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Effects of Different Local Agents after Extraction of Impacted Lower Third Molar on Postoperative Pain , Swelling and Infection

A Project
Submitted to the College of Dentistry, University of Baghdad,
Department of Oral and maxillofacial surgery in Partial Fulfillment for
the Bachelor of Dental Surgery.

By

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حامد
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Certification of the Supervisor

I certify that this project entitled" **Effect of DifferentLocal Agents after Extraction of Impacted Lower Third Molar on Postoperative Pain , Swelling and Infection''**was prepared by the fifth year student **Mariam bassim Hassan** under my supervision at the College of Dentistry / University of Baghdad in partial fulfilment of the graduation requirements for the Bachelor Degree in Dentistry.

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B.D.S, M.Sc., Ph.D.

Dedication

To those who are not matched by anyone in the universe, to whom God has commanded us to honor them, to those who have made a great deal, and have given what cannot be returned, to you these words, my dear mother and father, I dedicate this research to you; You have been my best supporter throughout my academic career.

Acknowledgment

First and above all, I praise **Allah**, the almighty for providing me this opportunity and granting me the capability to proceed successfully. This project appears in its current form due to the assistance of several people and the guidance of the supervisor. I would therefore like to offer my sincere thanks to all of them.

I'm profoundly grateful Dr**. Raghad Al-hashimi** Dean of College of Dentistry, University of Baghdad and Prof. Dr. **Ali AL- Bustani**, the associate dean for scientific affairs and assistant prof. Dr. **Ali Hussein Abbas** the Head of the Department of oral and maxillofacial surgery.

I would like to express deepest gratitude and thanks to my supervisor Dr**. Mohammed Abdel Razzaq** for his excellent scientific guidance, support patience, and providing us with comfortable circumstances for doing the research.

Abstract

Background: Third molar surgery is the most common procedure performed by oral and maxillofacial surgeons worldwide. It is usually associated with considerable postoperative complications such as pain , swelling , and infection that have biological and social impact. Factors thought to influence the incidence of complications after third molar removal include age, gender, medical history, oral contraceptives, presence of pericoronitis, poor oral hygiene, smoking , type of impaction, relationship of third molar to the inferior alveolar nerve, surgical time, surgical technique, surgeon experience, use of perioperative antibiotics, use of topical antiseptics, use of intra-socket medications, and anaesthetic technique.

For the general dental practitioner, as well as the oral and maxillofacial surgeon, it is important to be familiar with all the possible complications after this procedure.This improves patient education and leads to prevention, early recognition and management.The awareness of different methods of reducing morbidity after lower third molar surgery would help both the surgeon and the patients in the management of impacted lower third molar.

Aim: to evaluate the effectiveness of different types of local agents that used after surgical extraction of impacted lower third molars on reducing pain, swelling and infection.

Conclusions: The most frequent immediate and late complications were slight pain, swelling, and trismus. There are many locals agents that have proven effective in treating pain, swelling and infection without side effects, including Alvogyl , and Platelet Rich Fibrin.

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Abbreviation	Full text
NSAIDs	Non-steroidal anti-inflammatory drugs
CBCT	Cone Beam Computed Tomography
CT	Computed Tomography
MIC	Mindibular incisive canal
ZOE	Zinc oxide eugenol
PRF	Platelet rich fibrin
AO	Alveolar osteities
TGF	Transforming Growth Factor
PDGF	platelet derived growth factor
VEGF	vascular endothelial growth factor
EGF	Epidermal growth factor
LLL	Low-level laser
LLLT	Low-level laser therapy
PGE2	Prostaglandin E2
IL-6	Interleukin-6
IL-8	Interleukin-8
IL-10	Interleukin-10
TNF-α	Tumor Necrosis Factor Alpha

Introduction

Surgical extraction of impacted lower third molar is the most common operation in the oral and maxillofacial surgery. Lower molar extraction is related to inflammation of the organism, pain, swelling and momentary limitation of mouth movements **(Elitsa G et al., 2016).**

Drugs such as corticosteroids, nonsteroidal antiinflammatory drugs (NSAIDs) have been used to relieve complication. Although they are effective, they manifest side effects such as a tendency to systemic bleeding , gastrointestinal irritation, and allergic reactions (**P. J. Duan et al.,2014).**

There are a different of local agents without side effects have been used after surgical extraction of impacted third molars and the aim of these material is to decrease pain, swelling , infection and trismus. For example the most commonly used: alvogyl , platelet rich fibrin and laser therpy **(Kate Jones et al , 2022).**

Aim of the Study

This Review to evaluate the effectiveness of different types of local agents that used after surgical extraction of impacted lower third molars on reducing pain, swelling and infection.

Chapter one

Review of Literature

1.1 ANATOMY OF THE MANDIBLE

The mandible is the largest and strongest bone in the human skull. The mandible is composed of the body and the ramus and is located inferior to the maxilla **(Breeland G et al., 2022).**

The body is U-shaped and has an external and internal cortical surface. The external cortical plate is thickest at the mental protuberance and in the region of the third molar. There is also a thickened triangular mental protuberance bounded laterally by the mental tubercles. The mental foramen is located on the external surface in the vicinity of the root apices of the first and second premolars. There are variations in the exact location of the foramen, as noted by **Tebo and Telford (Fonseca et al., 2013).**

The mental foramen is an important landmark when considering placing implants in the foraminal region of the mandibular arch **(Greenstein and Tarnow, 2006).**

The mental foramen may be oval or round in shape, site and numbers of mental foramen are not constant, and may vary widely amongst different population groups . If more than one mental foramen found, the smaller foramina are known as accessory mental foramina. Topographical situation of mental foramen was noted and classified into six levels as demonstrated in Fig.(1) **(Dave et al., 2019**) .The presence of accessory mental foramina if found, whether on left or right side of the body, anterior/posterior or above/below the mental foramen (**Dave et al., 2019**).

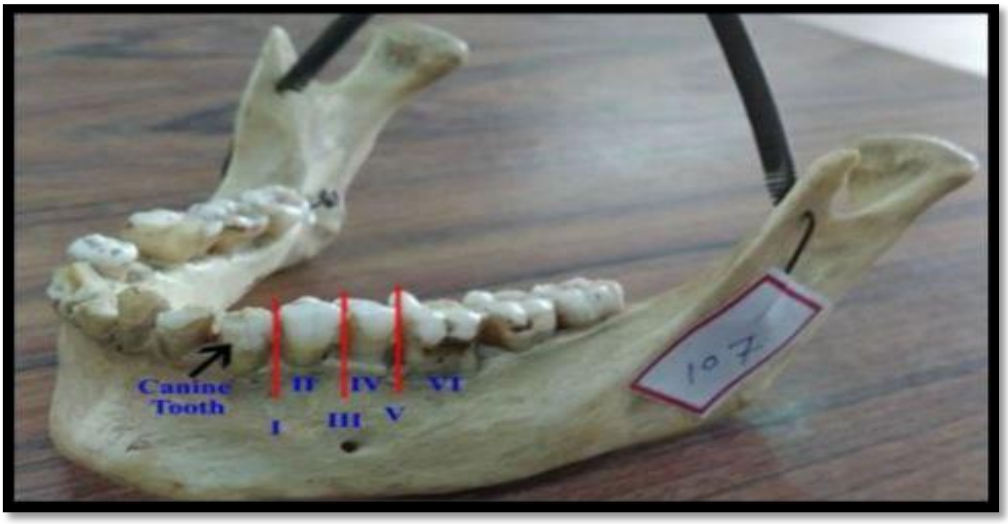

Fig.1: Position of mental foramen in relation to lower teeth **(Dave et al., 2019)**

