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## **Clinical study: Effect of Southern Saudi high altitude on the effectiveness and duration time of local anesthesia in dental-KKU clinics patients**

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### **Abstract**

**Introduction:** Some ten million of global population live at altitudes above 13,000 feet, majority in South America and one fifth of it in the Himalayas of Central Asia.

Man ascends to high altitude in aviation, in mountaineering, and during conditions when troops are moved from plain land to high altitudes. Modern mode of transportation also allows an increasing number of tourists to travel rapidly from sea level to high altitudes<sup>1</sup>. It is now more important to understand the effects of high altitudes associated with other factors on the human physiology.

**Aim:** The purpose of this clinical study was to study Effect of Southern Saudi High Altitude on the effectiveness and duration time of local anesthesia in Dental-KKU Clinics Patients.

**Material and Method:** 290 male patients (12 to 78) who reside in Abha and visiting the Dental Clinic of King Khalid University for routine dental treatments were included in this study.

**Results:** Study population included 290 males, who were willing to participate in clinical cross-sectional survey at the KKU dental clinics, Abha, one of the most populous states of KSA. The study included 290 male patients (12 to 78) who reside in Abha and visiting the Dental Clinic of King Khalid University for routine dental treatments were included in this study.

After obtaining the patients consents to participate in the study, Various dental treatments were performed under local anesthesia.

A total of 290 individuals were approached, out of which 290 agreed to participate in the study and aged between 12 and 78 years, the most common type of dental Procedure was Extraction "Surgical Procedure". 106 (37%) [Fig 1], followed by prosthodontic Procedure 96 (32.2%) [Fig 1], then Periodontic Procedure with 58 (20.3%), [Fig 1], and Endodontic Procedure 30 (10.5%), [Fig 1].....

**Discussion:** We have compared the results of our study with a study by Dr. Joseph A from Department of Anesthesiology of Dental, Center for Special Needs Patients, Faculty of Dentistry, University of Pittsburgh, published in 2013 in Pittsburgh, Pennsylvania, USA under the heading: Pharmacology of Local Anesthetics Used in Oral Surgery - "In conditions similar to the Abha heights," they found that the time period until the anasthatic agent began to work for both mepivacaine and lidocaine was 2-4 minutes (10)\*..

**Conclusion:** At HA, although there is a reduction in ambient pressure and decrease oxygen tension but anaesthesia can be safely conducted keeping in mind that physiological changes that occur at high altitude and management at altitude requires some modification of sea level techniques not only because of hypoxia but also because of sub optimal equipment available at high altitude area.

**Keywords:** local anesthesia, oral surgery

### **Introduction**

Some ten million of global population live at altitudes above 13,000 feet, majority in South America and one fifth of it in the Himalayas of Central Asia.

Man ascends to high altitude in aviation, in mountaineering, and during conditions when troops are moved from plain land to high altitudes. Modern mode of transportation also allows an increasing number of tourists to travel rapidly from sea level to high altitudes<sup>1</sup>. It is now more important to understand the effects of high altitudes associated with other factors on the human physiology.

Anesthesia at high altitude is a challenging task for all anesthesiologists. It may be required as a result of illness, accidents or war like situations among the acclimatized patients and also in

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un acclimatized ones who have been recently inducted to high mountains. In order to have safe anesthesia, we must consider the physiological changes occurring in human body and their

adaptation at high altitudes. High altitude generally means an elevation of 3000 meters or more, above the sea level [Table-1].

**Table 1:** Level of Altitudes "Altitude in Meters"

□ Base line - 3000 Meters above mean sea level.
□ Mild High Altitude - 3000 to 3600 meters above mean sea level up to 4200 meters acclimatized people.
□ Moderate High Altitude - 4200 to 4800 meters above mean sea level.
□ Extreme High Altitude - 4800 meters above mean sea level.

Although the biological effect of high altitude appear at lower levels, but at this level onwards, people ascending to high mountains generally show biochemical, physical or anatomical changes.

