



## Traumatic Extraction as a Risk Factor for Alveolar Osteitis A Randomized Controlled Trial

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### Abstract

**Objectives:** Assessment of incidence of alveolar osteitis following normal extraction techniques versus atraumatic extraction technique.

**Materials and Methods:** This study was conducted on one hundred patients requiring extraction of mandibular molars. The patients in the study were randomly divided into two equal groups. The Control group included fifty patients in which the extraction was carried out using the “Standard” English style vertical hinge extraction forceps. The study group included fifty patients in which the extraction was carried out using the Physics forceps. Patients follow up postoperatively was done to assess the incidence of alveolar Osteitis (AO) in each group.

**Results:** For intergroup comparison, there was clinically and statistically significant difference between both groups regarding the incidence of alveolar osteitis. There were four cases of Alveolar Osteitis in the control group (English style forceps extraction), showing 4% incidence. While in the study group (physics Forceps group) there were no recorded cases of Alveolar Osteitis, showing 0% incidence. Moreover, there was both statistically and clinically significant findings regarding gender and age as all Alveolar Osteitis cases were females and in their third decade of age.

**Conclusions:** Within the limitations of this study, it was concluded that the use of the Physics Forceps decreases the incidence of Alveolar Osteitis in highly susceptible patients (those with more than one risk factor of AO). Also, it was concluded that Traumatic extractions increase the incidence of Alveolar Osteitis and that Alveolar Osteitis has a female predilection and increased incidence in the third decade of age.

**Keywords:** Alveolar Osteitis, Dry socket, Traumatic Extraction, Physics Forceps,

## **Introduction**

Alveolar Osteitis (AO), which is more commonly known as Dry socket is a common complication following the extraction of teeth, it was first described by Crawford in 1896<sup>(1)</sup>. This complication appears in around 3% of non-surgical extractions<sup>(2)</sup>, but it is more common with surgical extraction of impacted third molars, where the incidence rises up to 30%<sup>(3)</sup>. Alveolar Osteitis is ten times more common in the mandible due to many factors<sup>(4)</sup>, such as: the higher density of the bone, leading to more difficult and traumatic extractions and the less blood circulation in the mandible when compared to the maxilla.

The exact etiology of the disease is still controversial<sup>(5)</sup>, but many risk factors were proven related. But unlike the etiology, the pathogenesis of the disease was discussed thoroughly in literature<sup>(6,7)</sup>. Alveolar Osteitis was found to be a fibrinolytic disorder, where the blood clot present in the extraction socket is lysed, leading to delayed wound healing<sup>(6)</sup>.

It was found that any of the many causative factors (e.g.: trauma, estrogen, bacteria..etc.) causes the conversion of plasminogen, which is the inactive form into plasmin, which is a fibrinolytic enzyme (active form) followed by disintegration of the fibrin network and loss of the blood clot in the extraction socket. This leads to the presence of an “empty socket”<sup>(6)</sup>.

The chief complaint of the patient with Alveolar Osteitis is a severe pain related to the extraction site arising on the third day after the extraction<sup>(7)</sup>. This occurs due to the presence of bare bone in the socket. Other signs and symptoms of Alveolar Osteitis include: empty socket, foul odour and others.

Many risk factors were related to Alveolar Osteitis, among them is the iatrogenic trauma during extraction. It was suggested that this trauma causes damage to the alveolar bone, which leads to localized inflammation of the socket<sup>(8)</sup>. This inflammation causes the release of many inflammatory mediators that act on increasing the amount of plasmin, which is fibrinolytic and causes the lysis of the fibrin clot<sup>(6)</sup>. Many studies showed that the greater the trauma during extraction, the greater the amount of these mediators and the consequent clot lysis<sup>(6)</sup>.

Another co-relation was found between traumatic extractions and Alveolar Osteitis. It was shown that traumatic extractions led to the compression of the bone lining the socket, which in turn compresses the blood vessels in the alveolar socket leading to thrombosis of these vessels and jeopardizing the blood supply in the area<sup>(25)</sup>. This ultimately leads to delayed wound healing, decreased immune response in the area and subsequent wound infection, finally leading to Alveolar Osteitis<sup>(9)</sup>.

In search for less traumatic methods of extraction, in the past decade many new techniques were introduced, these techniques were named “atraumatic extraction techniques”<sup>(10)</sup>. These techniques use different principals in extraction than the conventional extraction method, which mainly depends on the bucco-lingual movement for socket expansion.

The atraumatic extraction techniques use principals such as: vertical elevation of teeth, severing the periodontal ligament before extraction, creep and many more. These techniques do not cause fractures of the alveolar bone and so are less traumatic<sup>(11)</sup>. The instruments used in atraumatic extraction include many examples, such as: Periotomes, vertical elevation systems (e.g.: Benex System) and the Physics forceps.