Agthong et al. stated that the foramen was 28 mm from the midline of the mandible and 14 to 15 mm from the inferior border of the mandible **(Agthong et al., 2005).** and Similarly, **Neiva et al**. reported that the foramen was 27.6 mm (range: 22 to 31 mm) from the midline and 12 mm (range: 9 to 15 mm) from the most apical portion of the lower cortex of the mandible (**Neiva et al., 2004**) , However, this finding could be influenced by the amount of crestal bone loss, so its location can vary from the mandibular canine to the first molar with the mean height of 3.47 mm range: 2.5m5.5 mm) and the average width of 3.59 mm (range: 2-5.5 mm) (**Greenstein and Tarnow, 2006**).

After extraction of teeth and resorption of alveolar bone, the mental foramen is closer to the alveolar crest. In extreme situations, the mental foramen and mandibular canal can be adjacent to the crest of the alveolar ridge (**Greenstein and Tarnow, 2006).**

The mandibular canal is a canal within the mandible that is beginning in mandibular foramen on the medial surface of the ascending mandibular ramus. It runs obliquely downward and forward in the ramus, and then horizontally forward in the body till mental foramen. It carries inferior alveolar neurovascular (**Juodzbalys et al., 2010**).

Radiographs indicating close proximity of the foramen to the alveolar crest dictate that the foramen should be surgically located to avoid nerve damage (**Greenstein and Tarnow, 2006**).

The mental nerve can present a loop, an anterior extension of the inferior alveolar nerve mesial to the mental foramen, prior to exiting the canal. There are discrepancies between the data of radiographic and cadaveric dissection studies regarding the prevalence and length of the loop. Panoramic radiography may not be a very reliable imaging modality for identifying the presence and length of the anterior loop (**Desai et al., 2013, Rosa et al., 2013)**. The length ranging from (0.0 to 5.9 mm) is found on CBCT and a distance of 6 mm between the anterior border of the mental foramen and the most distal inter foraminal implant fixture is recommended (**Apostolakis and Brown, 2013)**. For detection, CT/CBCT scans are more accurate than conventional radiographs.

1.1.1 Mandibular incisive canal (MIC)

Olivier,1928 was the first anatomist to define the mandibular incisive nerve as a terminal branch of the inferior alveolar nerve, which extends anteriorly within the mandible, mesially to the mental foramen (**Desai et al., 2013**). The conventional two-dimensional radiographs (intraoral periapical, orthopantomographs) are of limited value as they often fail to show MIC (**Jacobs et al., 2002, Mraiwa et al., 2003**) while the spiral CT

and CBCT based studies showed 83-100% of its existence (**Makris et al., 2010, Desai et al., 2013)**. Most of the time, the incisive nerve did not reach the area below the central incisors. It is located closer to buccal cortex than the lingual cortical plate and curves toward the lingual side at the symphysis menti. It gives neurovascular supply to the lower incisors, canine and first premolar. Several procedures such as endosseous implant placement, genioplasty, autograft harvesting for ridge and sinus augmentations, screws and/or plate fixation in symphyseal and parasymphyseal fractures are performed in this interforaminal **(Desai et al., 2013)**.

1.1.2 Clinical anatomy of mandible third molar

Mandibular third molar is situated at the distal end of the body of the mandible where is connection withrelatively thin ramus.There is the region of weakness and the fracture can occur if excessive force will be applied during impacted wisdom tooth elevation without preliminary and adequate removing of surrounding bone.The buccal alveolar bone in this region is thicker than the lingual.The external oblique ridge forms the buttress that reinforced the buccal plate. The lingual nerve often lies close to the cortical plate. There is high risk of lingual nerve damage using lingual split technique or elevating third molar flap medially to the distoangular recess. In the most cases the roots of third molars are in close proximity to the mandibular canal. Furthermore, in some cases third molar roots can contact or penetrate into mandibular canal or they can be deflected.Close relationship of the canal with the roots can evoke inferior alveolar nerve damage during the surgery (**Gintaras Juodzbalys** & **Povilas Daugela, 2013**).

1.2 Third molar development

Third molar development, in comparison to other teeth in the dentition, has the greatest variation in morphology, anatomical position, and time of development and eruption **(Mohammad Zandi et al ., 2015)**

The developmental stages were as follows as pretending in fig.2: (**Haim Sarnat et al,.2003)**

Stage 0= no evidence of bud development

Stage 1= radiolucent bud, no calcification

Stage 2= calcification starts to half crown

Stage 3= calcification of half crown to full crown (no root)

Stage 4= root formation starts to half root length

Stage 5 = half root length to full length, open apex

Stage 6 = apices closed.

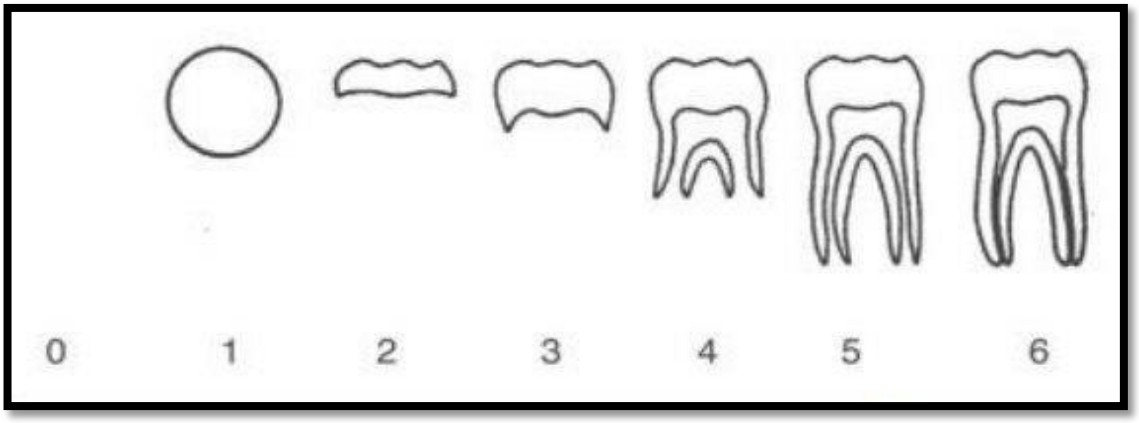

Fig.2: Stages of tooth formation used to assess development of the third molar. Each figure signifies the end of the stage **(Haim Sarnat et al ,. 2002).**

