Effect of Preoperative Anti-inflammatory Drugs and Analgesics on the Success of Inferior Alveolar Nerve Block: A Literature Review.

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Introduction

Obtaining successful anesthesia with an inferior alveolar nerve block (IANB) proves difficult in patients with irreversible pulpitis[1,2,17]. Even though IANB is successful in 85% to 95% of clinical scenarios[9], IANB failure rates have been reported between 43% and 83% due to pulpal changes associated with irreversible pulpitis[17]. Other proposed causes of high failure rates of IANB in patients with irreversible pulpitis include accessory innervations, inaccurate injection techniques, needle deflection and other variables[9]. While many studies have investigated different injection strategies for improved anesthesia[10,18], buccal infiltration and lingual infiltration remain superior as injection techniques[26]. A study by Allegretti et al. showed no significant difference in anesthetic efficacy when using 2% lidocaine, 4% articaine, or 0.5% mepivacaine for patients with irreversible pulpitis[2]. Due to difficulties improving anesthesia in cases of irreversible pulpitis with changes in technique and anesthetic agent, studies suggest that preoperative administration of nonsteroidal anti-inflammatory drugs (NSAIDs) or other anti-inflammatory drugs may be a safe way to increase efficacy of the IANB[5,12,21,26].

Argueta-Figueroa et al. reported an IANB success rate of 64% for symptomatic irreversible pulpitis and 86.9% for asymptomatic irreversible pulpitis[3], suggesting that controlling mediators of pain and inflammation may improve anesthetic results for patients with irreversible pulpitis. Administration of NSAIDs prior to IANB is thought to be beneficial by reducing levels of these inflammatory mediators, such as prostaglandins (PGs) and thromboxane A2, thus resulting in decreased nociceptor activation. The rationale for the use of other anti-inflammatory drugs, such as dexamethasone, is based on the same concept. Dexamethasone suppresses vasodilation, which inhibits the production of PGs through migration and phagocytosis of polymorphonuclear leukocytes[17]. Systematic reviews and meta-analyses support the claim that preemptive analgesics are more effective at increasing success of IANB when compared to placebo[17,21]. However, there is confounding clinical evidence related to the comparisons of different analgesics and their relative efficacy in improving success rates of IANB. This literature review aims to evaluate the efficacy of different anti-inflammatory drugs on the success rate of IANB.

Dexamethasone

Preoperative administration of dexamethasone to increase success rates of IANB is supported by clinical trials, systematic reviews, and meta-analyses[7,17,20]. An early study done in 1989 by Glassman et al. suggests that large doses (12mg) of dexamethasone given over a short time period (4 mg every 4 hours) is effective in reducing endodontic pain between appointments[7]. The result of this clinical trial serves as an initiator for further research into dexamethasone as a premedication to improve pain, more specifically the reduction of pain through improved anesthesia. There is limited literature on the use of preoperative dexamethasone for increasing the success rates of IANB in patients with irreversible pulpitis.

In a network meta-analysis by Pulikkotil et al., dexamethasone ranked first in efficacy in improving success rates of IANB compared to other drugs, such as NSAIDs and acetaminophen[17]. The results of the network meta-analysis confirm those seen in a clinical trial completed by Shahi et al., which demonstrated that dexamethasone had superior improvement of IANB compared to ibuprofen[20]. Another study done by Bidar et al. supports the used of dexamethasone 4mg preoperatively to improve the success of the IANB in patients with irreversible pulpitis. In this same study, there was no significant difference between dexamethasone and ibuprofen as premedication to improve IANB[4].

Non-steroidal anti-inflammatory drugs

There is evidence to both support and contest preoperative ibuprofen to improve the success rate of IANB in patients with irreversible pulpitis. Non-steroidal anti-inflammatory drugs inhibit cyclooxygenase which is responsible for the associated anti-inflammatory effects[24]. A study done by Shahi et. al compared the effects of preoperative administration of dexamethasone, ibuprofen, and placebo on the success of IANB. There was no significant difference between ibuprofen 400mg and placebo[20]. Similarly, Oleson et. al compared the success rate of IANB on patients with irreversible pulpitis after administration of 800 mg ibuprofen or a placebo. The results were 41% success rate with ibuprofen and 35% success rate with placebo, also concluding that there is no significant difference between ibuprofen and placebo[16]. Another study done by Aggarwal et. al compared ibuprofen, ketorolac, and placebo in the success rates of IANB. No significant effect on the success rate of IANB in cases of irreversible pulpitis was noted between these groups. A 29% success rate, 27% success rate, and 39% success rate of IANB was reported for placebo, ibuprofen, and ketorolac, respectively[1].

