EXPLORING ASPIRIN'S EXPANDED ROLE IN DENTISTRY BEYOND PAIN ALLEVIATION

Anukriti Kumari

Intern, School of Dental Sciences, Sharda University, Greater Noida, India, Orcid id - Orcid id – 0009-0001-8434-741X.

Ritik Kashwani

BDS, Private Practitioner, Ex-Junior Resident, School of Dental Sciences, Sharda University, Greater Noida, 201310, Orcid Id -0009-0008-8922-7522.

Sarabpreet Kaur

Oral and Maxillofacial surgery (MDS), Sri Guru Ram Das Institute of Dental Sciences and Research, Amritsar, Punjab, India

Shivansh Shekhar

MDS, Private Practitioner, Oral and Maxillofacial Surgeon, Patna , Bihar, India , 0000-0001-7313-1472

Shweta Sharma

MDS, Conservative Dentistry and Endodontics, Private Practitioner and Ex-Reader, Inderprastha Dental college, Ghaziabad, Uttar Pradesh

Sumana Kumar

Department of Microbiology, School of Life Sciences, JSS Academy of Higher Education &Research, Mysuru, India. Orcid id - 0000-0003-2482-439X

Corresponding Author - Ritik Kashwani

ABSTRACT:

Aspirin, a widely recognized medication acclaimed for its pain relief and anti-inflammatory properties, holds considerable importance within dental practice due to its influence on platelet function. Its ability to induce prolonged platelet impairment and subsequent extension of bleeding duration prompts significant considerations regarding its management before dental procedures, notably tooth extraction. The intricate balance between aspirin's antiplatelet effects and the risk of bleeding complicates decisions concerning its discontinuation, particularly when considering the potential for thromboembolic events following its cessation. This review meticulously examines how aspirin operates on platelet function, emphasizing its irreversible inhibition of COX-1, a pivotal factor in maintaining equilibrium between thromboxane A2 (TXA2) and prostaglandin I2

(PGI2). Synthesizing professional opinions and studies advocating for the continuation of aspirin therapy before dental extractions, the review underscores minimal bleeding risks while highlighting the heightened dangers associated with discontinuation. The discussion delves into the challenges of managing bleeding risks in dental procedures for patients undergoing aspirin therapy and underscores the potential grave consequences linked to sudden aspirin cessation. The review explores strategies aimed at mitigating bleeding risks, emphasizing the delicate balance required to address bleeding concerns without compromising cardiovascular health. This comprehensive exploration navigates the nuanced considerations surrounding aspirin therapy in the context of dental extractions. It amalgamates scientific insights, clinical findings, and professional recommendations to provide a holistic perspective for informed clinical decision-making.

Keywords: Aspirin, Bleeding , Platelet function , Dental extractions

INTRODUCTION:

Acetylsalicylic acid, commonly known as aspirin, stands as a versatile medication with widespread applications. Though it is renowned for its effectiveness in pain relief and anti-inflammatory functions, aspirin plays a noteworthy role in the realm of dentistry [1]. Dentists routinely integrate aspirin into their treatment strategies to tackle diverse dental conditions and alleviate associated symptoms [2]. Aspirin is known to induce a prolonged functional impairment in platelets, resulting in a clinically detectable extension of bleeding time [3]. Concerns about the potential risk of uncontrolled bleeding frequently led medical practitioners to advise discontinuation of aspirin intake for a period of seven to ten days before undertaking any surgical procedure [4]. One such routine procedure is dental extraction, a commonly performed intervention under local anesthesia, aimed at the removal of diseased, redundant, or problematic teeth. Teeth mortality is more prevalent in individuals aged 35 to 64 years [5]. Notably, patients who are prescribed aspirin face an elevated risk of bleeding, even during routine dental extractions. Nevertheless, individuals receiving aspirin therapy to prevent blood clot formation may face the risk of emboli formation if the treatment is discontinued [6] . The ongoing deliberation regarding whether to halt or continue aspirin usage before minor surgical procedures, including a straightforward dental extraction, poses a significant concern for both patients and dental practitioners [7]. This article aims to explore the rationale behind the decision to discontinue aspirin during tooth extraction. Aspirin operates by impeding platelet aggregation, a fundamental action outlined in the prostanoid hypothesis that underscores the delicate equilibrium between thromboxane A2 (TXA2) and prostaglandin I2 (PGI2) [8]. TXA2, primarily from platelets, fosters platelet aggregation and robust vasoconstriction, while PGI2, derived from endothelial cells, inhibits platelet aggregation and induces vasodilation. The synthesis of TXA2 involves converting arachidonic acid to prostaglandin H2, catalyzed by the enzyme cyclooxygenase type 1 (COX-1 or prostaglandin H-synthase 1). Vascular endothelial cells produce PGI2 using the cyclooxygenase type 2 (COX-2) enzyme. Although COX-2 exists in platelets, its presence is relatively lower compared to COX-1. Both COX-1 and COX-2 contribute to regulating vasoconstriction-vasodilation and platelet