In 2004 the Physics Forceps was developed, it is a differently designed forceps, it does not rely on bucco-lingual movement and the expansion of the socket, but rather utilizes the principals of first-degree levers,

and moment of force<sup>(12)</sup>. The Physics Forceps applies a sustained constant pressure on the periodontal ligament for a certain amount of time. This leads to increase in the stress on the periodontal ligament in a phenomenon called “creep”<sup>(12)</sup>. This ultimately leads to fatigue in the periodontal fibers holding the tooth in place and the tooth becomes loose in socket without fracturing the alveolar bone<sup>(13)</sup>. Afterwards the tooth could be easily held and removed with a needle holder or a mosquito. This extraction technique was found to be less traumatic to the alveolar bone than using the standard English style vertical hinge extraction forceps in the bucco-lingual manner<sup>(14,15)</sup>.

No studies in literature assessed the Alveolar Osteitis incidence with the standard English style vertical hinge extraction forceps in comparison to the atraumatic extraction techniques, including the Physics Forceps<sup>®</sup>. Therefore, the aim of this study is studying the effects of using an atraumatic technique, namely the use Physics Forceps on the incidence of Alveolar Osteitis, which can be of an added scientific value.

## **Materials and Methods**

This study was conducted after receiving an ethical clearance from the Research Ethics Committee of Faculty of Dentistry - Ain Shams University, assuring that the study follows the guidelines of the research ethical committee’s code of practice.

### **I. Patient Selection:**

This study included One hundred patients with mandibular molars indicated for extraction, that were seeking treatment at the OMFS outpatient clinic of the Faculty of Dentistry, Ain-Shams University. The procedures to be performed, as well as the potential benefits and risks were explained to the patients, along with a signed informed consent form obtained before enrolling them in the study.

### **Selection Criteria:**

#### **Inclusion Criteria:**

1. Adults with age range of 18 to 45 years.
2. Mandibular molars indicated for non-surgical extraction.
3. At least one risk factor of Alveolar Osteitis (e.g.: a history of pericoronitis, use of oral contraceptive pills, smoking, bruxism or a history of AO).

#### **Exclusion Criteria:**

1. Mandibular molars requiring surgical extraction.
2. Teeth with abnormal root morphology or abnormal alignment.
3. Patients with any condition contra-indicative of extraction (e.g. Coagulation problems).
4. Patients under antibiotic regimen or other medications (e.g. steroids or anti-depressants) at the time of the study.

5. Patients with any systemic diseases affecting healing (e.g. uncontrolled Diabetes Mellitus or immune-deficiency).
6. Patients lacking cooperation (e.g. mentally handicapped, or patients with limited mouth opening).

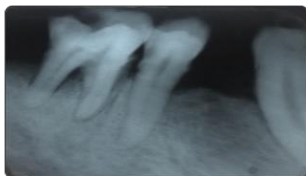
## **II. Patient Grouping and Allocation:**

Simple randomization by tossing a coin was used to randomly allocate the patients, the patients were split evenly between two groups.

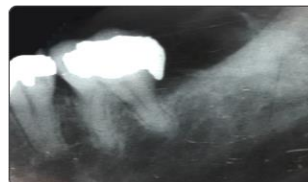
- **Control group:** 50 patients underwent mandibular molar extractions with “Standard” English style vertical hinge extraction forceps.
- **Study group:** 50 patients underwent mandibular molar using the “Physics Forceps”.

## **III. Pre-Surgical Assessment:**

1. Detailed dental and medical history was obtained from the patient.
2. All patients filled a standardized questionnaire, written specially to assess different Alveolar Osteitis risk factors.
3. Clinically the teeth were examined, to certify that they are indicated for extraction.
4. Periapical radiographs of the teeth were taken [Figures (1), (2)].



**Figure (1):** Periapical Radiograph showing Mandibular first molar with severe bone loss



**Figure (2):** Periapical Radiograph showing Mandibular first molar with a large over hanging amalgam filling and irreversible pulpitis.

## **IV. Surgical Technique:**

### **A. Anesthetic Protocol:**

In both groups, a maximum of two carpules of Mepecaine [2% Mepivacaine HCl combined with 1:20,000 Levonordefrine (vasoconstrictor)]\* were injected, as Inferior Alveolar Nerve block (IANB) combined with Lingual nerve block and long buccal nerve block.



\* Mepecaine –L , by Alexandria Company for pharmaceuticals , Egypt

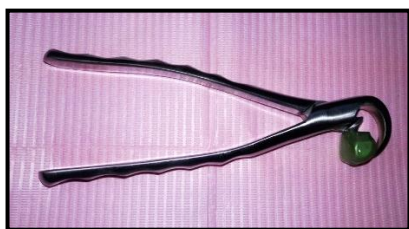
**Figure (3): Anesthetic Carpule (Mepivacaine 2%)**

**B. Surgical Procedure:**

All extractions were performed by the principal investigator to standardize the technique.

