STUDY PROTOCOL **01,05,2023**

The success of intraligamentary injection versus inferior alveolar block in symptomatic mandibular molars with irreversible pulpitis: A randomized double-blind clinical trial.

In this randomized controlled clinical study, it is aimed to compare the success of buccal infiltration anesthesia + intraligamentary anesthesia and inferior alveolar block anesthesia + buccal infiltration anesthesia with acute symptomatic irreversible pulpitis in the mandibular molars.

It is not always possible to provide adequate anesthesia with only the inferior alveolar block anesthesia technique in patients with acute symptomatic irreversible pulpitis in the mandibular molar tooth. In order to complete endodontic procedures painlessly, clinicians mostly use supplementary anesthesia techniques such as buccal infiltrative, intraligamentary injection (ILI) or intrapulpal anesthesia.

The intraligamentary injection (a periodontal ligament injection) allows a local anesthetic solution to be injected into the cancellous bone adjacent to the tooth to be anaesthetized (6). Earlier reports indicate a success rate of 50–96% for supplemental IL injections achieving pulpal anesthesia in endodontic therapy (2,4,6–9).Studies using ILI as a primary anesthetic technique in mandibular molars28-30 generally yield 0.2-0.9 ml in the mesial and distal sulcus.

Malamed et al., performed ILI as a primary anesthesia technique in mandibular molar teeth and deposited 0.2 ml of anesthetic solution from the mesial and distal sulcus and achieved a 60% success rate.

This study is aimed a comparative evaluation between buccal infiltration anesthesia + intraligamentary anesthesia and inferior alveolar block anesthesia + buccal infiltration anesthesia methods for endodontic treatment of mandibular molars with acute symptomatic irreversible pulpitis that creates a challenging procedure for both the patient and the clinician.

Materials and Methods

This study protocol is planned as parallel arm, double blind, single-centered and randomized controlled clinical trial. The ethics committee approval required for this study was obtained from Republic of Turkey, Ministry of Health, Turkish Medicines and Medical Devices Agency (21-AKD-186). The participants of the study were informed about the study protocol, benefits, possible complications and participants' human rights and an informed consent form was signed. The participants were selected from among the patients who applied to the Cukurova University, Faculty of Dentistry, Endodontic Clinic, between the dates from January to March 2022.

Sample size determination were performed according to the results of the study conducted by Lin et al. It was calculated by taking into account under the assumption that the difference is 45%, the power is 80%, and the error rate is 5%, there should be 22 patients per group. The sample size was set to 25 patients per group for possible dropouts. For randomization, the block permutation method with a computer-aided block size of 10 was used.

A total of fifty patient with the diagnosis of symptomatic irreversible pulpitis in the mandibular first or second molar teeth were include this study. The following inclusion criteria were taken as a basis; systemically healthy patients (American Society of Anesthesiologists [ASA] Class I or II) and patients between the ages of 18-65. The patients were excluded from the study if there was a pregnancy or nursery; allergy or sensitivity history against to articaine, epinephrine or any other used medication/materials; taking any analgesic drug or medication that interfere pain response 12 h before treatment. Also, patients with pathologic periodontal pockets during probing, have any pathology in the areas that planned for injection and have periapical pathology were excluded when considering clinical diagnosis.

The history of intermittent or spontaneous pain, even after the thermal stimuli have been removed, were based on the diagnosis of SIP and supported by clinical and radiological evaluation. Patients who have teeth with deep dentin caries or restored with composite/amalgam were included to the study. Teeth with crown restorations or abutments were excluded. After determining the vitality of the pulp with positive response to electrical pulp testing (Parkell Inc. NY, USA), cold testing (Endo-Frost, Coltene-Roeko, Langenau,

Germany) were used to scale felt pain as “before the beginning of the treatment”. In radiological evaluation, it has been looked for evidence of caries or initial restoration and no change in periodontium.

