



# IRAJ

**Iraqi**  
**Dental**  
**Journal**

Peer Reviewed Journal , Published by  
**The Iraqi Dental Association**

Volume:35 / Issue:2 / 2013

ISSN 2307-4779



# Guidelines For Authors

The “Iraqi Dental Journal” is a Periodical Peer Reviewed Journal  
Published by The Iraqi Dental Association

## MANUSCRIPT SUBMISSIONS

A covering letter of submission of each manuscript should be sent to editor in chief providing complete contact information for the corresponding author.

Manuscripts should be submitted by email to ([idadjournal@iraqidental.org](mailto:idadjournal@iraqidental.org)) as an attached Microsoft Word file. Illustrations should be jpeg high resolution files. Tables and figures should be clear and labelled in numerical order as they appear in the text and should to be embedded within the text , Illustrated charts should be placed as a picture (not as a Excel chart).

Posted submission should contain three copies of manuscripts plus CD-Rom containing a softcopy of the manuscripts in the same format mentioned above.

The authors should not previously submit or publish the manuscripts in any other journal or any part of it.

Manuscript Preparation: All Manuscripts should have: Font size of 12 point and preferred style is Times new Roman. Posted Manuscript should be printed on A4 papers. Do not use the automatic formatting features of Microsoft Word Office such as footnotes and endnotes. All pages should be numbered numerically.

## MANUSCRIPT ARRANGEMENT

- Title: All articles must have a title with the following information and in this particular order: title of the article (ten words maximum), surname, initials, qualifications and affiliation of each author, name, postal address, e-mail address and telephone contact details of the corresponding author.
- Abstract: Should be 200-250 words and should outline the purpose of article including background, material and methods, results and conclusions.
- Keywords: All articles should include “keywords”, up to five words or short phrases should be used. Use terms from the medical subject headings (mesh) of index medicos when available and appropriate. Keywords are used to index the article and may be published with the abstract.
- Conflict of Interest Information: Authors should declare conflicts of interest clearly.
- INTRODUCTION The introduction should be brief and describe the purpose of the study.
- Methods: should include the study design and setting. Statistical analyses have to be included with enough details.
- RESULTS concisely and reasonably summarize the findings. Graphics or tables should be included. Ta-

bles should be self-explanatory, clearly organized, and supplemental to the text of the manuscript. Each its appearance. Tables must be inserted in the correct position in the text. Authors should be place explanatory matter in footnotes, not in the heading. All figures must be inserted in the appropriate position of the electronic document. Symbols, lettering, and numbering (in Arabic numerals e.g. 1,2, etc... in order the appearance in the text) should be placed below the figure, clear and large enough to remain legible after the figure has been reduced. Figures must have clear descriptive titles.

- Discussion: Should deal with new ideas or importance of the article.
- Conclusion: linked with the aims of the study. Star new hypotheses when warranted.
- References: Cite references in numerical order in the text, in superscript format. Use brackets. In the References section, references must be typed in the order in which they are cited, not alphabetically. Authors are responsible for accuracy of all references. Personal communication and unpublished data should not be referenced. If essential, such material should be incorporated in the appropriate place in the text. List all authors when there are six or fewer, when there are seven or more; list the first three, then “*et al.*”.

### About IDJ

ISSN 2307-4779

KEY TITLE: Iraqi Dental Journal

ABBREVIATED KEY TITLE: Iraqi dent. j.

### AIMS

Iraqi Dental Journal is a peer-reviewed, open access journal that is a published original research articles, review articles, and clinical studies in all branches of dentistry scientific journal dedicated to the dissemination of new knowledge and information on all sciences relevant to dentistry and to the oral cavity and associated structures in health and pathological conditions.

The role of the IDJ is to inform its readers of ideas, opinions, developments and key issues in dentistry - clinical, practical and scientific - stimulating interest, debate and discussion amongst dentists of all disciplines. All papers published in the IDJ were subjected to rigorous peer review

### Audiance

Postgraduates, undergraduates, members of the dental team, hospitals community, academic & general practitioners.