**I. Physics Forceps Group (Study Group):**

The beak of the Physics Forceps<sup>®\*</sup> is placed in the depth of the lingual gingival sulcus as apical as possible, while the forceps bumper (which is covered with rubber to avoid trauma to the soft tissue) was placed buccally at the muco-gingival junction. The forceps is then moved gently in the buccal direction only and the movement is sustained for a couple of minutes until the tooth becomes loose and “pops out” of the socket. The tooth is then removed using a hemostat.



**Figure (4):** The Physics Forceps



**Figure (5):** The proper placement of the Physics Forceps



**Figure (6):** Rotation of The Physics Forceps in the buccal direction and the movement is sustained for one minute.

**II. Standard Vertical hinged forceps group (Control Group):**

Standard English-Style vertical hinge forceps<sup>\*</sup> was used for extraction, The forceps beaks were placed in the gingival sulcus as apical as possible, the forceps was then in the traditional bucco-lingual extraction movement for socket expansion, with the other hand of the surgeon used for support of the mandible.



**Figure (7):** Standard English style vertical hinge extraction forceps



**Figure (8):** Extraction of a mandibular molar using

**VI. Post –Operative Care:**

\* By Golden, USA

\* By Carl Martin GmbH, Germany

Immediate post operatively all the patients in both groups, were given written post-extraction instructions. The patients were also given a prescription of Paracetamol\*<sup>1</sup>500 mg tablet every 12 hours for 3 days.

## **V. Post-Surgical Follow up:**

Patients were contacted on the first day following the extraction via a phone call, and asked about pain levels and the consumption of analgesics. The patients were asked to return to the clinic if any signs of Alveolar Osteitis appear. All Patients were recalled to the clinic for follow-up visits on 3<sup>rd</sup> and 7<sup>th</sup> days post-extraction. In these visits clinical examination for any signs and symptoms of Alveolar Osteitis was performed. Patients who are not able to attend the follow up visits, were checked upon with a phone call on the 3<sup>rd</sup> day, in case of any alarming signs, those patients were recalled to the clinic for observation. If not, another call was done on the 5<sup>th</sup> day post-operatively to check again for any signs of Alveolar Osteitis.

### **Patients with Alveolar Osteitis:**

#### **Criteria (symptoms) of Alveolar Osteitis**

1. Severe pain starting on the 3<sup>rd</sup> day post-extraction.
2. Disintegrated blood clot in the extraction socket (“bare bone”).
3. Foul odour (halitosis) or bad taste maybe present.

#### **Management of Alveolar Osteitis:**

Patients diagnosed with Alveolar Osteitis filled a detailed questionnaire, including questions about possible Alveolar Osteitis risk factors, symptoms and the pain levels they felt.

Those patients were treated with gentle irrigation with saline followed by placing Alvogyl\*\*<sup>2</sup> dressing in the socket, which was replaced every other day until the symptoms were relieved.



**Figure (9):** Alvogyl Dressing

## **VI. Data Management and Statistical Analysis**

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\*Paracetamol,<sup>1</sup> El Nasr Pharmaceutical Chemicals Co. “ADWIC” – ARE.

\*\*Septodont



The collected data was revised, coded, tabulated and introduced to computer using SPSS 22.0 for Windows\*. Data was presented and suitable analysis was done according to the type of data obtained for each parameter.

### **I. Descriptive statistics:**

- Mean.
- Standard deviation ( $\pm$  SD).
- Minimum and maximum values (range) for numerical data.

### **II. Analytical statistics:**

The Chi-Square Test was used to assess the statistical significance of the difference between the study and the control group.

P- value: level of significance:

- $P > 0.05$ : Non-significant (NS).
- $P \leq 0.05$ : Significant (S).
- $P \leq 0.01$ : Highly significant (HS)

## **Results**

### **Overall Results**

In this study 100 mandibular molars selected according to preset criteria, were extracted in the department of OMFS Ain Shams University in the period from November 2015 till November 2017.

These cases were equally divided into two groups. All the cases included one or more risk factor for Alveolar Osteitis. All patients were assessed preoperatively by the principal investigator and a periapical radiograph was taken for the tooth to be extracted. A questionnaire concerning the risk factors of the Alveolar Osteitis was filled.

The follow up visits were on 3<sup>rd</sup> and 7<sup>th</sup> day and the patients that did not show up on the follow up visits were contacted by phone on the 3<sup>rd</sup> day to assess whether they need further medical attention Patients with signs and symptoms of Alveolar Osteitis were treated.

The results of this study were presented as follows:

- Clinical outcomes of the study.

