ACUTE INFECTIONS AND LOCAL ANESTHESIA FAILURE- A CORRELATION STUDY

Running title: Association of acute infections and failure of local anaesthesia.

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Abstract

Introduction: Acute dental infections occur mainly when bacteria invade the dental pulp and its surrounding tissues of the tooth. Various acute infections from dental origin include periapical abscess, pericoronal abscess, dentoalveolar abscess, pericoronitis. The most common cause for dental abscesses is dental caries, trauma or poor oral hygiene.

Aim: Our present study aimed to assess the correlation between acute infections and local anaesthesia failure in the patients who underwent surgical extractions.
Materials and methods: The present study was carried out in a private dental hospital in a university setting, Chennai. About n=51 cases of acute infections such as periapical abscess and dentoalveolar abscess cases were collected using the Dental hospital management system.The data collected was verified in excel and statistically analysed using SPSS software version 23.0.
Results: In our present study, a total of 51 cases of acute infections were included. In which 74.5% of periapical abscess and 25.4 % of dentoalveolar infections cases were taken. We analysed and correlated the acute infections; and the amount of local anaesthesia and technique used for the extraction. Out of 51 cases of acute infections, few cases were given 4 ml of local anaesthesia by infiltration technique and inferior alveolar nerve blocks (4%), 2 ml of local anaesthesia given using infraorbital nerve block (4%), 5 ml of anaesthesia was given by infiltration technique (2%).
Conclusion: In our study we observed that in acute infection cases local anaesthesia failed in 6%, which used infiltration and inferior alveolar nerve blocks for extractions. Thus our study has concluded that there is correlation between acute infections and failure of anaesthesia in terms of the amount of local anaesthesia and technique used to treat acutely infected teeth by surgical extractions.

Keywords: Acute infections; local anaesthesia; failure; correlation; innovative technique.

Introduction

Dental infections are relatively typical to diagnose and manage accurately by clinicians. Acute dental infections occur mainly when bacteria invade the dental pulp and its surrounding tissues of the tooth (1). Various acute infections from dental origin include periapical abscess, pericoronal abscess, dentoalveolar abscess, pericoronitis. The most common cause for dental abscesses which includes dental caries, trauma or poor oral hygiene. The management of abscess needs either surgical extraction and endodontic therapy (2). Local anaesthesia contributes to routine clinical practice in dentistry, so profound anaesthesia is important for the success rate for any surgical procedures. The failures in local anesthesia can be attributed to various factors, which includes injection through the intravascular route, on unusual anatomy, bone density, improper technique, presence of inflammation and a quantity of local anaesthesia being used for dental extractions (3). The typical signs and symptoms of localised dental infection elicited are presence of pain in the mouth and jaws, mobility of the tooth, tenderness, swelling and spontaneous drainage of pus at the site of infections ((3,4).

Acute dental infections normally happen when bacteria invade the dental pulp and it's surrounding tooth structures. The radiological indications for tooth-related contamination in the supporting bone are incredibly common in 13% cases which was illustrated in an earlier cross-sectional study (5). In addition to this, infections can also spread regionally and through the blood, causing disseminated infections profoundly in patients who are medically compromised. An acute dental abscess occurs when bacteria invade the pulpal and periradicular tissues (6). This condition is generally precipitated by active dental caries, failure of root canal treatment, chronic infection like periodontitis or trauma (7,8). Acute infection might be limited to the periapical space of the affected tooth, or it will spread to surrounding dentoalveolar bone as well as to delicate tissues. The main concerns for dentists in extracting acutely infected teeth are local anaesthesia failure, dissemination to the adjacent areas or causing infections through hematogenous spread and increased risk of causing alveolar osteitis (9). Other systemic causes of local anaesthesia failure are attributed to those with poorly controlled diabetes, who are at high risk of having dental infections. And presence of inflammation at the site of acute infection actively produces an acidic pH which also interferes with anaesthetic dissociation, as it induces hyperesthetic effect on the patients (10,11).

