



Overview of the Effectiveness of Aspirin, Ibuprofen, Acetaminophen On Teeth

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Abstract

The usage of medications like aspirin, ibuprofen and acetaminophen is well-accepted as pain relieving agents worldwide. Aspirin is a medication that is used not only for relieving pain but also for decreasing the risk of heart attack. Acetaminophen and ibuprofen have a significant role in decreasing chronic pain and inflammation. There is a deep connection between the dental procedures and the patients medicine intake. These effects can be known as side effects and damage the natural structure of the tooth or can be any disturbance in dental procedures especially in surgery and tooth extractions. Recognition of common medications and their effects is an important aspect not only for physicians but also for dentists and oral surgeons. The database of this article was derived from valid sources such as PubMed, Google scholar and Web of Science. The search method included the primary keywords like “aspirin”, “ibuprofen” and “acetaminophen” combined with “teeth”, “tooth extraction”, “oral cavity”, “dental procedures”, and/or “bleeding time”. Our results illustrated that a long-term application of aspirin favorably affects the

patients who are suffering from angina, stroke or myocardial infarctions. Other findings confirmed that ibuprofen has antipyretic, analgesic and anti – inflammatory features. Effective characteristics of paracetamol as the medicine of choice for the treatment of post-exodontia pain was demonstrated according to several studies. In this review article we provide details about the effects of the three aforementioned medications, their usage in the dental field and any adverse effects on healthy tooth structures.

Keywords: Aspirin, Ibuprofen, Acetaminophen, Heart Attack, Pain, Dental Procedures, Surgery, Tooth Extraction

Introduction

The nonsteroidal anti – inflammatory drugs (NSAIDs) are categorized as medications which reduce or relieve pain. NSAIDs provide analgesic and antipyretic effects. Analgesic effect means pain killing (as a painkiller), and antipyretic effect means fever reducing effect of this medication. Also in higher doses, NSAIDs can provide anti – inflammatory effects. The anti – inflammatory and analgesic properties work by inhibiting identified isoenzymes of prostaglandin G/H synthase that are known also as cyclooxygenase (COX), that are COX1 and COX2. Aspirin, ibuprofen and naproxen are the most common examples of this group of medications and they are available as over the counter medicines in most countries. The paracetamol that is known as acetaminophen is generally not included in NSAID’s classification because of its low level of activity against inflammation (anti – inflammatory). It can treat pain mainly with blockage of COX-2 mostly in the central nervous system, not much in other parts of the body.

Materials and methods

A literature search was undertaken of international databases (Google scholar, PubMed, and Web of Science) to provide a comprehensive overview of existing research evidence about the interactions between some medications like aspirin, ibuprofen and acetaminophen and their effect on teeth. The search strategy involved the primary keywords like “aspirin”, “ibuprofen” and “acetaminophen” combined with “teeth”, “tooth extraction”, “oral cavity”, “dental procedures”, and/or “bleeding time”. Only papers written in English were included; publication date was not restricted. During the study, care was taken to inspect the dates of papers (for they had the most accurate and updated information possible) and ensured its trustworthiness through the databases referred to. This article generally is a collection and overview of several published articles about the effect and impact of medications like aspirin, ibuprofen and acetaminophen on teeth.

Results

Our results demonstrated that the long-term usage of aspirin effectively influences the patients who are suffering from angina, stroke or myocardial infarctions. Many studies have shown that a low dose of ASA can have an effect on bleeding time while others have shown that there were no effects on bleeding after extraction of teeth.

Another promising finding approved that ibuprofen has antipyretic, analgesic and anti – inflammatory properties and a mixture of acetaminophen and Ibuprofen may reduce tooth sensitivity.

A further novel finding is that the paracetamol has a slight anti-inflammatory property. The results of the studies found clear support for the analgesic feature of paracetamol in the treatment of postoperative dental pain. Superior results are seen for the safe and effective features of the paracetamol as the medicine of choice for the treatment of post-exodontia pain.