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\* Statistical package for Social Science (SPSS) 22.0. IBM, United States

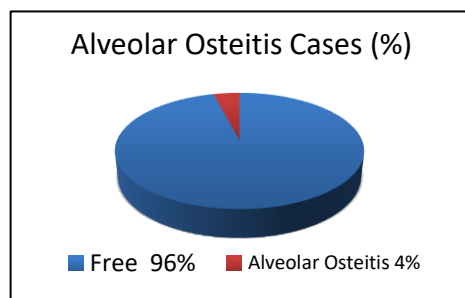
- Demographic Data.

## I. Clinical Outcomes of the study

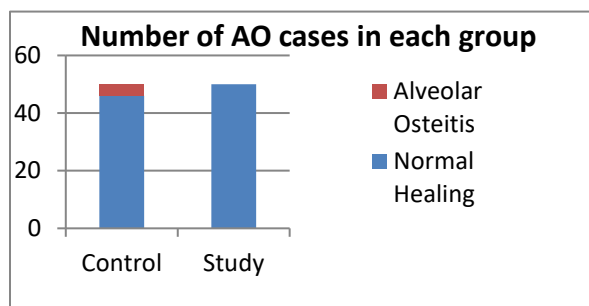
Out of the 100 extraction cases, four cases of Alveolar Osteitis occurred, which represents 4% of the cases.

**Table (1):** Showing the number of Alveolar Osteitis cases in each group

	Control Group	Study Group
<b>Total Cases</b>	50	50
<b>Number of AO Cases</b>	4	0



**Figure (10):** Pie chart showing percentage of Alveolar Osteitis Cases



**Figure (11):** Bar chart showing Number of AO Cases

All cases occurred in the control group, where the extraction was done using the “Standard” English style vertical hinge extraction forceps. But none occurred in the study group (Physics Forceps).

This was found statistically to be highly significant, as the significance level was ( $P < 0.0001$ ) using Chi-square test.

**Table (2):** Showing the details of the Alveolar Osteitis Cases

Gender	Age	Tooth extracted	Systemic Condition	Smoking	Oral Hygiene	Oral Contraceptive	Menstruation
F	32	6	Free	No	Fair	No	Ended 5 days before extraction
F	35	6	Free	No	Fair	No	Ended 10 days before extraction
F	28	7	Free	No	Fair	No	Present during



							extraction Ended 3 days before Extraction
F	34	6	Free	No	Fair	No	

### Clinical Picture of Alveolar Osteitis Cases

The patients came on the 3<sup>rd</sup> day post extraction complaining of severe pain at the extraction site, not relieved with over-the-counter analgesics.

On inspection the socket was empty and the clot was dislodged, leaving painful “bare bone”.



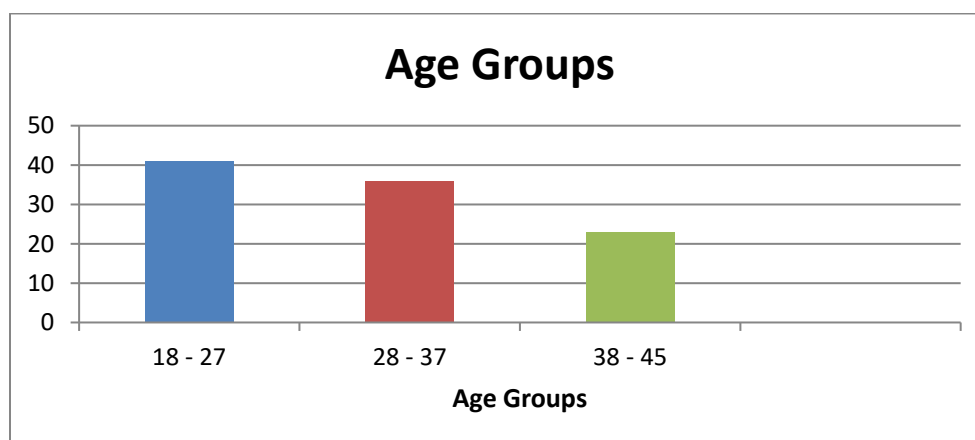
**Figure (12):** A Photo showing dry socket in a lower second molar

### I. Demographic Data

#### 1. Age Distribution:

The age range of the patients was 18- 45 years, while the mean age of the patients was 31.28 years with SD  $\pm$  2.83.

All Alveolar Osteitis cases were in their third decade of age (with exact ages of: 28, 34, 32 and 35 years old). This was found to be highly significant, with significance level ( $P < 0.0001$ ) using Chi-square test.