A clinical study has reported that even if the technique of anaesthesia is correct, the presence of inflammation causes anaesthesia to fail in 30-45% of patients (12). The management of acute dental infections can be treated by the extraction of an infected tooth, root canal treatment and through incision and drainage of pus. A randomised control study has illustrated that acute dental infections responded well in the patients who have undergone surgical procedure, without the administration of antibiotics to the patients (13,14). Several studies have inferred that, in about 88% of cases of extractions, anaesthetic failure occurs in patients who were given inferior alveolar nerve blocks. Few of the clinical studies have evaluated the outcome of anaesthesia in IANB in mandibular molars, it shows that in the majority of cases with pulpitis there is an anaesthetic failure in patients (15),(16). Our research and knowledge have resulted in high-quality publications from our team (17–31)

Thus our present study aimed to assess the correlation between acute infections and local anaesthesia failure in the patients who underwent surgical extractions.

Materials and methods

The present study was carried out in a private dental hospital in a university setting, Chennai. About n=51 cases of acute infections such as periapical abscess and dentoalveolar abscess were collected using the Dental hospital management system. Each case sheet represents the patient's demographic details such as name, age, gender, medical history, examination findings and management provided for the infections. The inclusion criteria for this study consists of the patient's extractions record, in which the amount of local anaesthesia and technique used for surgical extractions of maxillary and mandibular teeth was noted. The validity of data collected was checked by internal and external reviewers by checking the patient's photographs and presence of acute infections in their oral cavity and extractions done to treat the infections. Then all the data collected was tabulated in excel and statistically analysed using SPSS software version 23.0.

Results

In our present study, 51 cases of acute infections were included, out of which 38 cases of periapical abscess and 13 cases of dentoalveolar abscess were taken. All these patients with acute infections were treated with surgical extractions of a tooth. The patients' age ranged from 30-60 years, among 51 patients, the percentage distribution of type of acute infections diagnosed in the patients. It was found to be 74.5% of the patients were diagnosed with periapical abscess and 25.4 % of them with dentoalveolar infections in their oral cavity [Figure 1]. In figure 2, the bar graph represents the different types of local anaesthetic technique used for extraction of maxillary and mandibular teeth with acute infections. It was observed that 36 % of cases were treated using infiltration, 14% with infraorbital nerve block, 6% of cases with posterior superior alveolar nerve block and 44% with inferior alveolar nerve block technique [Figure 2]. In figure 3, the bar graph indicates the amount of local anaesthesia administered in patients who underwent extractions with acute infections. Here, the graph shows that 2ml quantity of local anaesthesia is more significantly used for the patients with acute infections. And only in a few cases of acute infections, 4 ml and 5 ml of local anaesthesia were given [Figure 3]. In figure 4, the bar graph represents the correlation between the acute infections; periapical abscess and dentoalveolar abscess and the amount of local anaesthesia used for the patients. It has been inferred that the majority of patients with acute infections are mostly administered with an average of 2ml of local anaesthesia; 64% in periapical abscess, 21% in dentoalveolar abscess cases, where as 1ml of local anaesthesia was given in periapical abscess cases (3%). In a few of the periapical and dentoalveolar abscess cases, the quantity of local anaesthesia was found to be increased from 4 to 5 ml (7%). However, this is not statistically significant, as the chi-square test; p-value = 0.472; which is $p > 0.05$, hence it is not statistically significant [Figure 4]. In figure 5, the bar graph represents the correlation between the technique of local anaesthesia and the quantity of local anaesthesia used to treat periapical and dentoalveolar abscess. This shows the majority of maxillary and mandibular teeth with acute infections are treated 2 ml of local anaesthesia (38%), 1 ml of local anaesthesia given by infraorbital (2%) and inferior alveolar nerve blocks (2%), 4 ml was given during the extraction by infiltration (2%) and inferior alveolar nerve blocks (4%), 5 ml of local anaesthesia was given by infiltration technique (2%) in maxillary and mandibular teeth [Figure 5].