Pain is the most common cause of fear and anxiety in dental practice. Local anaesthetics play a key role in reducing pain and anxiety and are used with or without epinephrine in specified concentrations for various dental procedures [1, 2]. As regards the maxillary anesthesia, supra periosteal injections into the muco-buccal fold, proximal to the apices of the teeth using conventional syringe and needle have been commonly used. However, certain instances may warrant multiple needle penetrations for adequate pulpal anesthesia, which increased the dose and caused collateral anaesthesia [5, 6]. In the mid-1990s, the computer assisted system has been developed which provided predictable pulpal anaesthesia of multiple maxillary teeth from a single injection, minimizing the dose with minimal or reduced risk of collateral anesthesia. It incorporated computer technology to control the rate of flow of the anesthetic solution through the needle. This concept was called computer-controlled local anaesthetic delivery (CCLAD) [7, 8]. It has a foot control that automates at precise pressure and volume rates which control the drug being delivered. It could be used for buccal, palatal, intraligamental infiltration and blocks. Some of the commercially available CCLADs are Wand, Wand plus and Compumed. Anterior middle superior alveolar (AMSA) and Palatal anterior superior alveolar (P-ASA) techniques are most frequently used with the computer- assisted system [9]. Besides the introduction of the technique, a systematic compilation on studies does not exist. Hence this systematic review aims to identify the use of computer-assisted local anaesthetic technique in producing predictable anaesthesia as conventional syringe needle technique, eliminating the disadvantages.

#### Local Anesthesia failure

Lack of success in obtaining complete anesthesia in dentistry may be related to anatomical, physiological or psychological factors. Anatomical variations at the site of the injection, infection or inflammation at the injection site and medical or psychological problems with which the patient may present, can affect the anesthetic outcome (patient related factors). Choice of anesthetic agents, the use of vasoconstrictors and experience of the operator may also influence the success of local anesthesia, factors related to the operator.

#### Aim

The purpose of this clinical study was to study Effect of Southern Saudi High Altitude on the Effectiveness and

Duration Time of Local Anesthesia in Dental-KKU Clinics Patients.

#### Material and Method

290 male patients (12 to 78) who reside in Abha and visiting the Dental Clinic of King Khalid University for routine dental treatments were included in this study.

Exclusion criteria: those already taking antibiotics and analgesic; those with a medical history of debilitating systemic diseases like diabetes mellitus; those on steroid therapy; those with a history of radiotherapy to the head and neck regions; and those that have social habits of smoking and alcohol consumption.

After obtaining the patients consents to participate in the study, Various dental treatments were performed under local anesthesia.

#### Pre-operative

The anesthesia dose, the type of anesthetic used and type of block.

#### During operative

The duration from the start of anesthesia to the sense of efficacy of an anesthesia was measured.

#### Post-operative

Instructions were given to the patients and both analgesics and antibiotics prescribed. A questionnaire containing the above-mentioned items was completed for each patient on the various days of evaluation. The data generated were then analyzed statistically using Microsoft Excel package.

#### Results

Study population included 290 males, who were willing to participate in clinical cross-sectional survey at the KKU dental clinics, Abha, one of the most populous states of KSA. The study included 290 male patients (12 to 78) who reside in Abha and visiting the Dental Clinic of King Khalid University for routine dental treatments were included in this study.

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A total of 290 individuals were approached, out of which 290 agreed to participate in the study and aged between 12 and 78 years, The most common type of dental Procedure was Extraction "Surgical Procedure ". 106 (37%) [Fig 1], followed by prosthodontic Procedure 96 (32.2%) [Fig 1], then Periodontic Procedure with 58 (20.3%), [Fig 1], and Endodontic Procedure 30 (10.5%), [Fig 1].