**Figure (13):** Bar chart showing different age groups

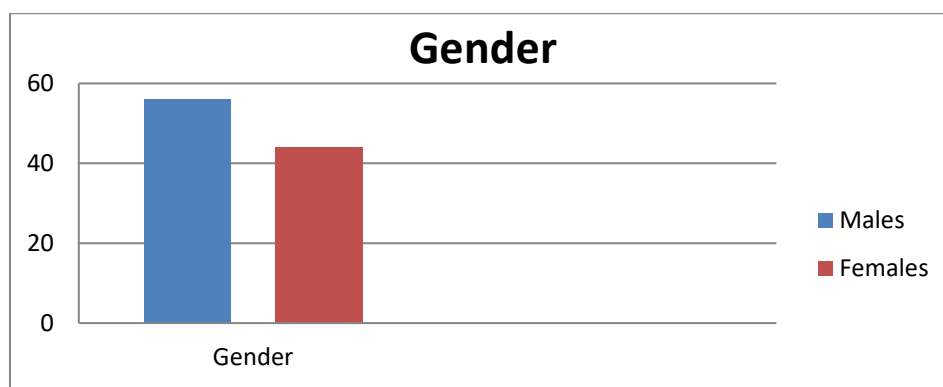
#### 2. Gender:

The number of females in the study was 44, while the number of males in the study was 56 patients, this gave a ratio of 1:1.27 (females: males).

### Female Predilection:

All of the cases that developed Alveolar Osteitis were females. This female predilection was found to be highly significant, with significance level ( $P < 0.0001$ ) using Chi-square test.

None of the Alveolar Osteitis cases were taking oral contraceptive pills, and the time of the menstrual cycle on which the extraction was performed was stated in the Alveolar Osteitis questionnaire they filled. It was found that these patients were on the: 7<sup>th</sup>, 10<sup>th</sup>, 12<sup>th</sup> and 17<sup>th</sup> days of the menstrual cycle respectively.



**Figure (14):** Bar chart showing Gender distribution

## Discussion

Alveolar osteitis is a common complication following the extraction of teeth, the incidence of Alveolar osteitis in normal extractions is about 3%<sup>(14)</sup>. This complication is characterized by severe pain in the site of extraction which occurs on the third post-extraction day<sup>(15)</sup>, this pain does not disappear with over-the-counter analgesics<sup>(16)</sup>.

Many risk factors were associated with Alveolar osteitis<sup>(5)</sup>, among them is traumatic extraction which was found by many studies to increase the incidence of Alveolar osteitis<sup>(21-23,31,33)</sup>. Studies showed that the greater the degree of trauma, the greater the incidence of Alveolar osteitis<sup>(6)</sup>.

Also, it was found that the increased difficulty of an extraction increases the incidence of Alveolar osteitis<sup>(6)(17)</sup>. Studies showed that the extraction of the mandibular molars is the most difficult<sup>(6)</sup>.

Up to our knowledge through reviewing the literature no connection between the use of the Physics Forceps or other atraumatic techniques and the incidence of Alveolar osteitis was investigated. So based on these findings, this study was conducted to assess whether the use of an atraumatic extraction technique will decrease the incidence of Alveolar osteitis or not.

In this study one hundred molars were extracted in the OMFS department in Ain Shams University from the period of November 2015 till November 2017. Each patient filled a detailed questionnaire related to Alveolar osteitis, and a periapical radiograph was taken to assess the shape of the root, to exclude abnormal root forms or dilacerations.

The one hundred patients were divided in two equal groups of fifty patients each. In the first group (study), the Physics Forceps<sup>®\*</sup> was used for extraction, this forceps was invented by Golden in 2004. It utilizes different biomechanical principals and extraction movements from the standard English style vertical hinged forceps<sup>(18),(19)</sup>.

The Physics Forceps works by applying constant pressure on the periodontal ligament of the tooth causing its fatigue, which renders the tooth loose in the socket with no need for socket expansion<sup>(20)</sup>. These features make the Physics Forceps much faster and more efficient and also less traumatic to the alveolar bone<sup>(21)</sup>. So, this group represented the atraumatic technique.

In the second group (control), the standard English style vertical hinge forceps<sup>+</sup> was used for the extraction. This was considered more traumatic than the Physics Forceps, due to increased pressure on bone during the bucco-lingual extraction movements.

Later the incidence of Alveolar osteitis was compared between the two groups, as a reflection of the effect of trauma on the incidence of Alveolar osteitis. The data was then collected through a detailed questionnaire considering other attributing risk factors related to Alveolar osteitis.

Patient inclusion criteria were based on the risk factors of Alveolar osteitis and so only mandibular molars were selected in this study. As the incidence of Alveolar osteitis is ten folds more common in the Mandible compared to the maxilla<sup>(8)</sup>, this was considered due to many aspects, such as: lower blood supply to the mandible, the presence of more dense bone<sup>(2)</sup>. Also, the extraction of mandibular molars is more difficult, requiring more manipulation during extraction, which in turn increases the amount of surgical trauma<sup>(22)</sup>. This difficulty in extraction is due to many aspects such as: the presence of the external oblique ridge, the high density of the bone in the posterior mandible and that these teeth are multi-rooted<sup>(17)(6)</sup>.

Many exclusion factors were used in order to narrow the patient selection into the highly susceptible ones, and to avoid any factors that could alter the results causing bias.