The first sign of tooth development (radiolucent bud) appeared first in the mandible at age **8.7** years. Failure of a radiolucent bud to appear at age 11 could be a first sign of agenesis, to be confirmed at age **14 (Haim Sarnat et al ,. 2002).**

Assessment of the stages of third molar development is of great clinical importance, as it helps surgeons to make a proper prediction as to whether an impacted tooth will erupt normally into the oral cavity or not. It can also be used to make a decision about timing of the impacted tooth removal and determining the degree of surgical difficulty. Furthermore, assessment of the stages of third molar development is an important part of the decision making and treatment planning for autologous transplantation of the third molar to replace a hopeless first or second molar. Other specialists including orthodontists and pedodontists frequently use the dental age for diagnostic and treatment planning purposes **(Mohammad Zandi et al ., 2015).**

Assessment of third molar stages was a reliable method of chronological age estimation. The mean ages of the first appearance of third molar bud, complete crown formation, and root apex closure were around **9, 14**, and **22** years, respectively. In both jaws, third molar development occurred symmetrically, and sexual dimorphism was observed at some developmental stages **(Mohammad Zandi et al ., 2014)**.

1.3 Third molar eruption :

In early **1954 Mead** has defined an impacted tooth as a tooth that is prevented from erupting into position because of malposition, lack of space, or other impediments. In **1998 Peterson** , characterized impacted teeth as those teeth that fails to erupt into the dental arch within the expected time. In **2004 Farman** wrote that impacted teeth are those teeth that prevented from eruption due to a physical barrier within the path of eruption(**Gintaras Juodzbalys & Povilas Daugela , 2013).**

According to **Elsey and Rock** in **2000,** impaction of the third molar is occurring in up to 73% of young adults in Europe. Generally, third molars have been found to erupt between the ages of 17 and 21 years. Furthermore, third molar eruption time have been reported to vary with races . For example, mandibular third molars may erupt as early as 14 years of age in Nigerians , and up to the age of 26 years in Europeans. The average age for the eruption of mandibular third molars in male is approximately 3 to 6 months ahead of females . Most authors claim that the incidence of mandibular third molar impaction is higher in females (**Gintaras Juodzbalys & Povilas Daugela , 2013).**

1.4 Classifications and risk factors identification :

In order to minimise number of complications during mandibular third molar extraction several classifications have been developed that are assessing the difficulty of surgical procedure and helping to create an optimal treatment plan. The most popular are **Winter's** and **Pell** and **Gregory's systems** who are classifying the inclinations and positions of the third molars based on the relation among the dental longitudinal axis, occlusal plane and ascending mandibular ramus. These systems have been extensively adopted and applied in clinical practice **(Radovan (Mottl et al,. 2021).**

1.4.1Winter classification: (Santosh P, 2015)

- Vertical (38%)
- Mesioangular (43%)
- Horizontal (3%)
- Distoangular (6%)
- Buccoangular
- Linguoangular
- Inverted
- Unusual

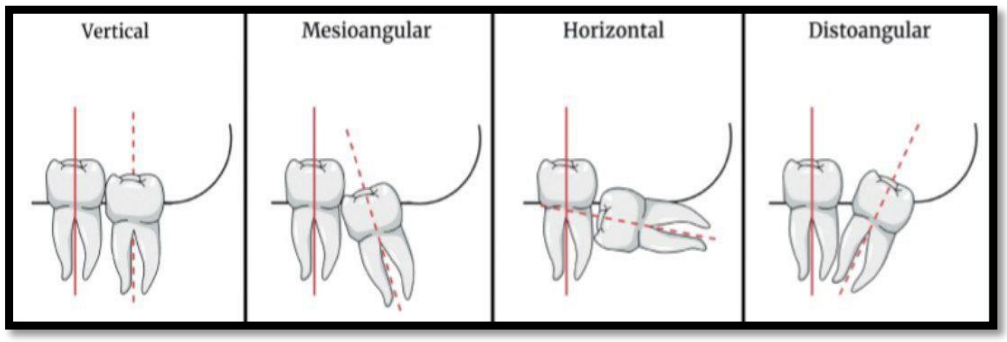

Fig.3: Winter's classification of lower third molars position. **(Radovan Mottl et al,. 2021).**

1.4.2 Pell and Gregory classification : (Santosh P , 2015)

Relation of the tooth to ramus of mandible and second molar

• **Class I:** Sufficient amount of space for accommodation of the mesiodistal diameter of the crown of the third molar.

• **Class II**: The space between the ramus and distal side of second molar that is, less than the mesiodistal diameter of the third molar.

• **Class III :** All / most of the third molars is located within the ramus.

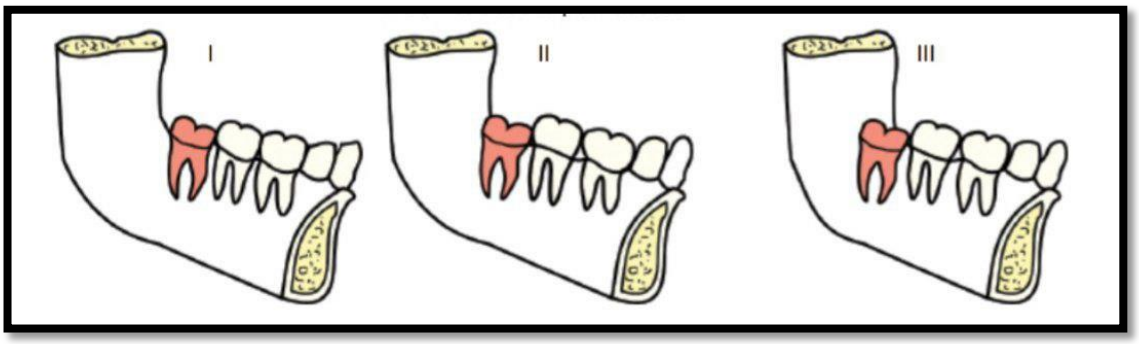

Fig.4: Surgical difficulty based on AP distance, second molar, and ramus **(John Wayland , 2018).**

Relative depth of the third molar in the bone :

• **Position A**: The highest portion of the tooth is on a level with/above the occlusal line.

• **Position B**: The highest portion of the tooth is below the occlusal plane, but above the cervical line of the second molar.

• **Position C**: The highest portion of the tooth below the cervical line of the second molar teeth in relation to the long axis of impacted second molar.