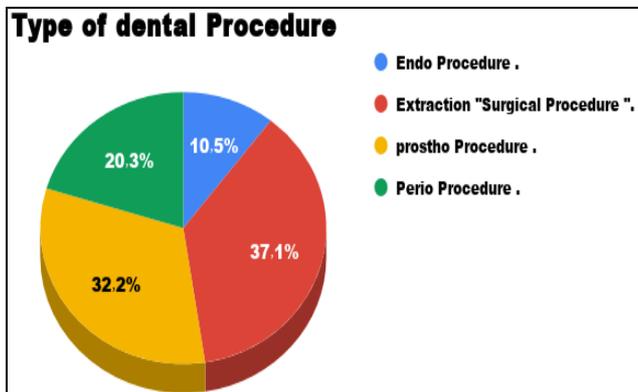


Fig 1: type of dental Procedure

A total of 226 patients were anesthetized by using Mepivacaine, where their proportion was 77.8%, and 64 patients were anesthetized with Lidocaine (22.2%) [Fig 2].

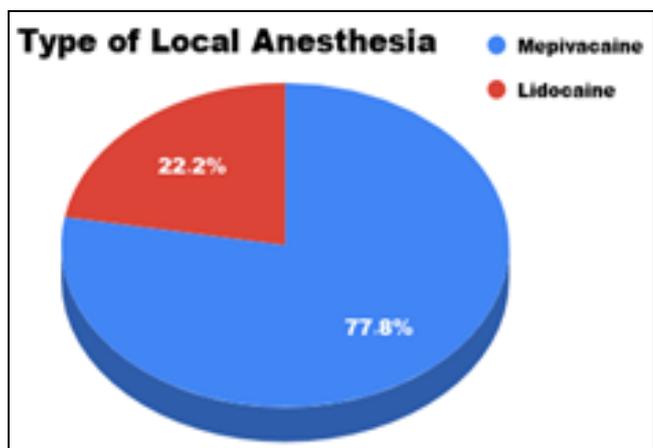


Fig 2: type of L.A.

A total of 286 patients (99.3%) were anesthetized by using 1 carpool, where their 4 patients (0.7%) anesthetized with 2 carpools, [Fig 3].

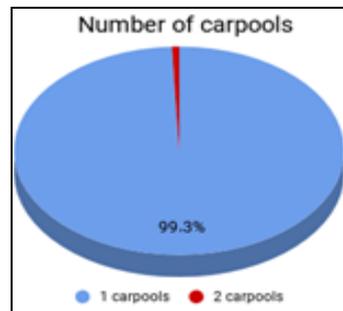


Fig 3: Number of carpools

The duration time until the anesthetic agent starting work was calculated in minutes, a total of 200 patients (69.4%) was anesthetized in 1-3 minutes, while it was 74 patients (25.7%) anesthetized within 3-6 minutes, and 14 patients (4.9%) anesthetized within 6-10 minutes [Fig 4].

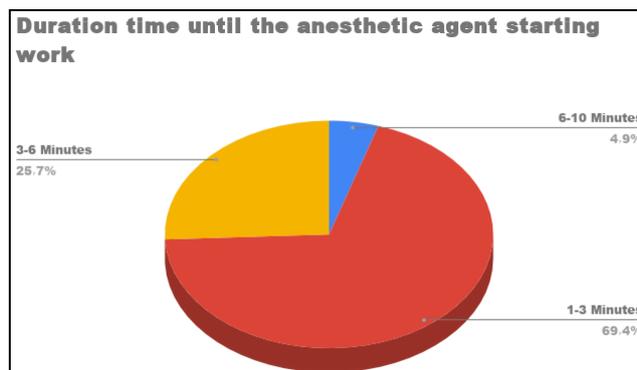


Fig 4: The duration time until the anesthetic agent starting work.

The Type of block depending on the condition of the patient and the required treatment, taking into account the dimensions and thickness of the jaw bone and evaluated in the panoramic view, a total of 208 patients was anesthetized by infiltration technique, while it was 64 patients anesthetized by Inferior alveolar nerve block technique, and 10 patients anesthetized by Mental nerve block technique, While that 2 patients anesthetized by Buccal nerve block technique, the same number of patients was anesthetized by Middle superior alveolar nerve block and Inter pulple block. [Fig 5].