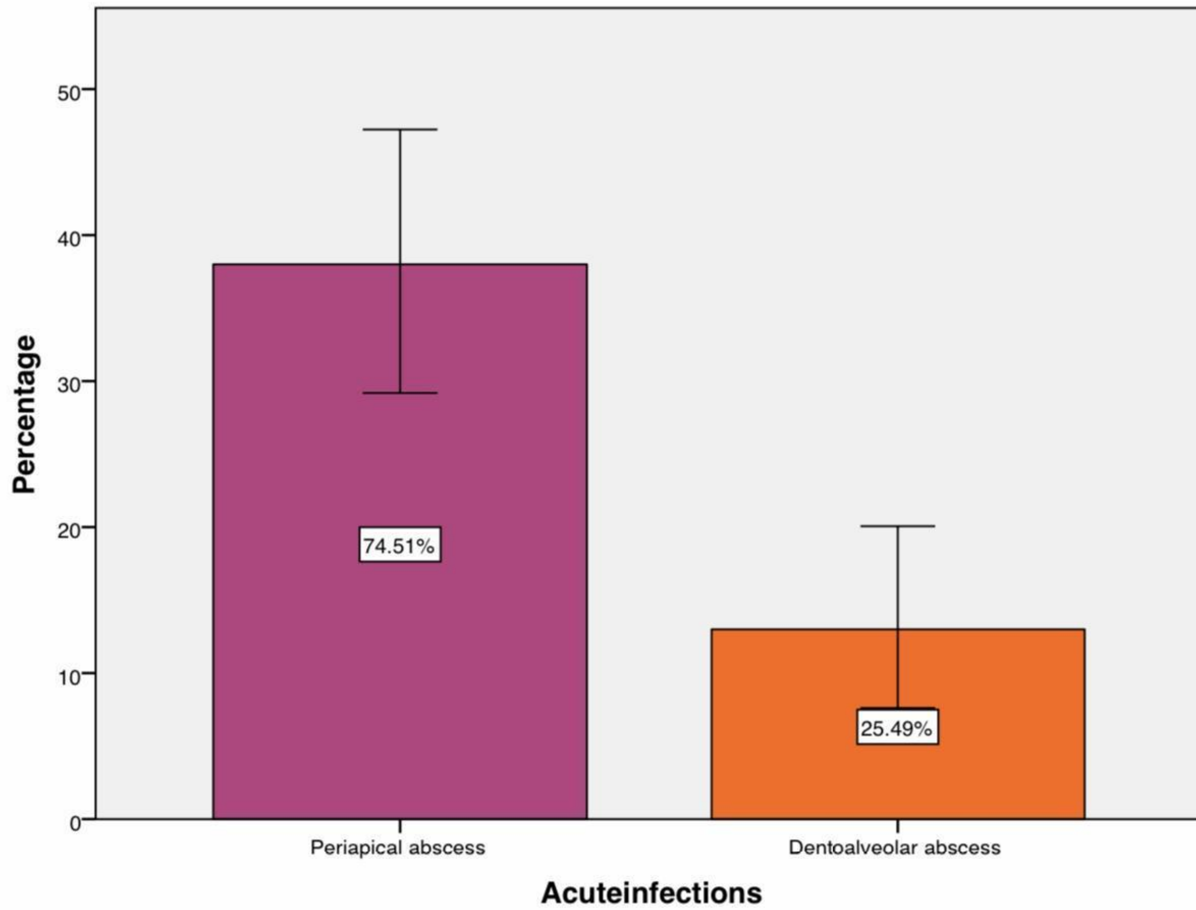

Figure 1: Bar graph represents the percentage distribution of types of acute infections diagnosed in the patients. It shows that 74.5% of the patients were diagnosed with periapical abscess and 25.4 % of them with dentoalveolar infections in their oral cavity.