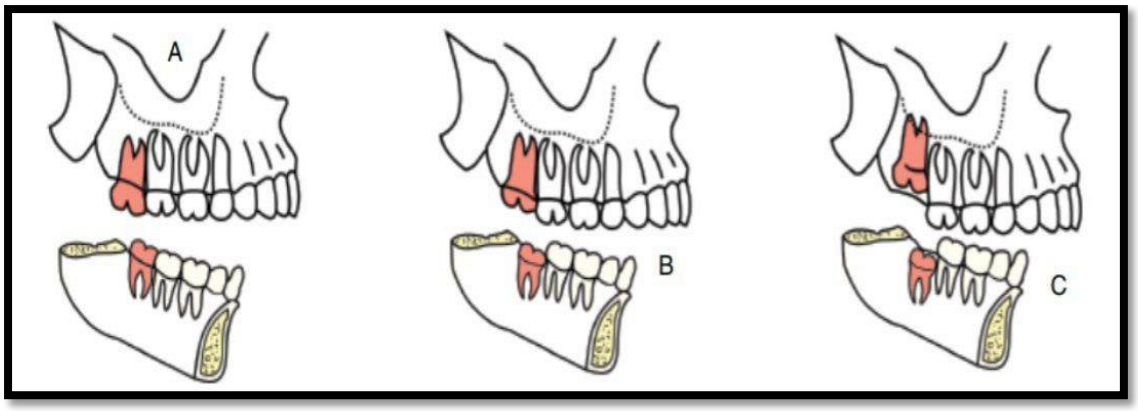

Fig.5: Surgical difficulty based on depth relative to second molar **(John Wayland , 2018).**

1.4.3 Classification according to nature of overlying tissue: (Santosh P , 2015).

This system is used by most dental insurance companies and one by which surgeon charges for his services :

- **Soft tissue impaction**
- **Partial bony impaction**
- **Fully bony impaction.**

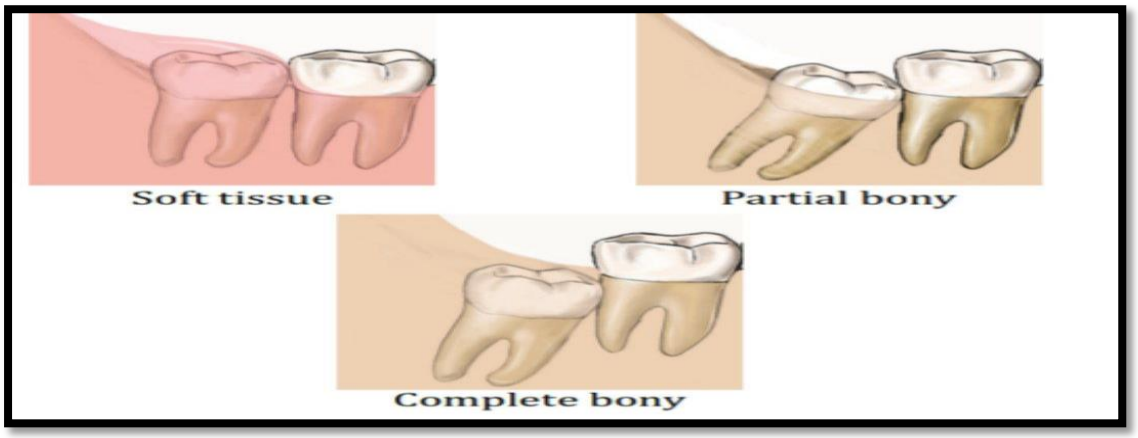

Fig.6: Classification based on tissue coverage over the impacted third molar **(Darpan Bhargava , 2023).**

1.5 Post operative complication related to lower third molar

Complications associated with the removal of impacted teeth are relevant and is aided by local and general factors which include tooth position, age of the patient, health status, knowledge and experience of the dental surgeon, and surgical equipment used.Most common complications associated with the removal of the third molar include pain, damage of sensory nerve leading to paresthesia, dry socket, infection, and hemorrhage. Severe trismus, oro-antral fistula, buccal fat herniations, iatrogenic damage to the adjacent second molar, and iatrogenic mandibular fracture may also occur, though very rarely **(Santosh P, 2015).**

Postoperative complications after the surgical extraction of a lower third molar still remain a significant factor in patient comfort and recover. The most frequently reported immediate and late complications related to third molar were slight pain, swelling, and trismus. Certain factors including preoperative complaints, angulation of impacted molars, the duration of surgery, the need for bone removal, the type of the utilized flap, and the need for tooth sectioning predicted and had an impact on the incidence of postoperative complications following third molar surgery. Females and older patients are likely to have more postoperative complications following surgical extraction of lower third molar (**Ziad Malkawi et al , 2011**).

1.5.1 Post operative Pain

Pain is one of the most common post operative compli cations of extraction and might be caused by the release of pain mediators from the injured tissues . Pain could discourage patients from seeking dental treatment (**Vahid Rakhshan , 2015) .**

Pain is a subjective reaction that is influenced by several factors including individual pain threshold, psychological assessment, general health,and pain perception.The biochemical background to post operative pain is that mechanical damage of blood vessels causes the production and relase of biochemical pain mediators which irritate free nerve endings (**Oikarine Kyostin ,1991**).

The post surgical pain begins when the effects of the local anesthesia subsides and reaches peak levels in 6 to 12 hours postoperatively. 37.7% patients reported mild pain on the third post-operative day and 43.4% patients had no pain on the 7^{th} post operative day (**Elitsa G&Milena Petkova.2016**).

1.5.1.1 Cuases of post operative pain

Post-operative pain and discomfort after extraction may be due to: **(Ahana Goswami et al ., 2020).**

•Traumatized hard tissue resulted from bruising of bone during instrumentation.

•Using burs for removal of bone.

•Damage and rough handling of soft tissue during extraction.

1.5.1.2 Risk factors for post-operative pain

1.Oral hygiene : The effects of hygiene maintenance on postoperative pain have not been widely assessed except in a few English and non-English articles. **Sáez Cuesta et al., 1999** extracted 100 wisdom teeth and found that patient with poor oral hygiene before surgery experienced higher pain levels during the first 6 postoperative hours. **Peñarrocha et al.,2001** explored 190 impacted third molars and found that pain increased with increasing lack of care to oral hygiene **(Vahid Rakhshan , 2015).**

2**. Difficulty of the extraction procedure and trauma:** an association between different aspects of surgical difficulty (such as the impaction level and angle, extent of bone removal or length of surgery) and pain or paresthesia. **de Santana-Santos et al**, stated that lengthier surgeries leave more painful sockets**(de Santana-Santos et al.,2013)**.

3.The operator's expertise: an experienced surgeon might carry out a cleaner, less traumatic and yet faster operation than someone new to the procedure. However, the evidence is controversial, as some authors did not denote a link between the surgeon's skill and the patient's postoperative pain.A surgeon's experience might reduce the postoperative pain only within a short period after the surgery but may have no influence on the duration or intensity of longer pains **(Vahid Rakhshan , 2015).**

4**. Tobacco smoking**: smoking might increase pain by reducing blood supply in the alveolar socket (**Vahid Rakhshan , 2015)**.