*Managing Editors*  
*Iraqi Dental Journal*





### Happiness, Success, Vision, and Mission

Most of people today endeavor to reach happiness and success, and many people are wondering whichever is first: happiness or success? Through my routine reading, I came to the conclusion that humans are divided into four classes.

One type of class has a mission and vision: they realize why they are in this life, what they want to accomplish, and how to reach their goals (by Vision). These are the leaders in life; the makers of civilizations, and they are characterized by high energy and happiness in order to immerse others that will gain from their mission. This class helps others

achieve success by being like an illuminating flashlight that helps others to acquire their own vision. These are our ideals.

**Another class has a mission but no vision:** They are aware of why they are in life and what they want, (they are happy), but they do not know a specific way to reach their targets and goals. They are dreaming but do not move. (They did not arrive to success but are spreading happiness and reassuring others. They lack the vision to be like the first class and we want to draw them into right vision and we urge them to earn it in our field.)

**Another class has a vision but no mission:** They know what they want to accomplish and they reach their targets and goals, but they do not gain satisfaction as a result of their finished efforts. One can see them live success after success, but they lack the happiness that has not achieved by their success. Being successful sometimes is a cause of misery to those who have passed their successes to others. Sometimes they do not feel happiness at the end of their life; they feel tired because happiness granted energy depletion.

**Another class has neither a mission or a vision:** They do not know why they are living or what they want in life. They are unhappy and failures. We have to help them because they account for the majority in our community.

Our mission and vision are clear in our scientific work in Iraq. It could be summarized as follows:

**Our Mission:** education, training, development, and scientific innovation in updated dentistry to dentists inside and outside Iraq.

**Our Vision:** Creativity in updated dentistry delivered to the world.

Join us in our journey to the summit!-in this issue (issue 2.vol.35 ) of IDJ (18) researcher in dentistry. A 37 leaders, consultants and a residents participated in competence of Dentistry in Iraq, also Join us 6 of scientific advisers from outside Iraq .. and continue our journey until we reach to the summit .. and we keep waiting for your suggestions and your opinions to live up value.

*Rafi M. Al-Jobory*  
*Editor in Chief*

## EDITOR IN CHIEF

- **Dr. Rafi M. Al-Jobory -**

*B.D.S., M.Sc.(perio.), Ph.D.(Oral Histo. & Bio.) - President Of Iraqi Dental Association - Lecturer , Department of Periodontology, College of Dentistry / Tikrit University*

## VICE EDITOR IN CHIEF

- **Consultant Dr. Abdulwahab Al-nasiri**

*B.D.S., F.F.D.R.C.S.I(Ireland), Consultant Maxillofacial Surgery - Vice President Of Iraqi Dental Association - Lecturer in AL-Rafiden college*

## EDITORIAL BOARD

- **Prof. Dr. Fakhri Alfatlawi**

*B.D.S., M.Sc.,(Ortho.) Ortho. Depart. college of dentistry-University of Baghdad*

- **Prof. Dr. Hussain F. Al-Huwaizi**

*B.D.S., M.Sc., Ph.D.,(Conservative) Conserv. Depart. college of dentistry - University of Baghdad*

- **Prof. Dr. Khulood A. AlSafi**

*B.D.S., M.Sc.,(perio.), Ph.D.( Oral Histo. & Bio.),perio. Depart. college of dentistry -University of Baghdad*

- **Prof. Dr. Ali F. AlZubaidy**

*B.D.S., F.F.D.R.C.S(Ireland), F.D.S.R.C.S.(England), F.D.S.R.C.P.S.(Glasgoww) ,Maxillo facial Depart. Faculty of dentistry-Hawler medical university*

- **Prof. Dr. Athraa Y. Al-Hujazi**

*B.D.S., M.Sc. Ph.D.( Oral Histo. & Bio.) O. diagnosis Depart. college of dentistry-University of Baghdad*

