentists may prescribe stronger NSAIDs for specific situations, it's important to note that some require special training to prescribe them. Here are a few examples:

Celecoxib (Celebrex): A COX-2 selective NSAID sometimes prescribed to minimize the risk of gastrointestinal side effects compared to non-selective NSAIDs. However, it may carry a higher risk of cardiovascular events.[20]

Diclofenac (Voltaren): A potent NSAID with analgesic and anti-inflammatory effects, sometimes prescribed for moderate to severe pain after dental procedures.

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Side effects: All NSAIDs can have side effects, with stomach upset, heartburn, and kidney problems being some of the most common. Consulting a dentist or doctor before taking NSAIDs is essential, especially if you have any underlying medical conditions.

For patients who cannot take NSAIDs due to side effects or medical history, dentists may recommend alternative pain relievers like acetaminophen (Tylenol) or opioid medications for short-term use.

Describe various side effects of NSAIDs used in dentistry

Nonsteroidal anti-inflammatory drugs, or NSAIDs, are frequently prescribed in dentistry to treat post-procedural discomfort and inflammation. They might have a variety of negative consequences even though they are usually effective. The following is a summary of some possible adverse effects of NSAIDs used in dentistry:

1.Gastrointestinal (GI) Issues:

Stomach upset and heartburn: This is one of the most common side effects of NSAIDs. They can irritate the stomach lining, leading to discomfort, indigestion, and heartburn.

Nausea and vomiting: In some cases, NSAIDs can cause nausea and even vomiting, especially if taken on an empty stomach.

Ulcers and bleeding: Long-term use or high doses of NSAIDs can increase the risk of stomach ulcers and bleeding. This risk is particularly concerning for individuals with a history of ulcers or gastrointestinal problems.

2.Renal (Kidney) Issues:

Reduced kidney function: NSAIDs can affect the kidneys' ability to filter waste products from the blood. This is especially risky for those with pre-existing kidney problems.

High blood pressure: NSAIDs can contribute to elevated blood pressure, which can be problematic for patients with hypertension.

3.Cardiovascular (Heart) Issues:

Increased risk of heart attack and stroke: Studies suggest a potential association between long-term NSAID use and an increased risk of cardiovascular events, particularly in high-risk individuals.

Other Potential Side Effects:

Headache and dizziness: These are less common side effects of NSAIDs but can occur in some individuals.

Tinnitus (ringing in the ears): This can be a temporary side effect of NSAID use.

Allergic reactions: While rare, NSAIDs can trigger allergic reactions in some people.

Factors Affecting Side Effects:

Type of NSAID: Non-selective NSAIDs, which inhibit both COX-1 and COX-2 enzymes, are more likely to cause GI side effects compared to COX-2 selective NSAIDs.

Dosage and Duration: The risk of side effects increases with higher dosages and longer durations of NSAID use.

Individual Risk Factors: Pre-existing medical conditions like gastritis, kidney disease, or heart problems can increase the susceptibility to side effects.

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Minimizing Side Effects:

Follow dosage instructions: Always take NSAIDs exactly as prescribed by your dentist and don't exceed the recommended dosage.

Take with food: Taking NSAIDs with food can help reduce stomach irritation.

Short-term use: Limit the duration of NSAID use to the recommended period for managing post-dental pain.

Consider alternatives: Discuss alternative pain management options with your dentist if you have concerns about NSAID side effects.

When it comes to treating pain and inflammation in dentistry, NSAIDs are useful instruments. But it's important to know about possible side effects and take precautions against them. Before taking any medicine following dental work, including NSAIDs, always check with your dentist.

In which prosthodontic treatment NSAIDs are contraindicated?

Nonsteroidal anti-inflammatory drugs, or NSAIDs, are not inherently incompatible with any particular prosthodontic procedure. However, because of the possible problems, there are several circumstances in which their use may be discouraged or need careful evaluation. The key issues are broken down as follows:

Reasons for Caution with NSAIDs in Prosthodontics:

Impaired Healing: NSAIDs can inhibit the body's natural inflammatory response, which plays a role in tissue healing. This can potentially delay or compromise healing following surgical procedures commonly associated with prosthodontics, such as implant placement or alveolar ridge augmentation.[21]

Increased Bleeding Risk: NSAIDs can affect platelet function, which can increase the risk of bleeding during and after surgery. This is particularly concerning for procedures involving soft tissue manipulation or bone grafting.[22]

Gastrointestinal Issues: While not directly related to the treatment itself, common side effects of NSAIDs like stomach upset and heartburn can be uncomfortable and potentially impact post-operative recovery, especially after procedures involving the oral cavity.