5- **Gender:** the association between clinical pain and gender is not a simple one, but females have reported more frequent pains compared to males in terms of various anatomic regions, neuropathic conditions, chronic musculoskeletal pains, temporomandibular pains, facial pains, toothaches,etc. the results could imply that females might have a higher sensitivity to pain stimuli perhaps due to psychosocial factors (mood, sex role beliefs) catastrophizing and sex hormones (**Vahid Rakhshan , 2015)**

6**. Age**: the production and process of sensory stimuli might be influenced by aging. The elderly could be at higher risk of complications, such as severe pain and sensory disturbances, possibly because the eldery have poorer healing potential, denser bones and completed dental roots (**Vahid Rakhshan , 2015)**.

1.5.2 Post operative swelling

Postsurgical swelling is an expected complication after third molar surgery. It can be caused by the response of the tissues to manipulation and trauma caused during surgery **(Elitsa G&Milena Petkova.2016)**.

A surgical trauma in the oral cavity always causes tissue injury characterized by hyperemia, vasodilatation, increased capillary permeability with liquid accumulation in the interstitial space and granulocyte and monocyte migration, due to the increased osmotic pressure in capillaries (**Francesco Sortino & Marco Cicciù , 2011**).

Swelling onset is gradual and maximum swelling is present during 48 hour after surgery.Regress of the swelling is expected by the 4th day and completely resolution occurs in 7 days**(Elitsa G&Milena Petkova.2016)**.

1.5.2.1Causes of swelling

Swelling is caused by poor surgical technique, use of blunt instruments, pulling on the flaps to gain access and inadequate drainage, entangled burs in the soft tissues, tightly placed sutures or surgical trauma **(Ahana Goswami et al ., 2020).**

1.5.3 Infection

An uncommon post surgical complication related to the removal of impacted third molars is infection. Blondeau F et al, reported that postoperative infection rate reported varies between 1.5% and 5.8%,or between 0.9% and % 4.3 **(Blondeau F et al,2007).** About 50% of infections are localized subperiosteal abscess-type infections, which occur 2 to 4 weeks after a previously uneventful postoperative course. These are usually attributed to debris that is left under the mucoperiosteal flap and are easily treated by surgical debridement and drainage. of the remaining 50%, few postoperative infections are significant enough to warrant surgery, antibiotics, and hospitalization **(Elitsa G&Milena Petkova.2016).**

1.5.3.1 **Risk factors associated with postoperative infection**

1-the postoperative infections are more likely to occur in deeply impacted third molars could indicate that surgical invasion, amount of alveolar bone ostectomy, and tooth sectioning are related to the incidence of postoperative infection (**Shintaro Sukegawa at el ., 2019**).

2- hemostatic treatment during mandibular third molar extraction surgery is also significantly associated with postoperative infection. The need for hemostasis during surgery may be due to difficulty in extracting the tooth or operator technique. In addition, a gelatin sponge used for

hemostasis may take about 4-6 weeks to absorb ; therefore, it might promote inection **(Shintaro Sukegawa at el ., 2019) .**

1.6 Local agents used after lower third molar extraction

1.6.1 Zinc Oxide Eugenol

ZOE was found to be the most cost-effective and easily available medication for dressing . The sedative , antibacterial, and obtundent properties of ZOE have been utilized in the management of dry sockets, as intra-alveolar dressings (**Satheesh Reeshma & Chacko Pearl Dain , 2021).**

Better pain control with the use of ZOE could be because of adherence of ZOE to bony walls of socket preventing the exposure of denuded bony surface and continuous contact of the walls with eugenol which has soothing effect. ZOE is more effective in initial pain relief as well as the final pain relief (**Chaurasia NK et al ., 2017**).

1.6.1.1 Procedure of ZOE placement

Copious irrigation of the extraction socket was undertaken using a mixture of isotonic saline and povidone-iodine solution, to clear the socket of any remnants of disintegrated blood clots and debris. A thin paste of ZOE was soaked in a gauze piece and placed in the extraction socket, adhering to aseptic measures. The dressings were changed on , 1st day , 3rd , 5th , and 7th days **(Satheesh Reeshma & Chacko Pearl Dain , 2021).**

1.6.2 Platelet Rich Fibrin(PRF)

PRF is an autologous fibrin-based (membrane, matrix or scaffold), living biomaterial,derived from human blood, also referred to as an optimized blood clot.PRF consisting of fibrin, platelets, growth factors and various cell types including leukocytes and stem cells**(Johan Hartshorne & and Howard Gluckman , 2016).**

Platelet concentrates have been used extensively in oral and maxillofacial surgeries . The use of PRF in the extraction sockets of mandibular third molars was introduced as an attempt to enhance the healing process and to reduce the potential postoperative complications (**Faez Saleh Al-Hamed at el ., 2017).**

PRF showed early pain reduction in established dry socket with minimal analgesic intake **(Srinivas Chakravarthi , 2017)**.The slow polymerization during PRF preparation seems to generate a fibrin network that enhances cell migration and proliferation. As PRF is a reservoir of platelets, leukocytes, cytokines and immune cells, it is reported to allow slow release of cytokines : TGF, PDGF, VEGF, and EGF which play a critical role in angiogenesis, tissue healing and cicatrization. Those properties could aid in the formation and stabilization of blood clots and hence decrease the incidence of AO **(Faez Saleh Al-Hamed at el ., 2017).**

1.6.2.1 Preparation of platelet rich fibrin :

Ten milliliters of venous blood was drawn and centrifuged at 3,000 rpm for 10 minutes. Three layers were isolated after centrifugation with the first layer of red blood cells at the bottom, the second layer of white blood cells in the middle, and platelet rich fibrin on the surface. The standard operating procedure was followed. The wound was irrigated with normal saline. PRF was placed in the socket and sutured using **3.0** mersilk with a figure of eight **(Srinivas Chakravarthi , 2017)**.