Acta Biomed 2024; Vol. 95, N. 1: ISSN: 0392-4203 | eISSN: 2531-6745

aggregation, and their activities are differentially influenced by aspirin, nonsteroidal anti-inflammatory drugs (NSAIDs), smoking, and various conditions characterized by heightened platelet turnover, such as immune thrombocytopenia and peripheral blood stem disorders [10]. Aspirin irreversibly inhibits platelet function by selectively acetylating the COX-1 enzyme in humans, a process persisting for up to 10 days, covering the platelet's entire lifespan. This irreversible inactivation occurs by binding to the enzyme's catalytic pocket, particularly at the arginine 120 residue, leading to the acetylation of the serine 529 residue [11]. This acetylation disrupts the usual interaction between arachidonic acid and tyrosine 385, impeding the initial step in cyclooxygenation. COX-1 is synthesized at every stage of platelet maturation during human megakaryocytopoiesis and remains noninducible in mature platelets (FIGURE 1) [12]. Conversely, newly formed platelets possess COX-2, which becomes inducible under conditions linked to increased platelet turnover and coronary bypass surgery. Aspirin demonstrates a notably higher inhibitory potency, about 150- to 200-fold, towards the constitutive enzyme COX-1 compared to the inducible COX-2 isoform. COX-1 exhibits heightened sensitivity to lower aspirin doses, specifically within the 40-80 mg daily range. Complete inactivation of platelet COX-1 and maximal inhibition of collagen-induced platelet aggregation occur at a daily dosage of 160 mg aspirin, extending antithrombotic efficacy up to 320 mg daily. Consequently, aspirin displays maximum antithrombotic effectiveness at considerably lower doses than required for its anti-inflammatory and analgesic functions. In contrast, inhibition of COX-2 is only achieved at higher doses necessary for analgesic or anti-inflammatory effects [13]. Thus, low-dose aspirin (40 to 320 mg) effectively inhibits platelet aggregation without impeding PGI2's function or vasodilating effects. Doses surpassing 320 mg daily may diminish antithrombotic efficacy due to prostacyclin production inhibition [14].

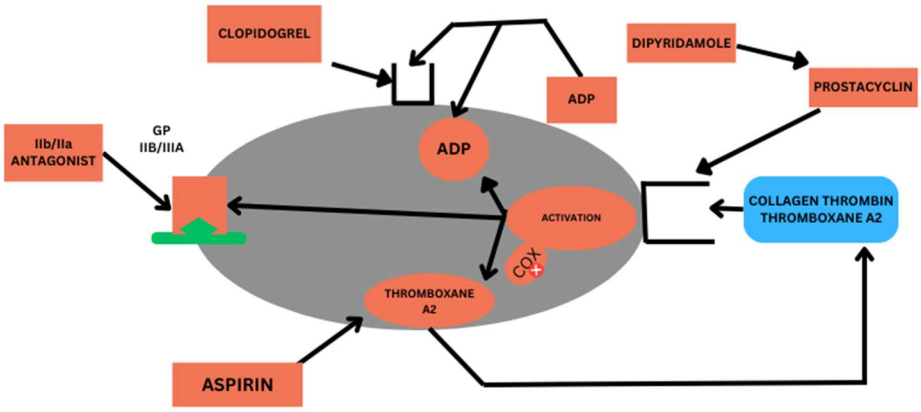

FIGURE 1: ANTIPLATET ACTION OF ASPIRIN

Several key points can be discussed regarding the role of aspirin in dental surgery:

Bleeding Risk Management:

Platelet Function and Bleeding: Aspirin is an antiplatelet medication that inhibits the formation of blood clots by reducing platelet aggregation. This can pose a challenge in dental surgery, where bleeding is a common concern, especially during extractions.