Patients with limited mouth opening or uncooperative, such as those mentally handicapped and children under 18 years old were excluded from the study. Patients taking antibiotics or immune-suppressive medications, such as: steroids were excluded from the study in order to avoid altering the incidence of Alveolar osteitis<sup>(5)(23)(24)</sup>. Some systemic diseases such as: Chronic Hepatitis or Diabetes Mellitus were excluded from the study due to their effect on clot formation and socket healing<sup>(7, 24, 93)</sup>. Patients with conditions contra-indicative of extraction, such as bleeding disorders (e.g. hemophilia) or those on anti-coagulation drugs such as: Warfarin<sup>\*</sup> or Clopidogrel<sup>+</sup>, were excluded from the study.

Also, patients who recently received radiation to the head and neck region were excluded, in order to avoid the occurrence of Osteo-radio-necrosis (ORN) after dental extractions<sup>(25)</sup>. Patients taking Bisphosphonates were also excluded in order to avoid developing of MRONJ (medication related osteo-

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\* Golden, USA

+ Carl Martin GmbH, Germany

\* Coumadin, **Bristol-Myers Squibb, USA**

+ Plavix, Sanofi, France

necrosis of the jaw) after extraction in those patients<sup>(26)</sup>. Finally, teeth that might need surgical removal or root separation as those with: abnormal root morphology, such as severe curvatures or dilacerations were excluded from the study.

In our study the detailed questionnaire given to the patient covered many of the risk factors related to Alveolar osteitis.

The first risk factor for Alveolar osteitis is the female predilection, in two separate studies **MacGregor**<sup>(27)</sup> and **Field et al**<sup>(15)</sup> showed higher incidence of Alveolar osteitis in the females. Another study done by **Tjernberg**<sup>(28)</sup> reported five times increase in incidence of Alveolar osteitis in females. **Catelleni**<sup>(29)</sup> showed in a study that women having dental extractions within days 23-28 of their menstrual cycle had the least incidence of Alveolar osteitis. This period coincides with lowest levels of estrogen hormone in the body. Also, another study by **Colby**<sup>(30)</sup> in 1997, supported these findings by Catelleni, that the days from 23 to 28 of the menstrual cycle showed the least incidence of Alveolar osteitis in female.

The main suspect behind this female predilection is the Estrogen hormone, which is either naturally present in the female bodies to regulate the menstrual cycle, also contraceptive pills contain a large dose of Estrogen, which is fibrinolytic in nature, it increases (factors II, VII, X and plasminogen), which causes blood clot lysis.

In two separate studies one by **Lilly** and the second by **Garcia**, Alveolar osteitis occurred three times more in females taking oral contraceptives than those not taking them<sup>(31) (32)</sup>. Also, oral contraceptive pills contain a high dose of Estrogen hormone, this is why these pills are the only medication associated with Alveolar osteitis. As their use led to the three-fold increase in incidence of Alveolar osteitis<sup>(32)</sup>.

In our study all of the Alveolar osteitis cases were females, this was also found highly statistically significant ( $P < 0.0001$ ), this strengthens the female predilection of the disease suggested by the findings of many other studies. None of these females were taking oral contraceptive pills. And all of them were in the first three weeks of the menstrual cycle, this matches the findings of the studies by **Catelleni**<sup>(29)</sup>, **Colby**<sup>(30)</sup> and **Eshghpour et al**<sup>(33)</sup> that suggested that the lowest incidence of Alveolar osteitis is in the fourth week (day 23 – day 28 of the menstrual cycle).

Another risk factor for Alveolar osteitis is the older age, as it never occurs in childhood. In a study by **Awang**<sup>(34)</sup> suggested that Alveolar osteitis is related to older age, and returned this to many aspects such as: more dense bone, less vascularity and root completion. Another study done by **Nitzan**<sup>(35)</sup> showed that Alveolar osteitis rarely occurs in childhood and its peak incidence is in third and fourth decades.

Also another study done by **Oginini et al**<sup>(36)</sup> showed that the peak age of Alveolar osteitis was in the third decade. The results of our study coincide with the findings of these studies, as all the Alveolar osteitis cases were in females between 25-35 years of age. This was found to be highly significant, with significance level ( $P < 0.0001$ ).

The relation between Alveolar osteitis and traumatic extractions has been suggested decades ago, **Birn**<sup>(6)</sup> in 1972 stated that the excessive trauma during extraction leads to excessive production of inflammatory mediators (kinases) which causes the destruction of the fibrin network and the blood clot inside the

extraction socket leading to Alveolar osteitis. Other studies by **Blum** <sup>(8)</sup> showed that the traumatic extraction led to the compression of the bone lining the socket, and its micro-blood vessels which decreases the blood supply in the socket, leading ultimately to delayed wound healing and Alveolar osteitis <sup>(9)</sup>.