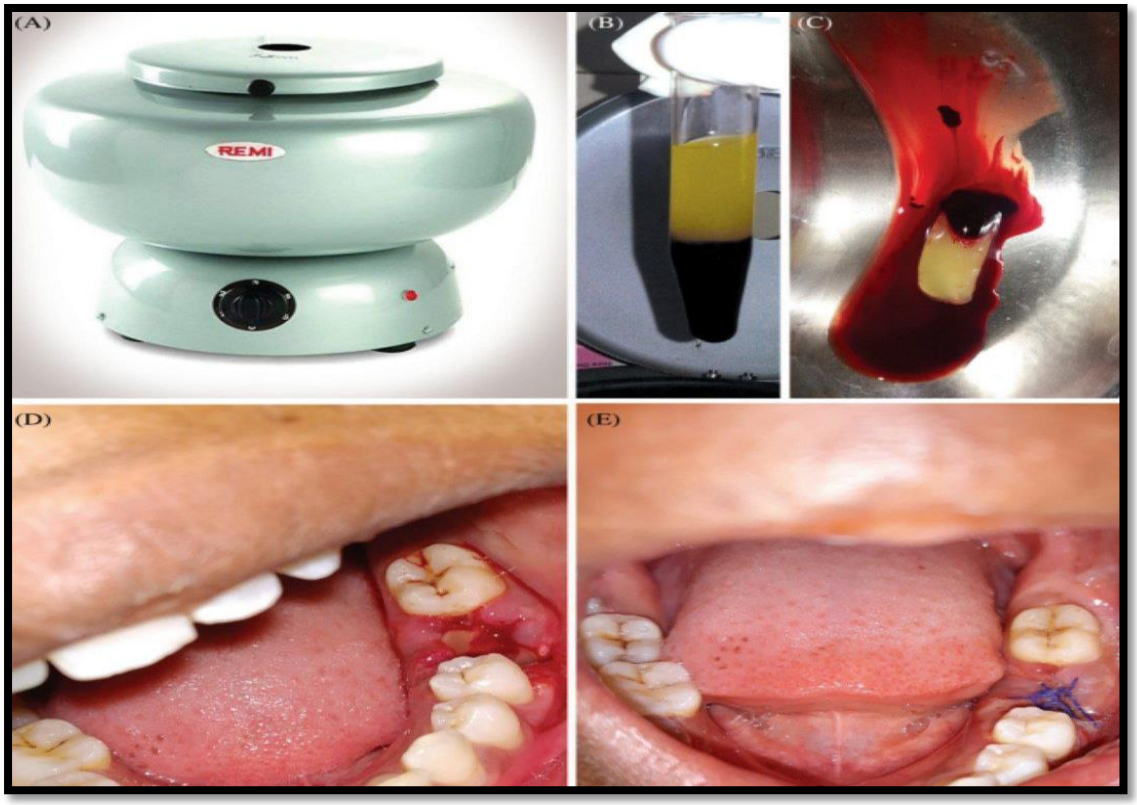

Fig.7: (A) Centrifuge used for platelet-rich fibrin extraction. (B) Blood after centrifugation. (C) Platelet-rich fibrin. (D) Platelet-rich fibrin placed inside the socket. (E) Platelet-rich fibrin-treated wound on7th post oprative day **(Satheesh Reeshma & Chacko Pearl Dain , 2021).**

1.6.2.2 Comparation between platelet-rich fibrin (PRF) and zinc oxide eugenol (ZOE) for pain relief in AO

1- **ZOE** dressing offers a simple, non-invasive, conventional , cost effective, and handy method, in contrast to **PRF**, which is minimally invasive, requires special armamentarium, and is more time consuming , along with additional expenses (**Satheesh Reeshma & Chacko Pearl Dain , 2021)** .

2- **ZOE** dressings can elicit allergic and foreign body reactions, whereas **PRF** is an autologous biomaterial with less chance of antigenicity and is more patient compliant (**Satheesh Reeshma & Chacko Pearl Dain , 2021).**

3- **ZOE** dressings are temporary and need to be changed at frequent intervals for pain relief as the dressings may dislodge or its effect wane over a period. On the other hand, **PRF** is a permanent autologous substitute secured inside the clot-less socket with sutures, with minimal chance of dislodging (**Satheesh Reeshma & Chacko Pearl Dain , 2021).**

4- **ZOE** dressings leave an unhealed empty socket on the seventh day as bone fill and healing are delayed, while acts as a scaffold for faster healing. However, there are inherent risks such as mismatches and viral and bacterial contamination during the handling of blood products. From the author's experience, PRF is cost-effective and imparts better healing and pain relief in AO patient **(Satheesh Reeshma & Chacko Pearl Dain , 2021).**

1.6.3 Alvogyl

Alvogyl is a dressing used as a topical treatment to prevent or manage a symptomatic post-extraction dry-socket. Its active ingredients are **eugenol** (acts as an obtundant**) , iodoform** (antimicrobial) aims to eliminate any low-grade infection and **butamben** (topical local anaesthetic) , and are transported by vegetable fibres of the Penghawar djambi plant that possess hemostatic properties when introduced in the post-extraction alveolus (**Didac Sotorra-Figuerola et al ,.2019 ; Denise C. Bowe , 2011**).

The use of Alvogyl can minimize **postoperative pain** severity, painkiller consumption, postoperative hemorrhage, and wound re-epithelialization. Alvogyl was also able to provide pain relief that was both rapid and long-lasting. Additionally, Alvogyl required fewer dressing changes than the others **(Assari et al , 2022).**

1.6.3.1Method of Placing Alvogy

A few fibers of Alvogyl was placed deep in the cleaned socket using a sterile dental tweezers ensuring that the exposed bone was completely covered, followed by the placement of sterile gauze which was removed after few minutes**(Sayed A. Rashed et al , 2019)**.

Fig.8: (A)Dry socket in lower molar area.(B)Placement of Alovgyl (C) One week postoperative healing of dry socket (**Sayed A. Rashed et al , 2019).**

1.6.4 Chlorhexidine gel

In recent years, the use of chlorhexidine has been increasingly common in different fields of medicine. Chlorhexidine is often present in different formulations such as mouthwashes, gels, creams or dentifrices. The numerous compositions reflect the several applications and the different fields of use **(Luca Fiorillo , 2019).**

Chlorhexidine (CHX) is a biguanide antiseptic agent, active agaist Gram-positive and Gram-negative bacteria and also against fungi. Chlorhexidine has been proven effective in the prevention of AO in the form of a mouth rinse and bioadhesive gel.The method of administration of this gel has the main advantage of providing a greater bioavailability in the application area, and therefore the medication has a more prolonged release **(Pilar Hita Iglesias et al, 2007 ;Luca Fiorillo, 2019).**

Alveolar osteitis with pain or inflammation can be reduced following a **0.2% chlorhexidine gel** protocol after third molar surgery .This was a surprising result, because a drug like chlorhexidine, which has no systemic contraindications and does not present a heavy absorption and metabolism for the patient, can replace a systemic pain-relieving therapy which is often rather burdensome to the systemic load, such as the liver or the kidneys (**Luca Fiorillo ,2019**).