Local Hemostatic Measures: To manage bleeding, various local hemostatic measures are employed, including suturing, cauterization, and pressure application. These techniques aim to minimize bleeding complications during and after dental procedures [15].

Risks of Discontinuation:

Thromboembolic Events: The traditional approach involved discontinuing aspirin prior to dental surgery to reduce bleeding risk. However, emerging evidence

suggests that abrupt cessation may lead to a rebound phenomenon, increasing the risk of thromboembolic events such as myocardial infarction and stroke [16, 17].

DISCUSSION

Canigral et al. conducted a study on patients undergoing various dental extractions while on antithrombotic therapy, which included aspirin, clopidogrel, their combination, NSAIDs, or LMWH. Their findings indicated that in 92% of cases, bleeding ceased within 10 minutes with pressure alone, while only 8% of moderately bleeding cases necessitated local hemostatic measures [18]. In a comprehensive literature review, Brennan et al. recommended the continuous use of aspirin during dental extractions, citing studies with robust evidence. Gaspar et al. concluded that oral surgical procedures in patients receiving aspirin therapy did not present significant hemostatic challenges, advocating for the uninterrupted continuation of aspirin pre-procedure [19]. The Oral Medicine and Oral Surgery Francophone Society, after reviewing literature and expert consensus, discouraged interrupting antiplatelet therapy before dental procedures, emphasizing minimal bleeding risks and the efficacy of local hemostatic measures. Recent consensus opinions from major medical and dental associations, including the American Heart Association, American College of Cardiology, and others, suggested either maintaining aspirin and clopidogrel therapy during minor oral surgical procedures for coronary artery stent patients or postponing treatment until completing the prescribed medication regimen [5]. Matocha highlighted the infrequent occurrence of bleeding post-dental extractions in low-dose aspirin therapy patients, with reported bleeding complications ranging from 0.2% to 2.3%, even when considering other risk factors [20]. Murphy et al.'s survey on dental practitioners revealed that 86% of respondents advising discontinuation of antiplatelet drugs before dental extractions did so after consulting the patient's physician, highlighting potential misalignments between dental protocols and current recommendations for managing patients on antiplatelet drugs and warfarin [21]. Napenas et al.'s retrospective analysis emphasized that the risk associated with discontinuing antiplatelet therapy, leading to potential thromboembolic events, outweighed the minimal bleeding risk from dental procedures, prioritizing thromboembolic prevention during dental interventions [22]. Ardekian et al.'s prospective study assessed post-tooth extraction bleeding risk in individuals taking 100

Acta Biomed 2024; Vol. 95, N. 1: ISSN: 0392-4203 | eISSN: 2531-6745

mg/day aspirin. Hemostasis was achieved in all patients using socket suturing and pressure packs, occasionally employing tranexamic acid for elevated bleeding [23]. Interestingly, bleeding complications occurred in both aspirin-discontinued and continued groups, with comparable incidence, suggesting effective hemostasis with local measures. The study aimed to ascertain if aspirin usage heightened bleeding during or after tooth extraction, hypothesizing no increased bleeding compared to a placebo (TABLE 1).

Study	Key Findings
Canigral et al.	In patients undergoing dental extractions while on antithrombotic therapy (aspirin, clopidogrel, combination, NSAIDs, LMWH), 92% experienced bleeding cessation within 10 minutes with pressure alone. Only 8% of moderately bleeding cases required hemostatic measures.
Brennan et al.	Recommends continuous aspirin use during dental extractions based on robust evidence from multiple studies.
Gaspar et al.	Patients on aspirin therapy undergoing oral surgical procedures did not face significant hemostatic challenges; advocates uninterrupted aspirin use before procedures.
Oral Med. Francophone Soc.	Discourages interrupting antiplatelet therapy before dental procedures, emphasizing minimal bleeding risks and efficacy of local hemostatic measures.
Major Medical Associations	Suggests maintaining aspirin and clopidogrel therapy for coronary artery stent patients during minor oral surgical procedures or postponing treatment until completing the medication regimen.
Matocha	Reports infrequent bleeding post-dental extractions in low-dose aspirin therapy patients, with bleeding complications ranging from 0.2% to 2.3%, even considering other risk factors.
Murphy et al.	86% of dental practitioners advising antiplatelet drug discontinuation before dental extractions did so after consulting the patient's physician, potentially highlighting protocol misalignments.