A study by **Kolokythas** <sup>(5)</sup> and another by **Noorozi** <sup>(16)</sup> showed that traumatic extraction procedures increase the incidence of Alveolar osteitis up to 10 times. Several other studies such as those by **Butler and Sweet**, and others done by **Larsen** <sup>(9)</sup> and **Torres Lagares et al** <sup>(37)</sup> all suggest that that traumatic extractions increase the incidence of Alveolar osteitis.

In our study the results support this hypothesis, out of the fifty patients undergoing extraction using the Physics Forceps<sup>®</sup> (Study Group) no cases of Alveolar osteitis were found in this group (atraumatic extraction group). On the other hand using the standard English style vertical hinge forceps (Control Group), four patients had Alveolar osteitis. This represented 8%, which is similar to the incidence found by many studies <sup>(23-25)</sup>. This was found to be highly significant ( $P < 0.0001$ ), and supports the relation between traumatic extraction and the increased incidence of Alveolar osteitis, and that the use of atraumatic extraction techniques such as the Physics Forceps decreases the incidence of Alveolar osteitis.

Up to our knowledge no study related the use of atraumatic extraction techniques on the incidence of Alveolar osteitis, this could be the nidus for further research and is thought to be of added scientific value.

## **Conclusions:**

Within the limitations of this study, we conclude the following:

1. The use of the Physics Forceps decreases the incidence of Alveolar Osteitis in highly susceptible patients (those with more than one risk factor of Alveolar Osteitis).
2. Traumatic extractions increase the incidence of Alveolar Osteitis.
3. Alveolar Osteitis has a female predilection and increased incidence in the third decade.

## **Recommendations:**

1. The use of atraumatic extraction technique for extraction in highly susceptible cases (with more than one risk factors of Alveolar Osteitis).
2. Dentists should be very cautious during dental extractions, in order to decrease the amount of trauma during extraction, which in return decreases the incidence of Alveolar Osteitis.
3. Increasing the sample size, to study more thoroughly the different risk factors related to Alveolar Osteitis.

## **References**

1. "Dry Socket". **Crawford, JY.** 1896, Dental Cosmos, Vol. 38, pp. 929-931.
2. *Metronidazole in treatment of "dry socket"*. **Rood, J. P. and Murgatroyd, J.** 1981, International Journal of Oral Surgery, Vol. 10, p. 345.
3. *Alveolar osteitis following removal of mandibular third molars.* **Fridrich , KL and Olson, RAJ.** 1990, Anaesthetic Program, pp. 32-41.
4. **Alling, CC and Helfrick, JF.** Impacted Teeth. [book auth.] JF. Helfrick and CC Alling. *Oral Surgery.* Philadelphia : WB Saunders, 1993, pp. 188-201.
5. *Alveolar Osteitis: A comprehensive review of concepts and contraversies.* **Kolokythas, A.** 2010, International Journal of Dentistry, pp. 50-58.
6. *Etiology and Pathogenesis of fibrinolytic alveolitis(dry socket).* **Birn, H.** 1973, International Journal of Oral Surgery, Vol. 2, pp. 215-263.
7. *Kinins and pain in dry socket.* **Birn, H.** 1972, International Journal of Oral Surgery, Vol. 1, pp. 121-125.
8. *Contemporary views on dry socket (alveolar osteitis): a clinical appraisal of standardization, aetiopathogenesis and managment: a critical review.* **Blum, I.R.** 2002, International Journal of Oral and Maxillofacial Surgery, Vol. 31, pp. 309-317.
9. *Alveolar Osteitis after surgical removal of impacted mandibular third molars, identification of the patient at risk.* **Larsen, PE.** 1992, Journal of Oral sugery, oral medicine and oral pathology, Vol. 73, pp. 393-397.
10. *A new atraumatic system for the tooth removal and implant placement.* **Babbush, Charles.** 2007, Implant Dentistry, pp. 139-142.
11. *Atraumatic Extraction: advantages and Implementation.* **Horowitz, R.** 7, 2010, Journal of Periodontology, Vol. 6, pp. 2056-2064.
12. *Atraumatic extractions: A Biomechanical Rationale.* **Misch, Carl and Perez, Helena.** 8, 2008, Dentistry today, Vol. 27, pp. 1-3.
13. *The elastic and ultimate properties of compact bone tissue.* **Relly, DT.** 1975, Journal Of Biomechanics, Vol. 8, pp. 393-405.