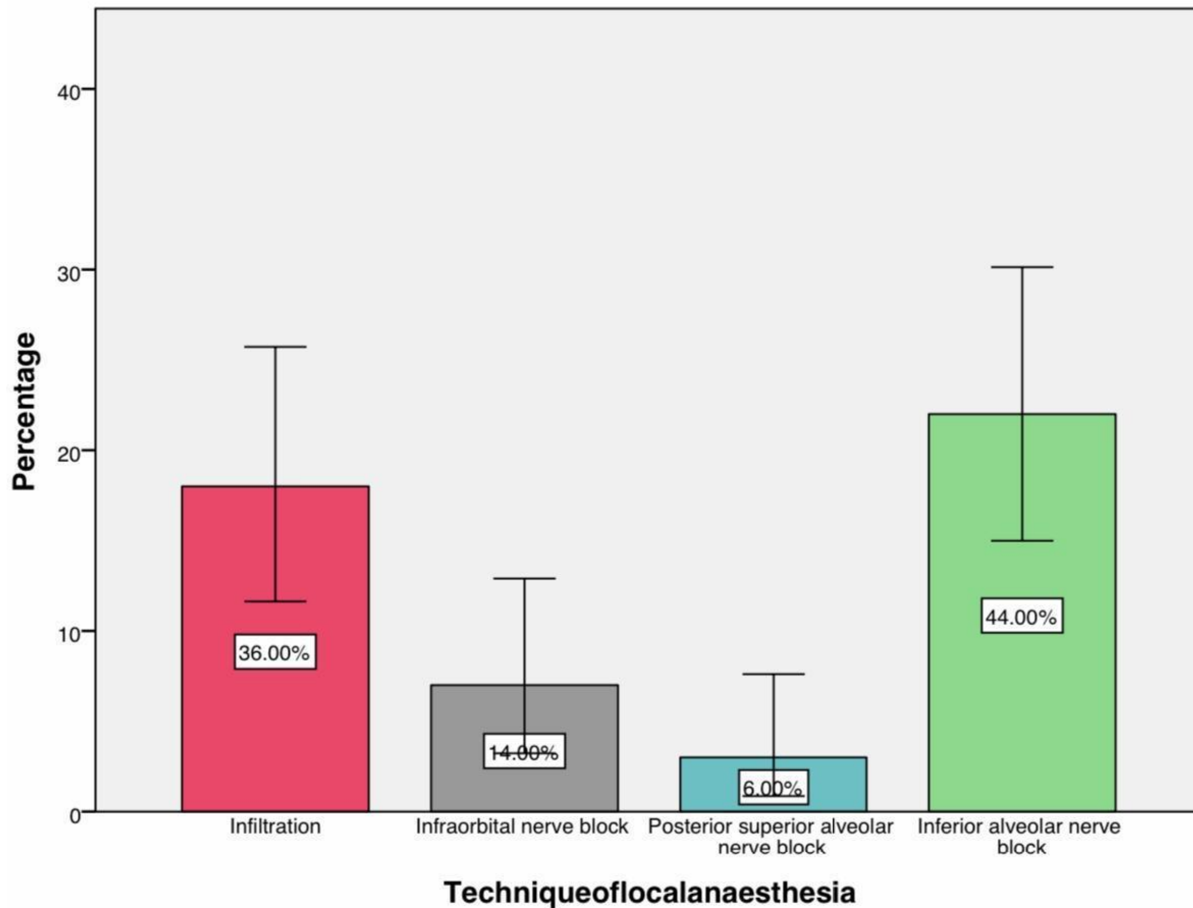

Figure 2: Bar graph represents percentage distribution of local anaesthetic technique used to treat acute infections in patients who underwent extractions. The graph has been plotted with the frequency taken on the scale from 0 to 40 on Y-axis. The X-axis represents the different techniques of maxillary and mandibular anaesthesia used for extractions. In this graph, pink denotes the infiltration technique, grey denotes infraorbital nerve block, blue denotes posterior superior alveolar nerve block and light green denotes inferior alveolar nerve block type of local anaesthetic techniques used for surgical extractions in patients taken for our study.