Napenas et al.	Emphasizes that the risk of thromboembolic events from discontinuing antiplatelet therapy outweighs minimal bleeding risks during dental procedures.
Ardekian et al.	Post-tooth extraction bleeding occurred in both aspirin-discontinued and continued groups, with comparable incidence. Local measures effectively achieved hemostasis in all cases

Patients undergoing oral surgery with platelet function disorders due to medications face an inherent risk of postoperative bleeding, influenced by factors such as the surgical procedure's nature, the severity of platelet dysfunction, and the extent of extraction trauma. Closure challenges in extraction sites further complicate achieving local hemostasis management. Severe hemorrhage or hematoma poses life-threatening risks, including airway obstruction. Preventive measures, such as removing granulation tissues, minimizing trauma, employing techniques like suturing and cauterization, aim to mitigate perioperative and postoperative bleeding risks. However, in patients on aspirin therapy, the potential for bleeding persists due to platelet dysfunction. Traditionally, discontinuing aspirin 7–10 days before invasive procedures was recommended. Yet, literature highlights the increased risk of severe thromboembolic events upon stopping antiplatelet therapy, as platelet function recovers. Abrupt cessation of aspirin results in elevated TXA2 activity and decreased fibrinolytic activity, potentially causing fatal thromboembolic events like myocardial infarction and stroke due to platelet rebound phenomenon. Numerous studies confirm the adverse impact of sudden. The use of aspirin in dental surgery is a topic of significant discussion and consideration due to its potential impact on bleeding risk and the need to balance that with the risk of thromboembolic events.

CONCLUSION

Aspirin, a blood thinner, can increase the risk of bleeding during dental procedures like extractions. However, abruptly stopping aspirin can also pose health risks, especially for individuals taking it for cardiovascular conditions. The guidelines regarding aspirin use before dental extractions may vary based on individual health factors. In the past, there were recommendations to stop aspirin before extractions, but recent guidelines tend to lean toward continuation of aspirin therapy in most cases, even during dental procedures.

Balancing the potential advantages and drawbacks is crucial when deciding whether to proceed with dental treatment while maintaining medication. A comprehensive clinical evaluation of the patient suggests that dental extractions can be conducted safely in individuals undergoing aspirin therapy, thereby mitigating the risk of thrombotic events. Current evidence supports the notion that there is no imperative need to modify or discontinue these medications. Instead, relying on local hemostatic measures proves effective in managing bleeding, affirming the safety of maintaining aspirin therapy during dental procedures.