- **Assist. Prof. Dr. Adel Al-Khayat**

*B.D.S. F.D.S.R.C.S.(England), M.MED.Sci(Sheffield) ,Head of Iraqi Commission for Medical Specialization in Maxillofacial Surgery O.surgery & Maxillofacial. Depart. - college of dentistry - University of Baghdad*

- **Assist. Prof. Dr. Lamya H. Al-Nakib**

*B.D.S. M.Sc.(o. & maxillofacial radiology), O. diagnosis Depart.- college of dentistry-University of Baghdad*

- **Dr. Mudher A. Abduljabbar**

*B.D.S., M.Sc. prosth. Depart. College of dentistry - University of Baghdad*

## SCIENTIFIC BOARD

- **Prof. Dr. Khalid Merza -** *B.D.S., F.R.C.S., Periodontist-Dean of dentistry college of Al-Rafidain*

- **Prof. Dr. Wael Alalousi -** *B.D.S., M.Sc., (preventive dentistry)*

- **Prof. Dr. Ausama A. Almula -** *B.D.S., M.Sc., Ph.D., orthodontist. , College of Dentistry-University of Baghdad*

- **Prof. Dr. Nidhal H. Ghaib -** *B.D.S., M.Sc. Ortho.. Depart. College of dentistry - University of Baghdad*

- **Prof. Dr. Wasan Hamdi -** *B.D.S., M.Sc., Ph.D., oral pathology. , College of Dentistry-University of Baghdad*

- **Consult. Dr. Amer Abdullah Jasim Al-Khazraji -** *B.D.S.(F.I.C.M.S.), High Diploma Laser in Medicine (H. Dip. L.M.) Consultant Oral & Maxillofacial Surgery, Head of Oral & Maxillofacial Department at Al- Nu'man Hospital.*

- **Dr. Muhanad M. AL-Janabi -** *B.D.S.(F.I.C.M.S.), Maxillofacial Surgery- lecturer- Assist. Dean of Dentistry college - University of Tikrit.*

- **Dr. Hassanien Ahmed Hadi -** *B.D.S.(F.A.C.M.S.), Maxillo surgery. Lecturer college of dentistry -University of Baghdad*

- **Dr. Ayad M. Mahmoud -** *B.D.S., M.Sc. conservative, Asst. Lecturer -college of dentistry University of Baghdad*

- **Dr. Ahmed Fadhil Faiq Aljard -** *B.D.S., M.Sc. ortho, Asst. Lecturer college of dentistry University of Baghdad.*

## ADVISORY BOARD

### ORAL DIAGNOSIS & BASIC SCIENCES

- **Prof. Dr. Tahani Abdulaziz Jaffer Al-Sandook -** *Specialist in Pharma.(Ph.D), Dean of dentistry college-university of Mousel*

- **Assist. Prof. Dr. Jamal Noori Ahmed -** *B.D.S., M.Sc., Ph.D, oral Medicine, O. diagnosis Depart. college of dentistry-University of Baghdad*

- **Assist. Prof. Dr. Intisar J. Mohamed -** *B.D.S., M.Sc., PH.D. (Oral histo & bio.) Assist. Dean of Dentistry Ccollege - University of Tikrit*

- **Assist. Prof. Dr. Duni W. Sabeaa Alfayad -** *B.D.S., M.Sc.( o.surg.), Ph.D. (O.patho.) Dean of Dentistry College - University of Al-Anbar*

- **Assist. Prof. Dr. Sahar H. Alani -** *B.D.S., M.Sc.(O.&Maxillofacial Radiology) Ph.D., (O.patho.), O. diagnosis Depart. college of dentistry-University of Baghdad*

- **Assist. Prof. Dr. Rajaa Souhail Najim -** *Ph.D. Medical Physics , Dean of Dentistry College - University of Tikrit*

- **Assist. Prof. Dr. Husam Al-Hamadi -** *(M.B.Ch.B, M.Sc. Ph.D) -Director of Pharmacology dep. Pharmacy College -Babylon university*