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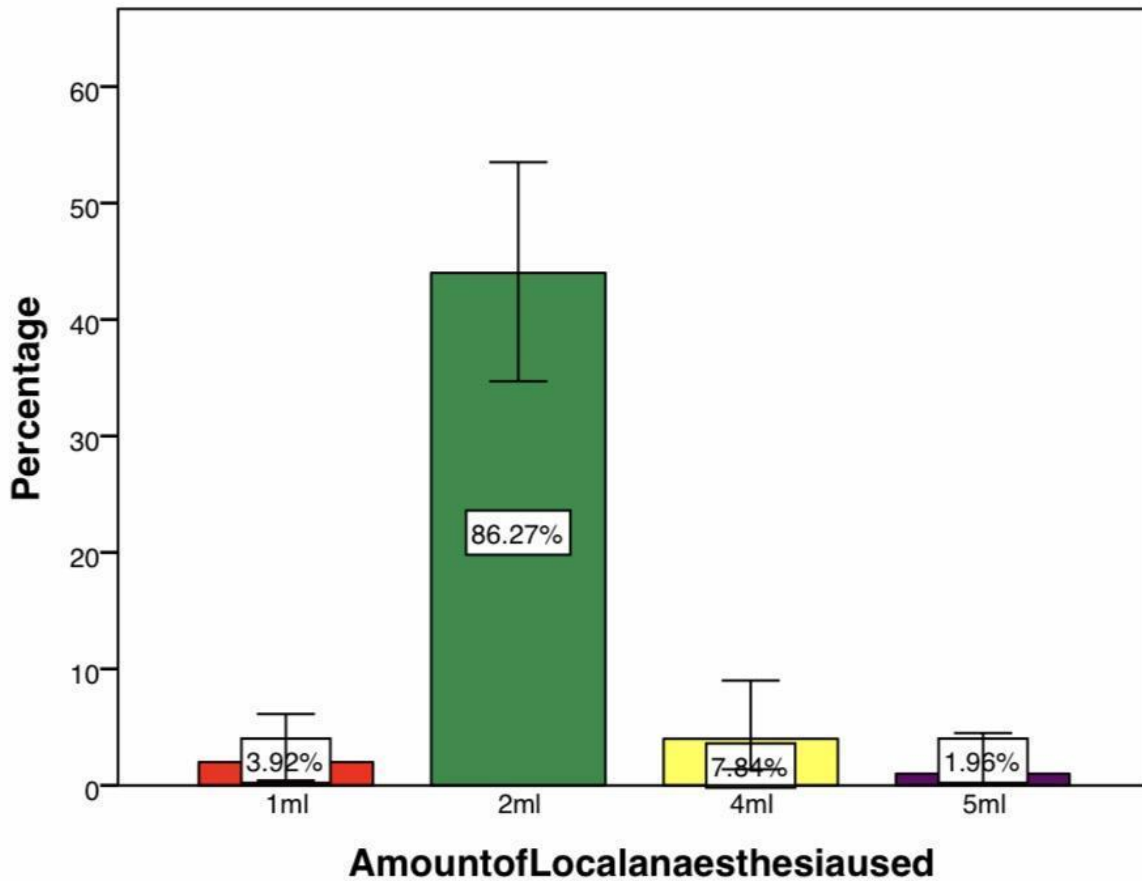

Figure 3 : Bar graph represents percentage distribution of the amount of local anaesthesia used to treat acute infections in patients who underwent extractions. The graph has been plotted with the frequency taken on the scale from 0 to 60 on Y-axis. The X-axis represents the quantity of local anaesthesia used for extractions. In this graph, red denotes the 1ml of local anaesthesia, green denotes 2ml of local anaesthesia and yellow denotes 4ml of local anaesthesia, purple denotes 5 ml of local anaesthesia used for surgical extractions in patients taken for our study. Here, the graph shows that a 2ml quantity of local anaesthesia is more significantly used for patients with acute infections.