1.6.5 Ozone gel

It has been purported as having a beneficial effect after third molar surgery. Ozone is a strong oxidant and has broad anti-microbial properties. It is also known to enhance oxygen metabolism, induce enzymes and activate the immune response.This has the effect of reducing the possibility of post-operative infection, improve tissue regeneration and speed up wound healing **(Howard Cho et al., 2017).**

1.6.6 honey

Honey has been in use as a wound dressing for thousands of years. It has shown prevent infections. It is antibacterial, anti-inflammatory , and odorless. It helps in granulation and epithelialization, shedding of necrotic tissue, and has analgesic and antioxidant effects. Honey helps to keep the wound moist. In addition, it stimulates white blood cells to produce cytokines, particularly interlukin1, interlukin 6, and tumor necrosis factor. Honey also helps to speed up the healing process and reduces scarring (**Arsalan Ansari et al ., 2019).**

Hygroscopic properties, acidic pH, and hydrogen peroxide present in honey make it antibacterial which was recognized by **Molan in 1992.**

Honey is ideal as dressing material in cases of AO. There was a significant decrease in pain following application of honey dressing in dry socket. Clinical signs such as erythema and swelling showed a significant decrease on regular application of honey dressing. The viscosity of honey is high, and it forms a physical barrier which prevents bacterial colonization of wound..Majority of the patients with exposed bone got healed socket with evidence of granulation tissue and healing gingiva in about 1 week **(Nikita Soni et al ., 2016) .**

Fig.9: Honey dressing placed **(Arsalan Ansari et al ., 2019)**

1.6.7 Cryotherapy

Cryotherapy is a popular non pharmacologic intervention used in the management of immediate postoperative inflammatory complications and is defined as the application of substances that remove heat from the body for therapeutic purposes. It is relatively safe as dose not have any adverse effect, cheap, easily available, and can be self administered. Cryotherapy includes numerous techniques to induce heat abstraction, such as ice packs, ice massage, frozen gel packs, ice chips in a plastic bag or in a washcloth, and application of cold compression therapy.Cold application reduces the skin temperature, leading to vasoconstriction of blood vessels and decrease of tissue metabolism, microvascular permeability, and nerve conduction velocity which would provide physiological benefits for patients undergoing third-molar removal, including decreased bleeding, muscles spasms,and inflammation (**Edmundo Marques do Nascimento-Júnior et al ., 2018).**

Subjects on cryotherapy generally reported lesser postoperative pain (due to the direct effect of cryotherapy on nerve conduction), lesser postoperative swelling, and lesser limittion of mouth opening, thereby leading to a better quality of a life after third molar surgery when compared with subjects who did not apply cryotherapy **(Adebayo A. bikunle1 & Wasiu L. Adeyemo , 2016).**

Fig.10: Application of ice pack over the masseteric region **(Adebayo A. bikunle1 & Wasiu L. Adeyemo , 2016)**.

1.6.9 Laser therapy

In the field of dentistry, the application of low-level laser (LLL) has been described since the 1970s. It is principally used to relieve pain, reduce inflammation and edema, and to accelerate healing after the oral and maxillofacial surgery. LLLT has been reported to prevent pain, trismus and swelling following the removal of impacted third molars since the 1980 S (**W. L. He et al ., 2015**).

LLLT is a simple and non- invasive modality that can be perforamed in a relatively short time (less than 5 minutes) in the dental office. Although we applied LLLT for three times over 1 week the outcomes of one time laser application immediately after the surgical procedure should also be considered promising, as it relieved pain symptoms at least on days 1 and 2 and facial swelling on day 2 **(Majid Eshghpour et al ., 2016).**

It is believed that LLLT stimulates the synthesis of endogenous endorphins, increases pain threshold and blocks neuronal conduction.

The anti-inflammatory effect of LLLT has been attributed to the increase in number and diameter of lymph vessels, reduction in permeability of blood vessels and inhibitory effects on inflammatory mediators such as PGE2, IL6, IL-10, and TNF-α **(Majid Eshghpour et al ., 2016).**

Chapter two

Conclusions

The most frequent immediate and late complications were slight pain, swelling, and trismus. There are many locals agents that have proven effective in treating pain, swelling and infection without side effects, including Alvogyl , and Platelet Rich Fibrin.

References

(A)

- Agthong S, Huanmanop T, Chentanez V. (2005) Anatomical variations of the supraorbital, infraorbital, and mental foramina related to gender and side. J Oral Maxillofac Surg ,63:800-804.
- Al-Hamed, F. S., Tawfik, M. A., Abdelfadil, E., & Al-Saleh, M. A. Q. (2017). Efficacy of Platelet-Rich Fibrin After Mandibular Third Molar Extraction: A Systematic Review and Meta-Analysis. Journal of oral and maxillofacial surgery : official journal of the American Association of Oral and Maxillofacial Surgeons , 75(6), 1124–1135.
- Ansari, A., Joshi, S., Garad, A., Mhatre, B., Bagade, S., & Jain, R. (2019). A Study to Evaluate the Efficacy of Honey in the Management of Dry Socket. Contemporary clinical dentistry, 10(1), 52–55.
- Apostolakis D, & Brown JE.(2013). The dimensions of the mandibular incisive canal and its spatial relationship to various anatomical landmarks of the mandible: A study using cone beam computed tomography. Int J Oral Maxillofac Implants, 28:117-24.
- Assari, A. S., Alrafie, H. S., Al Ghashim, A. H., Talic, F. N., Alahmari, A. M., Al Manea, M. Y., & Alrashdan, R. Y .(2022). Effectiveness of different socket dressing materials on the postoperative pain following tooth extraction: a randomized control trial. Journal of medicine and life, 15(8), 1005–1012.

(B)

- Bhargava D. (2022). Transalveolar Extraction Of The Mandibular Third Molars. 1st edition.CRC Press , 24_25.
- Bowe, D. C., Rogers, S., & Stassen, L. F. (2011). The management of dry socket/alveolar osteitis. Journal of the Irish Dental Association, 57(6), 305–310.
- Breeland, G., Aktar, A., & Patel, B. C. (2022). Anatomy, Head and Neck, Mandible, StatPearls.

(C)

- Chakravarthi S. (2017). Platelet rich fibrin in the management of established dry socket. Korean Association of Oral and Maxillofacial Surgeons, 43:160-165.
- Chaurasia, N. K., , Upadhyaya, C., , & Dixit, S., (2017). Comparative Study to Determine the efficacy of Zinc Oxide Eugenol and Alveogyl in Treatment of Dry Socket. Kathmandu University medical journal (KUMJ), 15(59), 203–206.
- Cho, H., Lynham, A. J., & Hsu, E. (2017). Postoperative interventions to reduce inflammatory complications after third molar surgery: review of the current evidence. Australian dental journal, 62(4), 412–419.

(D)

- Deliverska E G , Petkova M. (2016). COMPLICATIONS AFTER EXTRACTION OF IMPACTED THIRD MOLARS - LITERATURE REVIEW. Journal of IMAB - Annual Proceeding (Scientific Papers), 22(3):1202-1211.

- Desai A J , Thomas R , AB, T ,K. DS ,M. (2013).Current concepts and guidelines in chin graft harvesting: A literature review. International Journal Of Oral Health Sciences , 3(1).
- Daly BJM, Sharif MO, Jones K, Worthington HV, Beattie A . (2022). Local interventions for the management of alveolar osteitis (dry socket). Cochrane Library , Issue 9. Art. No.: CD006968.
- de Santana-Santos T, de Souza-Santos JA, Martins-Filho PR, da Silva LC, de Oliveira E Silva ED, Gomes AC.(2013) Prediction of post- operative facial swelling, pain and trismus following third molar surgery based on preoperative variables. Med Oral Patol Oral Cir Bucal ,18:e65

- Blondeau F, Daniel NG.(2007) .Extraction of impacted mandibular third molars: postoperative complications and their risk factors. J Can Dent Assoc ,73(4):325.70

(F)

- Fiorillo L. (2019). Chlorhexidine Gel Use in the Oral District: A Systematic Review. Gels (Basel, Switzerland) ,5(2), 31.