Here are some specific prosthodontic procedures where NSAIDs might be used with caution:

Implant Placement: Due to the potential for delayed healing and increased bleeding risk, NSAID use may be discouraged around the time of implant surgery. Alternative pain management options might be considered.

Alveolar Ridge Augmentation: Similar to implant placement, NSAIDs might be used with caution due to their impact on healing processes involved in bone grafting procedures.

Individualized Approach:

The decision to use NSAIDs after prosthodontic procedures ultimately depends on several factors:

Severity of Pain and Inflammation: If the pain is mild and manageable with alternative medications like acetaminophen, NSAIDs might be unnecessary.

Type of Procedure: The risks associated with NSAID use might be more or less concerning depending on the specific prosthodontic treatment.

Patient's Medical History: Underlying health conditions and current medications can influence the safety of NSAID use.

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Alternatives to NSAIDs:

Several alternative pain management options are available for patients undergoing prosthodontic procedures:

***Acetaminophen (Tylenol)*:** This medication can be effective for mild to moderate pain and has a lower risk of gastrointestinal side effects compared to NSAIDs.

***Opioids*:** Short-term use of opioid medications might be prescribed for managing severe post-operative pain. However, their addictive potential necessitates cautious use.

Topical Anesthetics: For procedures involving localized pain, topical anesthetic gels or sprays can provide temporary pain relief.

NSAIDs are useful tools for treating pain but using them in prosthodontics needs to be done with caution. The advantages of pain relief should be evaluated against the possible effects on bleeding risk and recovery. It is essential to speak with a prosthodontist or dentist to figure out the best pain management technique for your unique situation and course of treatment.

which are safest NSAIDs drugs?

Determining the "safest" NSAID depends on individual factors and the specific health concerns. Here's a breakdown of considerations:

Factors Influencing NSAID Safety:

Underlying Medical Conditions: Individuals with pre-existing conditions like heart disease, stomach ulcers, or kidney problems may need to avoid certain NSAIDs or use them with caution.

Individual Risk Tolerance: Some people are more susceptible to specific side effects like stomach upset or cardiovascular issues.

General Considerations:

COX-2 Selective NSAIDs: These drugs (like celecoxib) are designed to minimize the risk of gastrointestinal side effects associated with blocking COX-1. However, they may carry a higher risk of cardiovascular events for some individuals.

Dosage and Duration: The risk of side effects increases with higher dosages and longer durations of NSAID use. It's crucial to follow the recommended dosage and not exceed it.

Alternative Pain Management: For individuals who cannot take NSAIDs due to side effects or medical history, alternatives like acetaminophen (Tylenol) or opioid medications for short-term use might be considered.

Here's a breakdown of some safety considerations for different NSAID categories:

Non-Selective NSAIDs (e.g., ibuprofen, naproxen):

Generally well-tolerated, but carry a higher risk of stomach upset, heartburn, and ulcers compared to COX-2 selective NSAIDs.

COX-2 Selective NSAIDs (e.g., celecoxib):[23,24]

May offer a lower risk of gastrointestinal side effects, but some studies suggest a potential increase in cardiovascular events for some individuals.

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REFERENCES:

1. Ida Ghlichloo; Valerie Gerriets. Nonsteroidal Anti-Inflammatory Drugs (NSAIDs.Available from: https://www.ncbi.nlm.nih.gov › books › NBK547742. Last accessed on 15th March 2024.

2. Caner Gunaydin , S. Sirri Bilge. Effects of Nonsteroidal Anti-Inflammatory Drugs at the Molecular Level. Eurasian J Med 2018; 50: 116-21

3.Pairet M, Engelhardt G. Distinct isoforms (COX-1 and COX-2) of cyclooxygenase: Possible physiological and therapeutic implications. Fundam Clin Pharmacol. 1996;10:1-17.