Acta Biomed 2024; Vol. 95, N. 1: ISSN: 0392-4203 | eISSN: 2531-6745

REFRENCES

1. Aframian, D.J., Lalla, R.V., Peterson, D.E., 2007. Management ofdental patients taking common hemostasis altering medication.Oral Surgery Oral Medicine Oral Pathology Oral Radiology andEndodontics 103, s45.
2. Antiplatelets Trialists' Collaboration, 1994. Collaborative overview of randomised trials of antiplatelet therapy. Prevention of death, myocardial infarction, and stroke by prolonged antiplatelet therapyin various categories of patients. British Medical Journal 308, 81–106.
3. Yokoyama, T., Yamasaki, F., Yamashita, K., Manabe, M., Suwa, K.,2008. Bleeding time prolonged by daily low dose aspirin isshortened by one medium dose aspirin. Acta AnaesthesiologicaScandinavica 52, 1126–1130
4. Amrein PC, Ellman L, Harris WH. Aspirin-induced prolongation of bleeding time and perioperative blood loss. JAMA 1981; 245:1825-8.
5. Gaurav Verma, Dental Extraction Can Be Performed Safely in Patients on Aspirin Therapy: A Timely Reminder https://doi.org/10.1155/2014/463684
6. Mielke CH Jr. Aspirin prolongation of the template bleeding time: influence of venostasis and direction of incision. Blood 1982; 60:1139-42
7. Hennekens CH, Dyken ML, Fuster V. Aspirin as a therapeutic agent in cardiovascular disease: a statement for healthcare professionals from the American Heart Association. Circulation 1997; 96(8):2751-3.
8. Michael T. Brennan, DDS, MHS,a Richard L. Wynn, PhD,b and Craig S. Miller, DMD, MS,c Charlotte, NC, Baltimore, MD, and Lexington, KY. Aspirin and bleeding in dentistry: an update and recommendations. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2007; 104(3):316-23.
9. Ajani UA, Ford ES, Greenland KJ, Giles WH, Mokdad AH. Aspirin use among U.S. adults: Behavioral Risk Factor Surveil- lance System. Am J Prev Med 2006; 30:74-7.
10. Gaspar, L. Ardekian, B. Brenner, M. Peled, and D. Laufer,"Ambulatory oral procedures on low-dose aspirin," Harefuah,vol. 136, no. 2, pp. 108–110, 1999
11. J. R. Sonksen, K. L. Kong, and R. Holder, "Magnitude and timecourse of impaired primary haemostasis after stopping chroniclow and medium dose aspirin in healthy volunteers," BritishJournal of Anaesthesia, vol. 82, no. 3, pp. 360–365, 1999.
12. M. T. Brennan, R. L. Wynn, and C. S. Miller, "Aspirin andbleeding in dentistry: an update and recommendations," OralSurgery, Oral Medicine, Oral Pathology, Oral Radiology andEndodontology, vol. 104, no. 3, pp. 316–323, 2007.

13. M. Dogn´e, X. de Leval, P. Benoit, J. Delarge, B. Masereel, andJ.-L. David, "Recent advances in antiplatelet agents," CurrentMedicinal Chemistry, vol. 9, no. 5, pp. 577–589, 2002
14. Wahl, M. J. (2000). Myths of dental surgery in patients: receiving anticoagulant therapy. The Journal of the American Dental
Association, 131(1), 77-81.
15. Becker, D. E. (2013). Antithrombotic drugs: pharmacology and implications for dental practice. Anesthesia progress, 60(2), 72-80.
16. Owens, C. D., & Belkin, M. (2005). Thrombosis and coagulation: operative management of the anticoagulated patient. Surgical Clinics, 85(6), 1179-1189.
17. Kitchen, L., Erichson, R. B., & Sideropoulos, H.(1982). Effect of drug-induced platelet dysfunction on surgical bleeding. The American Journal of Surgery, 143(2), 215-217.
18. Cañigral A, Silvestre FJ, Cañigral G, Alós M, Garcia-Herraiz A, Plaza A. Evaluation of bleeding risk and measurement methods in dental patients. Med Oral Patol Oral Cir Bucal. 2010;15:e863–8
19. Brennan MT, Wynn RL, Miller CS. Aspirin and bleeding in dentistry: An update and recommendations. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2007;104:316–23.
20. Matocha DL. Postsurgical complications. Emerg Med Clin North Am. 2000;18:549–64
21. Murphy J, Twohig E, McWilliams SR. Dentists' approach to patients on anti-platelet agents and warfarin: A survey of practice. J Ir Dent Assoc. 2010;56:28–31
22. Napeñas JJ, Hong CHL, Brennan MT, Furney SL, Fox PC, Lockhart PB. The frequency of bleeding complications after invasive dental treatment in patients receiving single and dual antiplatelet therapy. Journal of the American Dental Association. 2009;140(6):690–695
23. Ardekian L, Gaspar R, Peled M, Brener B, Laufer D. Does low-dose aspirin therapy complicate oral surgical procedures? Journal of the American Dental Association. 2000;131(3):331–335
24. Rajarao, P. B. V., Murthy, B. S. N., Lavanya, K., Lakshmi, K. C., Praveen, L. S. S. N., & Lokesh, G. S. (2022). Evaluation of Machine Learning Algorithms for the Detection of Fake Bank Currency. Journal of Algebraic Statistics, 13(2), 3680-3688.
25. Raja Rao, P. B. V., & Sharma, N. (2021). Intellectual Routing Mechanism for Improving Qos in Manets for Secure Data Transmission. Turkish Journal of Computer and Mathematics Education (TURCOMAT), 12(6), 4659-4668.
26. Raja Rao, P. B. V. (2021). Enlargement Of Qos Based Hybrid Scheme for Routing Protocol In Manet. Turkish Journal of Computer and Mathematics Education (TURCOMAT), 12(11), 4916-4922.
27. Raja Rao, P. B. V., Prasad, M., Kiran Sree, P., Venkata Ramana, C., & Satyanarayana Murty, P. T. (2022, December). Enhancing the MANET AODV Forecast of a Broken Link with LBP. In International Conference on Intelligent Systems and Sustainable Computing (pp. 51-69). Singapore: Springer Nature Singapore.