### ORAL & MAXILLOFACIAL SURGERY AND PERIODONTICS

- **Assist. Prof. Dr. Ali AL-shawi -** *B.D.S., FDSRCS, FFDRCSI, (Maxillo facial)- Dean of dentistry college-University of Basrah*

- **Assist.Prof.Dr.Saif Sehaam Saliem** - B.D.S., M.Sc. (perio.) Assist. Dean of Dentistry College - University of Baghdad
- **Dr. Faez AL. Hamadany** - B.D.S., M.SC., PH.D, lecturer o. & Maxillofacial Surgery Depart. College of Dentistry-University of al-Mustansiria
- **Dr.Faraedon M. Zardaw** - B.D.S., M.Sc., Ph.D,perio ,lecturer perio. Depart. College of Dentistry-University of al-sulaimani
- **Dr .Alaa E. Ali** - B.D.S., M.Sc. Perio. Depart. College of dentistry - University of Baghdad

## PROSTHODONTICS

- **Prof.Dr.Abbas F. Al-huwazi** - B.D.S., M.Sc., Ph.D. Prosth, Dean of College of Dentistry-University of Kufa.
- **Assist.Prof.dr.Intesar Jamel Ismail** - B.D.S.,M.SC.,PH.D. prosth. depart. college of dentistry - university of baghdad
- **Assist.Prof.Dr.Thekra Ismael Hamad** - B.D.S., M.Sc., Ph.D. Prosth. Depart. College of dentistry - University of Baghdad
- **Dr.Suaad Al-Nakash** - B.D.S., , M.MED.Sci(Sheffield)Lecturer- Prosth. Depart. College of dentistry - University of Al-Mustansiria.
- **Asst.Prof. Ghasan A. Altae** - B.D.S., M.Sc.,Prosth. Depart. College of dentistry - University of Baghdad

## PEDO,PREVENTION& ORTHO,;

- **Prof.Dr.Zainab A. Al-Dahan** - B.D.S., M.Sc., Pedo &Preventive dentistry depart. College of dentistry - University of Baghdad
- **Prof. Dr. Sulafa K. El-Samarrai** - B.D.S., M.Sc., Ph.D., Pedo &Preventive dentistry depart. College of dentistry - University of Baghdad
- **Prof. Dr. Athraa M. Alwahab** - B.D.S., M.Sc., Pedo &Preventive dentistry depart. College of dentistry - University of Baghdad
- **Prof. Dr. Nidhal A. ALI** - B.D.S., M.Sc.Preventive dentistry depart. College of dentistry - University of Al-mustansiria.
- **Assist.Prof.Dr.Mohammad Rafid Abdulameer Ali** - B.D.S.,M.Sc.,Ortho. Depart. College of dentistry - University of Al-Mustansiria.
- **Assist.Prof. Dr.Wisam Wahab Al-Hamadi** - B.D.S.,M.Sc. Ortho. depart. College of dentistry - University of Babylon

## CONSERVATIVE AND COSMETIC DENTISTRY

- **Prof.Dr. Jamal Aziz Mehdi** - B.D.S., ,M.Sc. conserv.. Depart. College of dentistry - University of Al-Mustansiria
- **Assist.Prof.Dr.Enas Alrawi** - B.D.S., M.Sc., Conserv. Depart. college of dentistry-University of Baghdad
- **Assist.Prof.Dr.Abdulla Alshamma** - B.D.S., M.Sc.,Ph.D.(conservative depart. College of dentistry - University of Baghdad
- **Assist. Prof.Dr. Manhal Abdul-Rahman Majeed** - B.D.S., M.Sc.,Ph.D.(conservative depart. College of dentistry - University of Baghdad