Despite evidence refuting preoperative administration of NSAIDs for improvement of anesthesia in irreversible pulpitis, NSAIDs ranked second to dexamethasone in efficacy of increase the success rate of IANB in a systematic review and network meta-analysis by Pulikkotil et. al[17]. Moderate evidence exists to support the use of NSAIDs, especially ibuprofen >400mg 1 hour prior to IANB to provide additional anesthesia[11,15]. Doses of ibuprofen <400mg used in studies investigating the effect of preoperative NSAIDs on success rates of IANB may correspond to the ineffectiveness of these treatments observed in some of the studies[15]. Despite this potential explanation, studies using doses >400mg of ibuprofen concur that preoperative ibuprofen shows no significant difference compared to placebo[13,16].

Ketorolac is noted to be more beneficial as an NSAID in cases of severe inflammation due to advantages such as less likelihood for sequelae such as alterations in bleeding time, causation of renal failure, and reactions with combination therapies[24]. These advantages explain the rationale behind studies done comparing this NSAID to others such as ibuprofen. Various clinical trials have reported improved IANB success rates for patients with irreversible pulpitis when premedicated with ketorolac[19,25]. A systematic review and meta-analysis done by Sivaramakrishnan et al. confirmed the results of such clinical trials[24]. In one clinical study by Aggarwal et al., ketorolac was reported to have no significant improvement of the IANB[1].

Acetaminophen

As with NSAIDs, such as ibuprofen, there is evidence that shows no significant difference between acetaminophen and placebo when used preoperatively for improved success rates of IANB in patients with irreversible pulpitis[13,21]. In contrast, clinical studies such as those done by Ianiro et al. report IANB success rates of 71% when premedicated with acetaminophen compared to 46.2% with placebo. This study concludes that premedication groups have significantly higher success rates compared to placebo groups[8]. Acetaminophen doses in these studies range from 325mg to 1000mg, which may explain differences in results. Combination therapy with acetaminophen seems to be the focus of most clinical trials investigating the effect of analgesics on the success rates of IANB in patients with irreversible pulpitis[8,9,13,22,23].

Combination therapy

Preoperative combination therapies involving acetaminophen for improvement of IANB in cases of irreversible pulpitis include ibuprofen 400 mg with acetaminophen 325 mg[13], ibuprofen 800 mg with acetaminophen 1000 mg, and hydrocodone 10 mg with acetaminophen 1000 mg[6]. The majority of clinical trials report no clinical significance with combination therapies that include acetaminophen[6,9,13,22]. Even in combination with centrally-acting agents, acetaminophen has been shown to be ineffective in improving IANB. Modaresi et al. studied the preoperative effect of acetaminophen with codeine on the success rate of IANB in patients with irreversible pulpitis and found no clinical significance when compared to placebo[14]. However, in clinical trials done by Ianiro et al. and Singh et al. the opposite is reported[8,23]. A 71.4% success rate of IANB with ibuprofen with acetaminophen combination therapy compared to 28.5% success rate with placebo is documented[23]. Supporting this evidence is a study that reported similar values, 75.9% success rate of IANB for ibuprofen with acetaminophen versus 46.2% success rate seen with the placebo group[8].

Conclusion

The efficacy of preoperative medication for the improvement of the success rates of IANB in patients with irreversible pulpitis remains unclear. Current literature suggests that more clinical trials are needed to evaluate individual analgesic performance as well as relative performance. Studies that have been done use variations in analgesic dosages, different administration methods, and different analgesics. In addition, differences in operator skill during injection and clinical trial group sizes provides potential explanations for the differing opinions of the efficacy of preoperative analgesics for improvement of the IANB. These discrepancies make it difficult to compile the current literature for the purpose of determining analgesic efficacy in improving the success of IANB. More so, it becomes almost impossible to determine the relative efficacy of various analgesics. With the elucidation of the effects of anti-inflammatory drugs on the success of IANB, further studies of opioid and other centrally-acting agents would be indicated. One clinical trial done by Mahajan et al. reports that Tramadol 50mg shows a significant improvement in the success rate of IANB in patients with irreversible pulpitis compared with NSAIDs such as ibuprofen and combination therapy of ibuprofen and acetaminophen[13]. This suggests a potential for better success rates of IANB with the use of centrally-acting analgesics as premedication.

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