(G)

- Goswami A , Ghorui T , Bandyopadhyay R , Sarkar A , Ray A .(2020). A General Overview of Post Extraction Complications-Prevention, Management and Importance of Post Extraction Advices.Fortune Journal of Health Sciences, 3 (3): 135-147.
- Greenstein, G., & Tarnow, D. (2006). The mental foramen and nerve: clinical and anatomical factors related to dental implant

placement: a literature review. Journal of periodontology, 77(12), 1933–1943.

(H)

- Hartshorne J & Gluckman H . (2016). A comprehensive clinical review of Platelet Rich Fibrin (PRF) and its role in promoting tissue healing and regeneration in dentistry. Part 1: Definition, development, biological characteristics and function. INTERNATIONAL DENTISTRY – AFRICAN EDITION. VOL. 6, NO. 5.
- Hita-Iglesias, P., Torres-Lagares, D., Flores-Ruiz, R., Magallanes-Abad, N., Basallote-Gonzalez, M., & Gutierrez-Perez, J. L. (2008). Effectiveness of chlorhexidine gel versus chlorhexidine rinse in reducing alveolar osteitis in mandibular third molar surgery. Journal of oral and maxillofacial surgery : official journal of the American Association of Oral and Maxillofacial Surgeons , 66(3), 441–445.

(J)

- Jacobs R, Mraiwa N, vanSteenberghe D, Gijbels F, Quirynen M.(2002). Appearance, location, course, and morphology of the mandibular incisive canal: An assessment on spiral CT scan. Dentomaxillofac Radiol ,31:322-7.
- Juodzbalys G , Daugela P . (2013) . Mandibular third molar impaction: review of literature and a proposal of a classification. J Oral Maxillofac Res, 1;4(2):e1.
- Juodzbalys, G., Wang, H. L., & Sabalys, G .(2010). Anatomy of Mandibular Vital Structures. Part II: Mandibular Incisive Canal, Mental Foramen and Associated Neurovascular Bundles in

Relation with Dental Implantology. Journal of oral & maxillofacial research,1(1), e3.

(K)

- Kaya, G. Ş., Yapici, G., Savaş, Z., & Güngörmüş, M. (2011). Comparison of alvogyl, SaliCept patch, and low-level laser therapy in the management of alveolar osteitis. Journal of oral and maxillofacial surgery : official journal of the American Association of Oral and Maxillofacial Surgeons ,69(6), 1571–1577.

(M)

- Makris N, Stamatakis H, Syriopoulos K, Tsiklakis K, van der Stelt PF , et al .(2010).Evaluation of the visibility and the course of the mandibular incisive canal and the lingual foramen , cone-beam computedtomography. Clin Oral Implants Res , 21:766-71.
- Malkawi Z, Al-Omiri MK, Khraisat A.(2011).Risk indicators of postoperative complications following surgical extraction of lower third molars.Medical principles and practice : international journal of the Kuwait University, Health Science Centre ,20(4):321-325.
- Mottl R , Kunderová M , Slezák R , Schmidt J. (2021). Iatrogenic Fracture of the Lower Jaw: A Rare Complication of Lower Molar Extraction. Acta Medica (Hradec Kralove), 64(2):101-107.
- Mraiwa N, Jacobs R, Moerman P, Lambrichts I, van Steenberghe D, Quirynen M . (2003).Presence and course of the incisive canal in the human mandibular interforaminal region: Two-dimensional imaging versus anatomical observations. Surg Radiol Anat , 25:416-23.

(N)

- Neiva RF, Gapski R, Wang HL. (2004) Morphometric analysis of implant-related anatomy in Caucasian skulls. J Periodontol ,75:1061-1067.

(O)

- Oikarinen K . (1991). Postoperative pain after mandibular third-molar surgery. Acta Odontologica Scandinavica ,49:7-13.

(P)

- Patil S . (2015).Impacted Mandibular Third Molars: Review of Literature and a Proposal of a Combined Clinical and Radiological Classification . Annals of medical and health sciences research ,5(4):229-34.

(R)

- Rakhshan V. (2015). Common risk factors for postoperative pain following the extraction of wisdom teeth. Journal of the Korean Association of Oral and Maxillofacial Surgeons,41(2), 59–65.
- Rashed S A , Elsharkawy A T , Zaied A. (2019) . Evaluation of Efficacy of Platelet-Rich Fibrin (PRF) versus Alvogyl and Zinc Oxide and Eugenol (ZOE) packing in the Management of Alveolar Osteitis: A prospective randomized clinical study.EGYPTIAN DENTAL JOURNAL,Vol. 65, 1005:1013.
- Reeshma S ,& Dain C P .(2021). Comparison of platelet-rich fibrin with zinc oxide eugenol in the relief of pain in alveolar osteitis.Health Science Reports,4:e354.

- Rosa MB, Sotto-Maior BS, Machado Vde C, Francischone CE .(2013) . Retrospective study of the anterior loop of the inferior alveolar nerve and the incisive canal using cone beam computed tomography. Int J Oral Maxillofac Implants ,28:388-9.

(S)

- Sarnat, H., Kaffe, I., Porat, J., & Amir, E. (2003). Developmental stages of the third molar in Israeli children. Pediatric dentistry ,25(4), 373–377.
- Soni, N., Singh, V., Mohammad, S., Singh, R. K., Pal, U. S., Singh, R., Aggrwal, J., & Pal, M. (2016). Effects of honey in the management of alveolar osteitis: A study. National journal of maxillofacial surgery,7(2), 136–147.
- Sortino, F., & Cicciù, M. (2011). Strategies used to inhibit postoperative swelling following removal of impacted lower third molar. Dental research journal, 8(4), 162–171.
- Sotorra-Figuerola, D., Alberdi-Navarro, J., Gainza-Cirauqui, M. L., Muñoz-Zapata, J. P., & Aguirre-Urizar, J. M. (2019). Foreign-body reaction to an alveolar dressing (Alvogyl): Presentation of 4 cases. Journal of Oral Diagnosis , 4, e20190009.
- Sukegawa, S., Yokota, K., Kanno, T., Manabe, Y., Sukegawa-Takahashi, Y., Masui, M., & Furuki, Y.(2019). What are the risk factors for postoperative infections of third molar extraction surgery: A retrospective clinical study?. Medicina oral, patologia oral y cirugia bucal. 24(1), e123–e129.

(U)

- Urvi H. Dave U H. , Gupta S , Astik R . (2019). Cross sectional analysis of positional and numerical variations of mental foramina in dry human mandibles. Indian Journal of Clinical Anatomy and Physiology, 6(1):81-84.

(W)

- Wayland J .(2018). Impacted third molar .1st edition .Wiley Blackwell ,21_22.