## INTRNATIONAL SCIENTIFIC BOARD

- **Prof. Marco Esposito /Italy BDS, PhD Italy.** -Professor, Gutenberg University, Sweden Editor-in-Chief, European Journal of Implantology (EJOI) - Editor at Cochran Library
- **Prof. Dr. Natheer H Al-Rawi/UAE BDS,MSc, PhD Oral Pathology.**
- **Ass. Prof. Elie Azar Maalouf / Lebanon DDS, DSO Lebanon,** President of the Lebanese Dental Association - Chairman of the department of Periodontology at the Lebanese University
- **Assist. Prof. Dr.Abdulrahman M. Salih/UAE B.D.S., M.Sc.,Ph.D.(Restorative depart. College of dentistry – Ajman University of science and Technology.**
- **Assist. Prof. Dr. Asmaa T Uthman/UAE BDS, MSc Oral & Maxillofacial Radiology.UAE**
- **Dr. Hassan Maghaireh/ UK BDS, MSc, MFDS, RCS Edinburgh .UK.** Clinical Lecturer, University of Manchester - Editorial Director, Smile Dental Journal
- **Dr. Walid Nehme/Lebanon DDS, MS Lebanon** - President Lebanese Society of Endodontology - President Arab Endodontic Society

## EDITORIAL ASSISTANT

- **Dr. Alan H. Mawlood AlQassab** - B.D.S, H.D.D (Ortho), M.Sc (O.&maxillofacial surg.), MOMSRCPS (Glasgow) (O.&maxillofacial surg.Depart. Faculty of dentistry -Hawler medical university
- **Dr.Mohmmmed Nahidh M. Hassan** -B.D.S., M.Sc.,Orth. Depart. College of dentistry - University of Baghdad
- **Dr. Saeed Khalil Al emamy.** - B.D.S. Iraqi Ministry of Health

## MEDIA &PUBLIC RELATION MANAGERS

- **Dr. Abobaker Ziad Alrawi** - B.D.S. Iraqi Ministry of Health
- **Dr. Ahmed Salih** - B.D.S. Iraqi Ministry of Health
- **Dr. Bashar H. Hasan** - B.D.S. Iraqi Ministry of Health

## GRAPHIC DESIGNERS

- **Ali Ihsan Hadi**
- **Solange sfeir**
- **Mohammed Aqeel**





## Affiliation Between Smile Dental Journal & Iraqi Dental Journal



Smile Dental Journal is quarterly issued, peer-reviewed open access dental journal that is available in both printed and electronic copies, registered in the Jordanian National Library under registration number: 3954/2008, ISSN number 2072-473X for printed version and 2072-4748 for electronic version.

Smile Dental Journal has been selected to be one of the sources of input of the Index Medicus for the WHO Eastern Mediterranean Region (IMEMR), Ulrich's, DOAJ, Open J-Gate, Index Copernicus, Portal LivRe & Electronic Journals Library.

Literature review, original research, clinical case reports, case series, short communication, randomized clinical trials, and book reviews are among our scope of published material, where the clinical aspect of dentistry is presented in a scientific way, starting each article with an abstract, backed up by references in accordance with the Vancouver citation style.

One of our major concerns is the review process of the papers prior to their publication. Peer-review is a process of revision that insures accuracy, clarity, and smooth readability of these papers. In Smile's editorial policy we adopt the double blinded peer review, where both the reviewer and author are kept anonymous. Manuscripts are reviewed on a double-blind basis by two reviewers from the editorial review board of Smile and/or by external reviewers depending on the manuscript content and specialty.

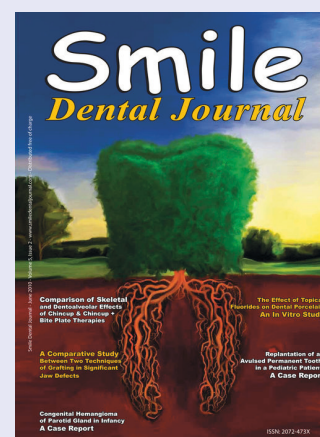
We eagerly look forward to the cooperation between Smile Dental Journal and The Iraqi Dental Association, that will surely enrich Smile's scientific content with high quality, well structured dental articles from our Iraqi colleagues that will be a great benefit to our readers all over the world, from one side, and on the other side will help our Iraqi colleagues to get the maximum exposure for their published articles that they deserve.