Effect of aspirin on teeth

The acetylsalicylic acid (ASA) is known as aspirin as its generic name. It is used as an analgesic, anti-inflammatory, antipyretic and for prevention of platelet aggregation. It is suggested to patients suffering from angina, stroke or myocardial infarctions, to use aspirin for the long term. Many studies have proved bleeding associated with ASA (Anonymous, 2002).

The ASA suppresses the assembly of prostaglandin (PG) and thromboxane (Thx) by the inactivation of cyclooxygenase enzyme. Additionally it blocks Thx A2 leading to a defect in platelet aggregation. The function in platelets results in reduction of the incidence of embolism. The Antiplatelets Trialists' Collaboration in an exceedingly meta-analysis of 135,000 patients in around 300 studies has shown the prophylactic effect of ASA on patients who have suffered from myocardial infarct, angina or stroke, which the vascular events were reduced by 20–25% and mortality reduced by 12% (Antiplatelets Trialists' Collaboration, 1994). The effect of aspirin on platelets is calculated by bleeding time. Many studies have shown that a low dose of ASA can have an effect on bleeding time (Yokoyama et al., 2008; Marshall et al., 1997). However, others have shown that there were no effects on bleeding after extraction of teeth (Krishnan et al., 2008).

The investigated dental extraction in three groups, Group 1 patients stopped the use of aspirin before dental extraction, Group 2 continued aspirin during the dental extraction and Group 3 did not use aspirin. They found that no significant differences in bleeding time were evident among all three groups and they recommended that patients should continue taking ASA during dental extraction (Krishnan et al., 2008).

Discontinuing the use of ASA before dental extraction was also investigated and they recommended that the use of ASA did not have to be

discontinued before dental extraction (Aframian et al. 2007). Although the effects of aspirin on the oral mucosa are well-documented, there is little documentation of the effects of aspirin-chewing on the enamel and dentin. The common factor in these cases is that aspirin was the only possible cause of the tooth erosion. Dentists should be aware of the effects of aspirin-chewing on tooth structure and advise their patients accordingly. The aspirin is a common, chronically administered preventive treatment for cardiovascular disease, but is often discontinued prior to invasive dental procedures because of concern for bleeding complications. We hypothesized that aspirin does not cause increased bleeding following a single tooth extraction. Thirty-six healthy persons requiring a tooth extraction were randomized to receive 325 mg/day aspirin or placebo for 4 days. Cutaneous bleeding time (BT) and platelet aggregation tests were obtained prior to extraction. The primary outcome measure, oral BT, and secondary bleeding outcomes were evaluated during and following extraction. No significant baseline differences, except for diastolic blood pressure, were found between groups. There were no differences in oral BT, cutaneous BT, secondary outcome measures, or compliance. Whole-blood aggregation results were significantly different between the aspirin and placebo groups. These findings suggest that there is no indication to discontinue aspirin for persons requiring single-tooth extraction.

Effect of Ibuprofen on teeth

The odontogenic pain can be caused by release of inflammatory mediators or noxious physical stimuli. The hydrodynamic theory is the most widely known theory that explains tooth sensitivity. This theory expresses that some kinds of rapid movement of fluids that are found in the dentinal tubules, and following stimulus application, results in the activation of sensory nerves in the inner dentin part of the tooth or in the pulp. The physical stimuli can activate nociceptors on dentinal tubules, leading to the dental pain perception. Inflammatory mediators can depolarize or sensitize the nociceptors on pulpal tissue.

This process includes two major groups of enzymes: lipoxygenases and cyclooxygenases (COX). The COX pathway induces prostaglandins production, known as an essential role for the pathogenesis of pulpal disorder. The involvement of prostanoids directly in some kinds of pulpal pain was proposed especially when the intravenous (IV) administration of NSAIDs (non – steroidal anti – inflammatory drugs), that are known to stop and block the pathway of COX, resulted in the inhibition of nerve stimulation activity in cat pulp significantly (Hargreaves et al., 2002).