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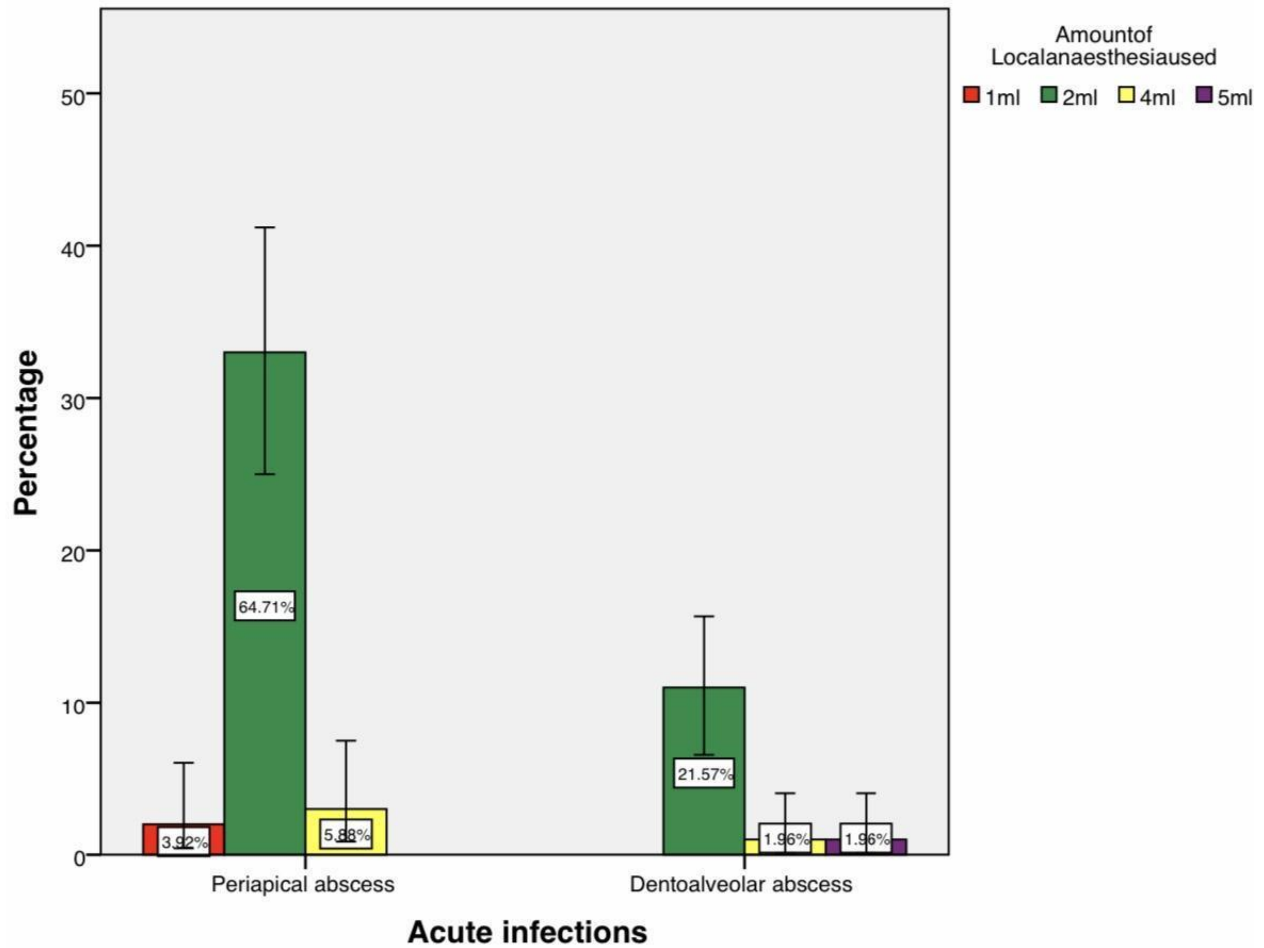

Figure 4: Bar graph represents the correlation between the acute infections; periapical abscess and dentoalveolar abscess and amount of local anaesthesia used for the treatment. The X-axis represents the cases of acute infections taken for our study and Y-axis plotted from the scale as 0 to 50 represents the percentage of local anaesthesia used to treat acute infections by extractions. Here, red denotes the 1ml of LA, green denotes 2ml of local anaesthesia and yellow denotes 4ml of local anaesthesia, purple denotes 5 ml of local anaesthesia used for surgical extractions in patients with acute infections. The Chi-square test; p-value = 0.472 ; which is p > 0.05, hence it shows statistically insignificant. It shows that the majority of patients are administered with 2ml of local anaesthesia and few cases with 4 to 5 ml of local anaesthesia were used in both the acute infection during extractions.