Best regards,

*Dr. Issa Bader*

*Founder & Editor-in-Charge*

*Smile Dental Journal*





# Table of content

<b>Oral Diagnosis</b>	<b>2</b>
» The prevalence of Sella Turcica Bridging in Different skeletal Classes -----	2
<i>Lamia Al-Nakib , Areej A. Najm</i>	
<b>Periodontics</b>	<b>7</b>
» The Inhibition Effect of 940 nm Diode Laser on Some Microorganisms Associated With Gingivitis	7
<i>Muhammed Ibrahim Hazeem , Muthenna Shaban Rajab , Hadeel Mizher Younis</i>	
<b>A Message From a Resercher</b>	<b>12</b>
» New technologies in dentistry -----	12
<i>Alan H. Mawlood Al-Qassab</i>	
<b>Oral &amp; Maxillofacial Surgery</b>	<b>13</b>
» The Relation Between Trismus And Difficulty Of Mandibular 3rd molar Impaction (Clinical & Prospective Study) -----	13
<i>Rozh M. Hussien , Dilman N. Muhammad , Alan H. Mawlood</i>	
<b>Preventive Dentistry</b>	<b>18</b>
» Calcium Renal Stone in Relation to Salivary and Urinary Constituents -----	18
<i>Shaimaa Kh. Yaser , Mohammed S. Al-Casey , Ali Y. Majid</i>	
» Effect of Garlic Extracts on Streptococci and Mutans Streptococci, in Comparison to Chlorhexidine Gluconate (A comparative in vitro and in vivo study) -----	24
<i>Jinan M. Rashad , Sulafa K. El-Samarrai</i>	
<b>Pedodontics</b>	<b>31</b>
» Oral Factors Predisposing To Injury Of Permanent Incisors In School Children In Al-Ramadi City -----	31
<i>Lamia I.S AL-dulayme</i>	
<b>Orthodontics</b>	<b>35</b>
» The Role of Local Injection of Tnf-a Antagonist on Orthodontic Tooth Movement in Rabbits----	35
<i>Anees M. Mudhir , Rafah H. Al-Marooof , Fadhil Y. Jasim</i>	
» Facial Measurements and Maxillary Anterior Teeth Mesio-Distal Dimensions, Is There A Relationship?-----	41
<i>Haider M. A. Ahmed, , Yasir R. A. Al-Labban , Mohammed Nahidh</i>	
» The Prediction Failure for Orthodontic Treatment of Class II Malocclusion -----	46
<i>Hussien Abid Ali Alnajar , Wisam Wahab Alhamady</i>	
<b>Prosthodontics-----</b>	<b>49</b>
» Fabrication of Duplicate Denture With Metal Functional Cusps Using A Sectional Mold Technique -----	49
<i>Tariq Jasim Mohamed</i>	

## The prevalence of Sella Turcica Bridging in Different skeletal Classes

**Lamia Al-Nakib**

BDS, MSc , Assistant Prof., Oral and Maxillofacial Radiologist, University of Baghdad, College of Dentistry, Oral Diagnosis Department.

**Areej A. Najm**

BDS, MSc , Assistant Lecturer, Oral and Maxillofacial Radiologist, University of Baghdad, College of Dentistry, Oral Diagnosis Department.

### ABSTRACT

**Background:** Sella Turcica is an important anatomical structure for cephalometric assessment because within its center lies sella point which helps in evaluation of craniofacial morphology. The purpose of this study was to evaluate the prevalence of a Sella Turcica bridge and linear measurements of sella in subjects with different skeletal Classes.

**Materials and method:** Sella Turcica bridging and size were evaluated for five hundred pre-treatment digital lateral cephalometric radiographs of Iraqi male (223) and female (277) patients with age range 10-39 years, they were collected and classified into three groups according to skeletal classes.