Discoloration of teeth varies in appearance, etiology, severity, localization and adherence level of tooth structure. After eruption of tooth, pulp necrosis and

aging are considered as the main reasons of intrinsic discoloration. Tea, coffee, red wine, oranges, carrots and tobacco can also give rise to the extrinsic stain (Hattab et al., 1999; Watts et al., 2001). Although the polishing and scaling of teeth can remove many extrinsic stains, the results may not be satisfactory. For treatment of discolored teeth, vital tooth bleaching can be considered as a highly successful and non – invasive method (Christensen, 1998).

There are different methods for vital bleaching of teeth, but the basic approaches consist of mass market bleaching products, dentist – supervised bleaching of night guard and power or in – office bleaching (Al Shethri et al., 2003).

The tooth sensitivity and gingival irritation are considered as the most common side effects related to vital tooth bleaching (Tam, 1999).

Currently, inflammatory mediators can play a vital role in external tooth bleaching, but as it is understood, the mechanisms of sensitivity of teeth especially after external bleaching of teeth have not been determined completely. Some studies and researches have attempted evaluating the histology of pulp after bleaching, but with opposite results. The damages that are related to structural pulp were not perceived in human premolars which were exposed to 35 percent hydrogen peroxide in vivo that had been submitted and extracted for some kinds of histological evaluation 30 days after exposure (Robertson et al., 1980).

Ibuprofen is an NSAID which inhibits COX, thus inhibiting prostaglandin synthesis. There are two different types of cyclooxygenase (considered as COX-1 and COX-2). Ibuprofen inhibits both of them (COX 1 and COX 2). It is obvious that Ibuprofen's antipyretic, analgesic and anti – inflammatory activity is principally achieved through the inhibition of COX – 2.

The NSAID category of medications is widely used as the pre – medication for in – office treatment of bleaching in some dental practices and also unpublished data from an experiment clinically recommended that a combination of acetaminophen and Ibuprofen may decrease sensitivity of tooth from in – office bleaching (Charakorn et al., 2009).

Effect of acetaminophen on teeth:

N-acetyl-p-aminophenol is the chemical name for paracetamol (acetaminophen), which is used as an antipyretic and analgesic. It is a nonopioid analgesic with antipyretic properties and is efficient in pain relief with a low risk of side effects (Moore et al., 1986). It is one of the most widely used analgesics, and it is available without prescription all around the world. The analgesics such as paracetamol (acetaminophen) and ibuprofen are administered and used to treat postoperative third molar pain (Coulthard et al., 2014). In cases that other nonsteroidal anti-inflammatory drugs (NSAIDs)

aren't appropriate, paracetamol is the analgesic of choice. For the treatment of post-exodontia pain, paracetamol is a safe and effective medicine.

Paracetamol (acetaminophen) is commonly associated with the nonsteroidal anti-inflammatory drugs (NSAID) family, and is known to have a minor anti-inflammatory effect (Rang, 2003). The suppression of prostaglandin production by the enzyme cyclo-oxygenase is believed to be the primary mechanism by which NSAIDs generate analgesia (Malmberg et al., 1992). The exact mechanism of action is still unknown. Paracetamol is considered to be a selective inhibitor of the newly discovered COX-3 enzyme, a cyclo-oxygenase-1 variation, in the central nervous system, according to many studies. This inhibition could be the main mechanism by which paracetamol reduces pain and probably temperature (Chandrasekharan et al., 2002).

There is a considerable body of research which shows that paracetamol suppresses cyclo-oxygenase by lowering the cyclo-oxygenase enzyme's high oxidative state and oxygen radical co-substrates (Aronoff et al., 2006).

In a variety of clinical studies, paracetamol has been found to be an effective analgesic in the treatment of postoperative dental pain (Kiersch et al., 1994). Since pain intensity after third molar surgery is considered to reach its peak between 3 and 5 hours after surgery, this pain model is used to assess the effectiveness of a single analgesic dose (Fisher et al., 1988).

According to a study, paracetamol at a dosage of 500 mg three times a day (1.5 g) is enough to achieve consistent pain control following exodontia as long as the surgical stress to the tissues is limited. The findings of this study are based on cases when elective orthodontic extractions were performed without the presence of an infection (Deshpande et al., 2014).