14. *Metronidazole in treatment of "dry socket"*. **Rood, JP.** 1981, International Journal of Oral surgery, Vol. 10, p. 345.
15. *Dry socket incidence compared after a 12 year interval*. **Frazakerlev, M and Field, EA.** 1988, British Journal of Oral and Maxillofacial surgery, Vol. 23, pp. 419-423.
16. *Modern concepts in understanding & management of the "dry socket" syndrome: comprehensive review of literature*. **Noroozi, Ahmed.** 2009, Oral surgery oral medicine oral pathology, Vol. 107, pp. 30-35.
17. *Alveolar Osteitis prevention by immediate placement of medicated packing*. **Bloomer, Charles.** 2000, Oral Surgery oral med oral pathology, Vol. 90, pp. 282-284.
18. *Technological advances in extraction techniques & outpatient oral surgery*. **Dym, Harry and Weiss, Adam.** 2012, Dental clinics of North America, Vol. 56, pp. 245-266.
19. *Dental Plier Design with offsetting jaw and pad elements for assisting in removal of upper and lower teeth*. **Golden, RM.** 890, June 2005, US Patent 6, Vol. 910.
20. *Comparison between Physics and conventional forceps in simple dental extraction*. **El Kenawy, Mohamed and M. Said Ahmed, Wael.** 4, 2015, Journal of Oral and Maxillofacial Surgery, Vol. 14, pp. 949-955.
21. *Use of innovative Physics forceps for the extractions in preparation for dental implants*. **Kosinski, Timothy.** 2, 2012, Implant news and Views, Vol. 14, pp. 1-12.
22. *Types, frequencies and risk factors of complications of third molar extraction*. **Chi, Bui.** 2003, Journal of Oral and Maxillofacial Surgery, Vol. 61, pp. 1379-1383.
23. *Clinical Concepts of Dry Socket*. **Cardoso, Camila Lopes.** 2010, Journal of Oral and Maxillofacial Surgery, Vol. 68, pp. 1922-1932.
24. *Topical metronidazol in treatment of "dry socket"*. **Mitchell, L.** 4, 1984, British Dental Journal, Vol. 156, pp. 134-139.
25. *Osteoradionecrosis: A new concept of its pathophysiology*. **Marx, Robert E.** 5, May 1983, Journal of Oral and Maxillofacial Surgery, Vol. 41, pp. 283-288.
26. **Ruggiero, Salvatore L.** Diagnosis and Management of MRONJ. [book auth.] Fonseca. *Oral and Maxillofacial Surgery*. Third. 2017, pp. 507-527.
27. *Etiology of dry socket: a clinical investigation*. **MacGregor, AJ.** 1968, British Journal of Oral and Maxillofacial Surgery, Vol. 6, pp. 49-58.
28. *Influence of oral hygiene measures on the development of alveolar osteitis after the surgical removal of mandibular third molar*. **Tjernberg, A.** 6, 1979, International Journal of Oral Surgery, Vol. 8, pp. 430-434.
29. *Effect of oral contraceptives on dry socket*. **Catellani.** 1980, Journal of American Dental Association, pp. 777-780.
30. *The general practitioner's perspective of the etiology, prevention and treatment of dry socket*. **Colby, RC.** 5, September 1997, General Dentistry, Vol. 45, pp. 461-467.
31. *Alveolar osteitis associated with third molar extraction*. **Lilly, GE, et al.** 4, April 1974, Journal of American Dental Association, Vol. 88, pp. 802-806.
32. *Does oral contraceptive use affect the incidence of complications after extraction of molars*. **Garcia, A.G., et al.** April 2003, British Dental Journal, Vol. 194, pp. 453-455.



33. *The effect of menstrual cycle on the frequency of alveolar osteitis after surgical removal of mandibular third molar: a single blind randomized clinical trial.* **Eshghpour, M, Rezaei, N M and Nejat, A.** 14, 2013, Journal of Oral and Maxillofacial Surgery, Vol. 71, pp. 484-489.
34. *The etiology of dry socket: A review.* **Awang, MN.** 1989, International Dental Journal, Vol. 39, p. 236.
35. *On the genesis of dry socket.* **Nitzan, D., Sperry, J.F and Wilkins, T.D.** 6, 1983, Journal of Oral and Maxillofacial Surgery, Vol. 23, pp. 706-710.
36. *A Clinical evaluation of dry socket in a Nigerian Teaching hospital.* **Oginni, F O.** 2003, Journal of Oral and Maxillofacial Surgery, Vol. 61, pp. 871-876.
37. *Effectiveness of intra-alveolar CHX gel in the reducing the incidence of AO.* **Torres-Lagares.** 2006, International Journal of Oral and Maxillofacial Surgery, Vol. 35, pp. 348-350.
38. *A double-blind study on effectiveness of tetracycline in reducing the incidence of fibrinolytic alveolitis.* **Swanson, AE.** 2, 1990, Journal of Oral Surgery Oral Medicine and Oral Pathology, Vol. 70, pp. 165-167.
39. *Local anesthesia and dry socket.* **Meechan, JG.** 1987, International Journal of Oral and Maxillofacial Surgery, pp. 279-284.
40. *Dry socket frequency after interligamentary injections.* **Tsirlis, Anatasios, et al.** 8, August 1992, Quinsese International Journal, Vol. 23, pp. 575-577.