In order to categorize patients’ pain, the “Heft–Parker Visual Analogue Scale” (HP-VAS) was used (1) before the beginning of the treatment, (2) the beginning of the treatment, (3) after the perforation of the pulp, (4) during the extirpation of the pulp/instrumentation. HP-VAS is a 170 mm line without a value that written “no pain” in the head and “greatest pain I have ever experienced” at the end. This line was measured and divided into 4 categories; 0=no pain, ≤54 mm mild pain, 54-114 mm moderate pain, ≥114 mm severe pain.

Blinding and anesthesia procedures

The fifty patients that included in the study were randomly divided into 2 groups (n=25) in accordance with the randomization block. All anesthetic attempts were performed by an endodontist (S.Y) who received the patients according to the group and teeth were isolated with rubber-dam to maintain the blindness. In all applications, 4% articaine hydrochloride with 1:100.000 epinephrine (Ultracaine® DS Forte ampule and cartridge, Sanofi Aventis, Germany) was used as anesthetic solution.

IANB group: A standard IANB injection was performed with a standard 27-G needle and dental injectors (Septodont, Saint-Maur-des-Fosses Cedex, France) using the traditional Halsted approach. After determining the injection site and performing aspiration, 1.8 mL of solution was injected at a rate of 1 mL/min to block the inferior alveolar nerve. The patient was questioned about lip numbness after fifteen minutes. If there was no numbness, patient was excluded. In the case of lip numbness was achieved, 1 mL of buccal infiltration anesthesia was applied to the buccal sulcus of the tooth. Then, tooth was isolated with rubber dam.

ILI group: Initially, 1 mL of buccal infiltration anesthesia was administered to the buccal sulcus of the tooth with a standard 27-G needle and dental injectors. After five minutes, ILI was performed using an ILI device (Sopira Citoject, Heraeus Kulzer GmbH Hanau, Germany) with needle of 30-G and 12 mm in length (Sopira Carpule). The needle tip was held obliquely to the long axis of the tooth and slowly entered to the periodontal ligament until feeling constant and uninterrupted back pressure. It was ensured that the needle was correctly placed in the periodontal area. Anesthetic solution was injected at 4 location (mesiobuccal, distobuccal,

mesiolingual and distolingual) in each tooth. Sophira device administers 0,06 mL anesthetic solution in each dosing unit. Thus, it was triggered 3 times for each location (0,18 mL) to achieve subsequent anesthesia. Totally, 0,72 mL solution were injected for each tooth. Then, tooth was isolated with rubber dam.

Endodontic intervention

Access cavity preparation was performed using a round bur by an endodontist (P.G) who is blinded about the participants' group. When the patient felt pain, the intervention was stopped and patient was allowed to mark on the HP-VAS. If the patient did not feel pain until the perforation of pulp chamber, it was recorded as no pain. After the perforation of pulp chamber, pulp was removed using a sharp excavator and HP-VAS was marked thirdly. Then, root canals were established using a size 10 K-file and working lengths were determined using an electronic apex locator. All root canals were prepared with Reciproc® (VDW, Munich, Germany) using an endomotor (VDW Gold; VDW, Munich, Germany). HP-VAS was marked again by patient to assign the felt pain during instrumentation. If this marking was no pain to mild pain, then the anesthesia was recorded as "successful". If this marking was moderate pain to severe pain, then the anesthesia was recorded as "failed". In the existence of pain, additional injections were administered in every stages of treatment belongs to intervention group (IANB or ILI or intrapulpal if pulpal perforation occurs). Root canal treatment was completed with routine irrigation and obturation procedures in a single visit.

Statistical Analysis

IBM SPSS Statistics Version 20.0 package program was used for statistical analysis of the data. Categorical measurements were summarized as numbers and percentages, and numerical measurements were summarized as mean and standard deviation. Chi-square test statistics were used to compare categorical measures between groups. The ShapiroWilk test was used to determine the assumption of normal distribution of the numerical measurements. Independent T test was used to compare the mean age of the groups. Generalized EstimatingEquations (GEE) method was used to examine the change in HP-VAS values during intervention and to determine the features that affect this change. Statistical significance level was taken as 0.05 in all tests.