The outcomes of research involving a wide variety of forms of surgery, such as inguinal hernia surgery, caesarean section, orthopaedic surgery, and wisdom tooth removal, were used to determine the efficacy and safety of paracetamol (Toms et al., 2008; Derry et al., 2009).

The patients with toothaches frequently utilize paracetamol to relieve acute dental pain.

While acetaminophen is safe when used as directed, it can cause serious side effects such as liver failure and damage if taken in excessive amounts. Patients with dental discomfort are known to abuse nonprescription analgesics, according to a previous study. The patients with dental pain had a higher rate of non-prescription analgesic overuse, and acetaminophen is commonly used to treat dental pain, so we assumed that patients with dental pain may be at a higher risk of unintentional acetaminophen overdose than patients taking acetaminophen for other reasons. Patients with dental pain should be asked about their analgesic use and instructed on how to use non-prescription analgesics safely (Vogel et al., 2011). However, so far just one

study has looked at paracetamol in connection to third molar removal discomfort after surgery (Weil et al., 2007).

The most relevant comparison was between 400 mg of ibuprofen and 1,000 mg of paracetamol, as these are the most regularly administered amounts in clinical practice.

Weil et al. (2012) investigated 2048 individuals (1148 of them were given paracetamol and 892 were given a placebo) and found that paracetamol provided statistically significant pain alleviation and pain severity at both 4 and 6 hours when compared to placebo.

The number of patients who reported adverse effects was not statistically significant, with overall 19% in the paracetamol group and 16% in the placebo group (Weil et al., 2007).

Abbreviations:

NSAIDs: nonsteroidal anti – inflammatory drugs

ASA: acetyl salicylic acid

PG: prostaglandin

THX: thromboxane

BT: bleeding time

COX: cyclooxygenases

IV: intravenous

Conclusion

This overview of recently published related articles shows the importance of knowing side effects of common medications that are frequently used by the patients and their effects on tooth structure and their role in surgical procedures. The dosage of antiplatelets like aspirin must be controlled before the tooth extraction and surgical dental procedures because it can cause non-stop bleeding which is dangerous for the body. There is a significant role of ibuprofen in dentistry not only for its pain relieving effect, but also for its effect of color changing of the tooth and clinical bleaching. The acetaminophen is also an effective analgesic which is mostly used as the painkiller specially after dental procedures. There are many similarities between the ibuprofen and acetaminophen but both are so common medications with varied effects on the body and tooth. In our future research we would like to go more through details in microscopic changes in teeth which were caused by these three medications.

References:

1. Aframian, D.J., Lalla, R.V. and Peterson, D.E., 2007. Management of dental patients taking common hemostasis-altering medications. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*, 103, pp.S45-e1.

2. Al Shethri, S., Matis, B. A., Cochran, M. A., Zekonis, R., & Stropes, M. (2003). A clinical evaluation of two in-office bleaching products. *Oper Dent*, 28(5), 488-95.
3. Anonymous, 2002. Drug Information for Health Care Professionals. United States Pharmacopeia Drug Information, vol. 1. 22nd ed., Greenwood Village Co., Micromedex, 2002, p. 2591.
4. Aronoff, D.M., J.A. Oates, and O. Boutaud, New insights into the mechanism of action of acetaminophen: its clinical pharmacologic characteristics reflect its inhibition of the two prostaglandin H 2 synthases. 2006.
5. Bushra, R. and Aslam, N., 2010. An overview of clinical pharmacology of Ibuprofen. *Oman medical journal*, 25(3), p.155.
6. Chandrasekharan, N.V., Dai, H., Roos, K.L.T., Evanson, N.K., Tomsik, J., Elton, T.S. and Simmons, D.L., 2002. COX-3, a cyclooxygenase-1 variant inhibited by acetaminophen and other analgesic/antipyretic drugs: cloning, structure, and expression. *Proceedings of the National Academy of Sciences*, 99(21), pp.13926-13931.
7. Charakorn, P., Cabanilla, L. L., Wagner, W. C., Foong, W. C., Shaheen, J., Pregitzer, R., & Schneider, D. (2009). The effect of preoperative ibuprofen on tooth sensitivity caused by in-office bleaching. *Operative dentistry*, 34(2), 131-135.
8. CHRISTENSEN, G. J. (1998). Bleaching teeth: report of a survey, 1997. *Journal of Esthetic and Restorative Dentistry*, 10(1), 16-20.
9. Collaborative overview of randomised trials of antiplatelet therapy--I: Prevention of death, myocardial infarction, and stroke by prolonged antiplatelet therapy in various categories of patients. *Antiplatelet Trialists' Collaboration*. 1994. *BMJ.*; 308(6921):81-106.
10. Coulthard, P., E. Bailey, and N. Patel, Paracetamol (acetaminophen) for pain after oral surgery. *Oral Surgery*, 2014. 7(2): p. 81-86.
11. Derry, C., Derry, S., Moore, R. A., & McQuay, H. J. (2009). Single dose oral ibuprofen for acute postoperative pain in adults. *The Cochrane database of systematic reviews*, 2009(3), CD001548.
12. Fisher, S.E., Frame, J.W., Rout, P.G. and McEntegart, D.J., 1988. Factors affecting the onset and severity of pain following the surgical removal of unilateral impacted mandibular third molar teeth. *British dental journal*, 164(11), pp.351-354.
13. Hargreaves KM. Pain mechanisms of the pulpodentin complex. *Seltzer and Bender's Dental Pulp*. Carol Stream, IL: Quintessence Publishing Co, Inc. 2002:188-94.