4.Vane JR, Bakhle YS, Botting RM. Cyclooxygenases 1 and 2. Annu Rev Pharmacol Toxicol. 1998;38:97-120.

5.Bennett A. Prostaglandins: Their release, biological effects and relationships to pain and inflammation. Cephalalgia. 1986;6(Suppl. 4):17-20.

6.Wardle EN. Guide to the prostaglandins. Br J Hosp Med. 1985;34:229-32.

7.Bacchi S, Palumbo P, Sponta A, Coppolino MF. Clinical pharmacology of non-steroidal anti-inflammatory drugs: a review. Antiinflamm Antiallergy Agents Med Chem 2012; 11: 52-64.

8.Sara Delgadillo Barrera , Lilia Jadith Bernal Cepeda , Jaime Eduardo Castellanos Parra. The importance of cyclooxigenase in dentistry: a narrative review. Braz J Oral Sci. 2024;23:e241181:1-19.

9.Yuan C, Sidhu RS, Kuklev DV, Kado Y, Wada M, Song I, Smith WL. Cyclooxygenase Allosterism, Fatty Acid-mediated Cross-talk between Monomers of Cyclooxygenase Homodimers. J Biol Chem. 2009;284:10046–10055.

10.Dubois RN, Abramson SB, Crofford L, Gupta RA, Simon LS, Van De Putte LB. Cyclooxygenase in biology and disease. FASEB J. 1998 Sep;12(12):1063-73-84.

11.Simmons DL, Botting RM, Hla T. Cyclooxygenase isozymes: the biology of prostaglandin synthesis and inhibition. Pharmacol Rev. 2004 Sep;56(3):387-437.

12. Peter Tschoppe , Andrej M Kielbassa. The role of COX-2 in dentistry. Past or future?. Schweiz Monatsschr Zahnmed . 2006;116(9):880-6.

13. StatPearls – Aspirin. Available from: https://www.ncbi.nlm.nih.gov/books/NBK549782/.Last accessed on 13th Jan 2024.

14. Medscape.Nonsteroidal Anti-Inflammatory Drug (NSAID) Classes. Available from: https://emedicine.medscape.com/article/2172136-overview.Last accessed on 13th Jan 2024.

15.DailyMe-Indomethacin-capsule.

Available from:https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=110aada7-dfe8-4ecf-80c7-4dac8907ad29.

16.GMCH-NonSteroidalAnti-inflammatoryDrugs(NSAIDs).

Avaiable from: https://gmch.gov.in/sites/default/files/documents/NON-STEROIDAL.pdf. Last accessed on 13th Jan 2024.

17.DailyMe-Celecoxib-capsule.

Available from:https://dailymed.nlm.nih.gov/dailymed/lookup.cfm?setid=8d52185d-421f-4e34-8db7-f7676db2a226. Last accessed on 13th Jan 2024.

ISSN: 2583-6129
DOI: 10.55041/ISJEM02112

18.Mechanism of Action of Nonsteroidal Anti-Inflammatory Drugs: IntechOpen.Available from: https://www.intechopen.com/chapters/55279]. Last accessed on 13th Jan 2024.

19.StatPearls-COX-2Inhibitors.

Avaialable from: https://www.ncbi.nlm.nih.gov/books/NBK556012/].Last accessed on 13th Jan 2024.

20.[DailyMed-Celecoxib-capsule.

Available from:https://dailymed.nlm.nih.gov/dailymed/lookup.cfm?setid=8d52185d-421f-4e34-8db7-f7676db2a226]. Last accessed on 13th Jan 2024.

21. Oral and Maxillofacial Surgery Secrets (7th Edition). St. Louis, MO: Elsevier; 2018. Prosthodontic Management of Maxillofacial Defects, Chapter 81.

22.Hemostasis and Anticoagulation Therapy for Oral and Maxillofacial Surgery: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3184233/].Last accessed on 27th Jan 2024.

23. MedlinePlus - NSAIDs: https://my.clevelandclinic.org/health/treatments/11086-non-steroidal-anti-inflammatory-medicines-nsaids.Last accessed on 25th June 2024.

24.American College of Rheumatology - NSAIDs: http://www.sccg.biz/generalDocuments/NSAID%20Use%20for%20Arthritis.pdf. Last accessed on 25th June 2024.