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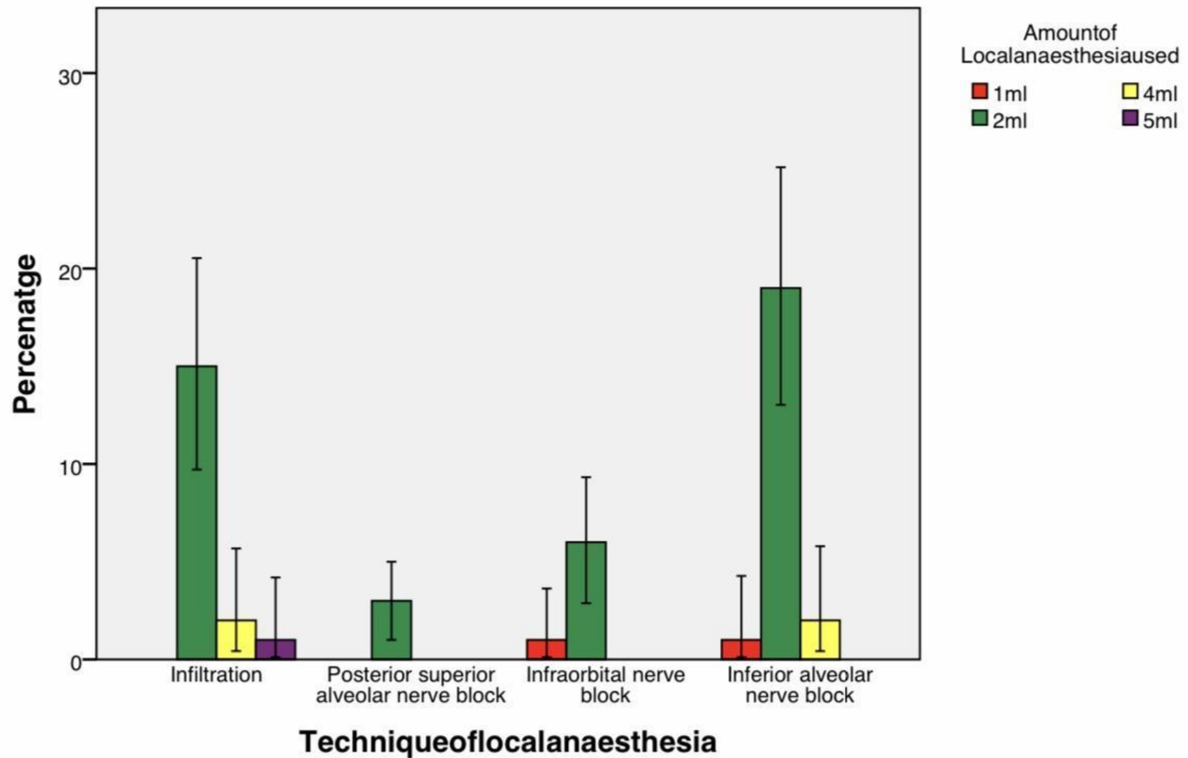

Figure 5: Bar graph represents the correlation between the technique of local anaesthesia ; and the amount of local anaesthesia used for the extractions in acute infections. X-axis represents the local anaesthetic technique used in the extraction of maxillary and mandibular teeth. Y-axis plotted from the scale as 0 to 30 represents the percentage type of local anaesthetic technique used to treat acute infections by extractions. Here, red denotes the 1ml of LA, green denotes 2ml of local anaesthesia and yellow denotes 4ml of local anaesthesia, purple denotes 5 ml of local anaesthesia used for surgical extractions in patients with acute infections. The Chi-square test; p-value = 0.34 ; which is p > 0.05, hence it shows statistically insignificant. It shows that the majority of teeth with acute infections were treated with 2ml of local anaesthesia and in few cases 4ml of local anaesthesia was administered by infiltration and inferior alveolar nerve blocks, 5 ml were given by infiltration technique.