14. Hattab, F. N., Qudeimat, M. A., and AL-RIMAWI, H. S. (1999). Dental discoloration: an overview. *Journal of Esthetic and Restorative Dentistry*, 11(6), 291-310.
15. Kiersch, T., S. Halladay, and P. Hormel, A single-dose, double-blind comparison of naproxen sodium, acetaminophen, and placebo in postoperative dental pain. *Clinical therapeutics*, 1994. 16(3): p. 394-404.
16. Krishnan B, Shenoy NA, Alexander MJ *Oral Maxillofac Surg*. 2008 Oct; 66(10):2063-6.
17. Malmberg, A.B. and T.L. Yaksh, Antinociceptive actions of spinal nonsteroidal anti-inflammatory agents on the formalin test in the rat. *Journal of Pharmacology and Experimental Therapeutics*, 1992. 263(1): p. 136-146.
18. Marshall P.W., Williams A.J., Dixon R.M., Growcott J.W., Warburton S., Armstrong J., Moores J. A comparison of the effects of aspirin on bleeding time measured using the simple method and closure time measured using the PFA-100 in healthy volunteers. *British Journal of Clinical Pharmacology*. 1997;44:151–155.
19. Moore, P.A., Werther, J.R., Seldin, E.B. and Stevens, C.M., 1986. Analgesic regimens for third molar surgery: pharmacologic and behavioral considerations. *The Journal of the American Dental Association*, 113(5), pp.739-744.
20. Robertson, W. D., & Melfi, R. C. (1980). Pulpal response to vital bleaching procedures. *Journal of endodontics*, 6(7), 645-649.
21. Tam, L. (1999). The safety of home bleaching techniques. *Journal (Canadian Dental Association)*, 65(8), 453-455.
22. Toms, L., McQuay, H. J., Derry, S., & Moore, R. A. (2008). Single dose oral paracetamol (acetaminophen) for postoperative pain in adults. *The Cochrane database of systematic reviews*, 2008(4), CD004602.
23. Watts, A.M. and Addy, M., 2001. Tooth discoloration and staining: a review of the literature. *British dental journal*, 190(6).
24. Weil, K., Hooper, L., Afzal, Z., Esposito, M., Worthington, H. V., Van Wijk, A. J., & Coulthard, P. (2008). Paracetamol for pain relief after surgical removal of lower wisdom teeth. *Australian Dental Journal*, 53(2), 184-185.
25. Yokoyama T., Yamasaki F., Yamashita K., Manabe M., Suwa K. Bleeding time prolonged by daily low dose aspirin is shortened by one medium dose aspirin. *Acta Anaesthesiologica Scandinavica*. 2008;52:1126–1130.