28. Rajarao, P. B. V., Murthy, B. S. N., Srikanth, S., Ramanujam, M. G., Gopal, M. S. R. V., Neeraja, M., & Vamsi, K. (2022). Using Deep Learning to Predict Plant Growth and Yield in Greenhouse Environments. Telematique, 3834-3848.
29. Rao, P. R., & Tattikota, M. (2012). An Empirical Method for Multiview Point Clusterization.
30. Krishnaiah, N., Murthy, B. S. N., Satyanarayana, R. V., & Rajarao, P. B. V. (2011). Secured Routing and QoS using DSR in MANET. International Journal of Computer Applications in Engineering Sciences, 1(4).
31. Sree, P. K., Prasad, M., Raja Rao, P. B. V., Ramana, M. C. V., Murty, S., Mallesh, M. A. S., & Raju, M. P. S. A Comprehensive Analysis on Risk Prediction of Heart Disease using Machine Learning Models.
32. Kotaprolu, R. R., & Rajarao, P. B. V. Intelligent and Secured Attribute Based Cloud Data Maintenance with Advanced Searching Scheme.
33. Josphineleela, R., Raja Rao, P. B. V., Shaikh, A., & Sudhakar, K. (2023). A Multi-Stage Faster RCNN-Based iSPLInception for Skin Disease Classification Using Novel Optimization. Journal of Digital Imaging, 1-17.
34. Raja Rao, P. B. V., Prasad, M., Kiran Sree, P., Venkata Ramana, C., & Satyanarayana Murty, P. T. (2022, December). Enhancing the MANET AODV Forecast of a Broken Link with LBP. In International Conference on Intelligent Systems and Sustainable Computing (pp. 51-69). Singapore: Springer Nature Singapore.
35. Pilli, B. V., Nagarajan, S., & Devabalan, P. (2021). Detecting the Vehicle's Number Plate in the Video Using Deep Learning Performance. Review of International Geographical Education Online, 11(5).
36. Raja Rao, P. B. V., & Sharma, N. (2021). Intellectual Routing Mechanism for Improving Qos in Manets for Secure Data Transmission. Turkish Journal of Computer and Mathematics Education (TURCOMAT), 12(6), 4659-4668.
37. Satyanarayana Murty, P. T., Prasad, M., Raja Rao, P. B. V., Kiran Sree, P., Ramesh Babu, G., & Phaneendra Varma, C. (2023, June). A Hybrid Intelligent Cryptography Algorithm for Distributed Big Data Storage in Cloud Computing Security. In International Conference on Multi-disciplinary Trends in Artificial Intelligence (pp. 637-648). Cham: Springer Nature Switzerland.
38. Maddula, P., Srikanth, P., Sree, P. K., Rao, P. B. R., & Murty, P. S. (2023, January). COVID-19 prediction with Chest X-Ray images using CNN. In 2023 International Conference on Intelligent and Innovative Technologies in Computing, Electrical and Electronics (IITCEE) (pp. 568-572). IEEE.
39. Sree, P. K., Chintalapati, P. V., Prasad, M., Babu, G. R., & Rao, P. R. (2023, September). Waste Management Detection Using Deep Learning. In 2023 3rd International Conference on Computing and Information Technology (ICCIT) (pp. 50-54). IEEE.