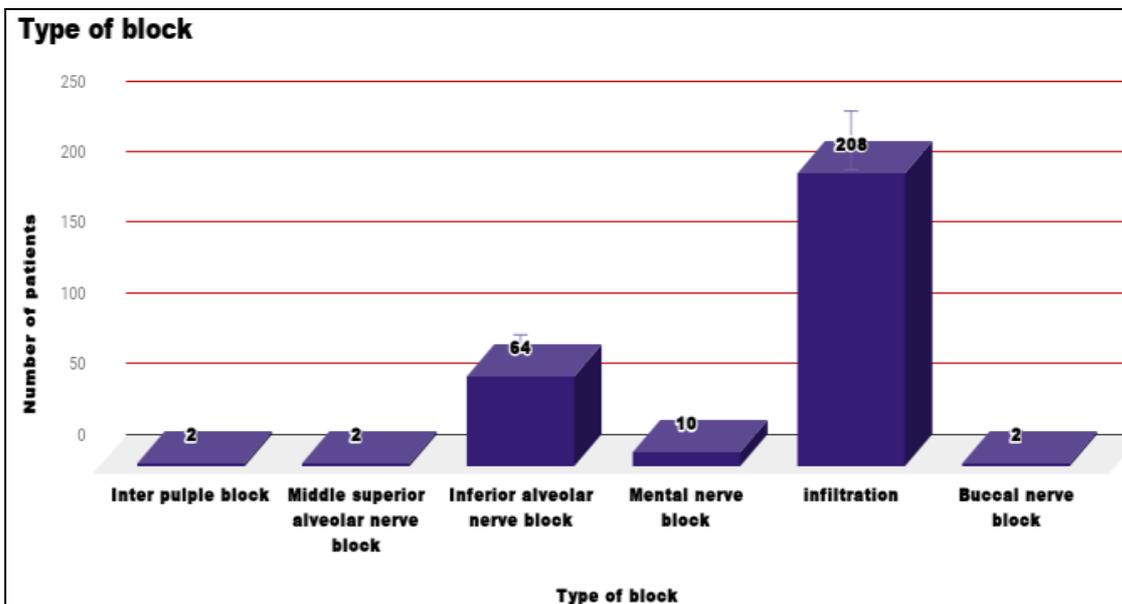


Fig 5: The Type of block depending on the condition of the patient and the required treatment.

## Discussion

We have compared the results of our study with a study by Dr. Joseph A from Department of Anesthesiology of Dental, Center for Special Needs Patients, Faculty of Dentistry, University of Pittsburgh, published in 2013 in Pittsburgh, Pennsylvania, USA under the heading: Pharmacology of Local Anesthetics Used in Oral Surgery - "In conditions similar to the Abha heights," they found that the time period until the anesthetic agent began to work for both mepivacaine and lidocaine was 2-4 minutes (10)\*

While in our study we found that the time period until the anesthetic agent works for both mepivacaine and lidocaine "the same anesthetic agent in Dr. Joseph A study" was anesthetized within 3-10 minutes in 88 Patients from 290 Patients.

Hypoxia in high places is the principal stimulus for an increase in red blood cell production at high altitude due to Defective saturation of arterial blood with oxygen, hypoxia at HA causes high pressure and increased flow in cerebral blood vessels leading to cerebral vasodilatation. As a result there is decreased cortical function, due to the effect of mountainous highlands and lack of oxygen, the usual simple anesthesia is sometimes an obstacle and a challenge for doctors to anesthetize their patients.

On return to sea level / lower altitude, there is decrease in red cell volume but compensatory increase in plasma volume. This signals that subjects who have lived at high altitude and then return to sea level may have higher than normal plasma volume for an unknown period of time. If such persons return to high altitude within this period, he may well be more susceptible to High Altitude.

## Conclusion

At HA, although there is a reduction in ambient pressure and decrease oxygen tension but anaesthesia can be safely conducted keeping in mind that physiological changes that occur at high altitude and management at altitude requires some modification of sea level techniques not only because of hypoxia but also because of sub optimal equipment available at high altitude area.

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