Discussion

We analysed the amount of local anaesthesia and the technique used for extractions in patients with periapical abscess and dentoalveolar abscess. Out of 51 cases of acute infections, few cases were given 4 ml of local anaesthesia by infiltration technique and inferior alveolar nerve blocks, 2 ml of local anaesthesia given using infraorbital nerve block, 5 ml of anaesthesia was given by infiltration technique. In these cases higher quantities of local anaesthesia were used which indicates there might be failure of local anaesthesia. Also the recommended dose of anaesthesia for infraorbital nerve block is about 0.9 ml to 1.5 ml. In our study we observed that the majority of teeth which are extracted by an infraorbital nerve block used a higher amount 2 ml of local anaesthesia which is more than the recommended value.

From the results obtained, it has been observed that there is correlation between acute infections and failure of local anaesthesia. In some patients who were treated with infiltration and inferior alveolar nerve blocks (6%), resulted in failure of anaesthesia than other local anaesthetic techniques which showed less incidence. Similar to our study findings, a prospective study performed among 82 patients has compared the perioperative complications of extractions in acutely infected teeth and asymptomatic teeth. It was observed that there is no significant difference between acute infections in terms of the amount of anaesthetic solution used and duration of extraction (32).

The reason for the event of local anaesthetic failure should be evaluated and the underlying cause must be identified, ensuring sufficient anaesthetic effect. A correct dose of local anaesthesia should be determined based upon the patient's body weight, and then the maximum recommended dosages should be provided (33). A previous study has reported that acute infections in the oral cavity probably have inflammation, which will increase the acidity in infected sites, preventing the local anaesthetics to act. However, local anaesthesia administered for dental procedures generally acts less effective in inflamed tissues. Many clinical studies have reported the success rate of anaesthesia, about 69% in infiltration anaesthesia and 76% in inferior alveolar nerve blocks (34). In our present study, we observed that 2ml quantity of local anaesthesia is more significantly used for patients with acute infections which represents that local anaesthesia does not fail in many cases. Similar, clinical study done by Vreeland et al, illustrated that there is no significant difference in the failure of local anaesthesia when the lidocaine is doubled in concentration (2% to 4%) (35). A study done by Aggarwal et al reported that the presence of inflammation causes failure of anaesthesia in 30-45% of patients (36). Many studies have reported the common reasons for the failure of anaesthesia such as trismus, infection, inflammation, and previous surgery or trauma (37,38). Despite this, only a few studies have correlated acute infections and failure of the local anaesthesia.

A clinical study has compared the frequency of anaesthetic failures in patients with irreversible pulpitis after a single inferior alveolar nerve block, which were about 30-80 % of cases where local anaesthesia was ineffective in patients (39). In our present study, we took a case of periapical abscess and dentoalveolar abscess infections. Likewise, a case report study done among the patients with dental abscess induced trismus evaluated the effect of local anaesthesia during extraction. It has been reported that local anaesthesia is not so productive within the presence of pus and acidic pH at the site of dental abscess. Thus this study has described that potent analgesic is expected to administer to allow deep tissue perfusion in case of dental abscess (40), (41),(42), (43), (44), (45).
Our present study had certain limitations, as it is being done in a single university setting, with a small sample size and a short period. Also, incomplete data records might be excluded from the study. Thus our future extent of our study relies on better knowledge of the effect of local anaesthesia and its association with acute infections.

Conclusion
Local anaesthesia is now being fundamentally used in the completion of surgical procedures. Failure of local anaesthesia occurs commonly in acute inflammatory conditions such as periapical abscess and apical periodontitis. The exact reasons for the failure of anaesthesia in acute infections were not given in clinical studies. In our study local anaesthesia failed in 6% of acute infections cases which used infiltration and inferior alveolar nerve block for extractions. Hence our study has concluded that there is correlation between acute infections and failure of anaesthesia in terms of the amount of local anaesthesia and technique used to treat acutely infected teeth by surgical extractions.

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Conflict of interest
The authors declare no conflict of interest.
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