**RESULTS** Sella turcica bridging was found in the three groups, the overall rate of Sella Turcica bridging was higher in skeletal class III group (42.57%) and in female (21.2%) but the difference was non-significant. There was a significant difference in sella bridging between the three age groups (it was higher in the younger age group). A non-significant difference in sella size between genders, age groups and skeletal classes.

**Conclusions:** the prevalence of sella turcica bridging is greater in patients with a skeletal Class III relationship, females and young age group. Skeletal class, age and gender had a non-significant difference in Sella Turcica linear measurements. Bridging of sella, in the absence of clinical signs or symptoms, is considered a normal variant of the sella turcica, although many pathological processes can be associated with this calcification.

**Key words:** sella turcica; sella bridging; skeletal class.

### INTRODUCTION

Lateral cephalometric radiograph displays numerous cranial, facial and oral anatomic structures imaged from lateral aspect. Cephalometric radiography is a helpful aid in diagnosis, treatment planning and predicting treatment outcome in current orthodontic practice <sup>(1, 2)</sup>. The morphology of Sella Turcica is, in this connection, of importance for the cephalometric positioning of sella point [S], the central reference point used in evaluation of the cranial morphology and inter-relationship between jaws. <sup>(3)</sup>

Sella Turcica is situated on the intracranial surface of the body of the sphenoid bone. The anterior border of sella turcica is represented by the tuberculum sella and the posterior border by the dorsum sella. The pituitary gland is surrounded by sella turcica, whereas two anterior and two posterior clinoid processes project over the pituitary fossa. The anterior clinoid processes are formed by the medial and anterior prolongations of the lesser wing of the sphenoid bone, and the posterior clinoid processes by the endings of the dorsum sella. During embryological development, Sella turcica area is a key point for the migration of the neural crest cells to the frontonasal and maxillary developmental fields. <sup>(4, 5)</sup>

Morphologically, three basic types (oval, round, and flat) have been classified, the oval and round types being the most common, deviation from normal size and shape of sella turcica can be an indication of a pathological condition of the gland <sup>(5)</sup>. A larger size may be indication of pituitary tumor over producing hormones such as ACTH, Prolactin and Growth hormones, thyroid stimulating hormone and vasopressin leading to Cushing's syndrome, amenorrhea and acromegaly. A small size can lead to decreased pituitary function causing symptoms such as short stature, retarded skeletal maturation and growth. Small Sella Turcica are notable in humans who either have an absent or a partial formed diaphragm sellae. <sup>(2)</sup> Calcification of diaphragm sellae, which radiologically has been described as 'roofing' or 'bridging' of the sella, in the absence of clinical signs or symptoms, is considered a normal variant of the sella turcica <sup>(6)</sup>, although many pathological processes can be associated with this calcification.

As far as aetiology is concerned, it has been suggested that an ICL (interclinoid ligament) is laid down in cartilage at an early stage of development and then ossifies in very early childhood. This ossification can be due to the complex embryology of the sphenoid

bone<sup>(3)</sup>. According to this theory; a sella turcica bridge should be considered a developmental anomaly.

Additionally, bridging of Sella Turcica has been reported to occur in distinctive syndromes or skeletal and dental malformations<sup>(5,7-10)</sup>. In a 'normal' population, the prevalence of a Sella Turcica bridge has been reported with a frequency of 1.75 to 6 per cent in anatomical and radiographic studies<sup>(5,11, 12)</sup>.

## SUBJECTS AND METHODS

Total of 500 digital cephalometric images of Iraqi patients attending the Diagnosis and Orthodontic Departments, College of Dentistry/Baghdad University were collected and examined (only the radiographs of good quality were included in the study).

**Analysis of the craniofacial complex:** By using Auto CAD 2010 computer program, seven points and six lines were determined (fig. 1). The images were divided in to three groups according to skeletal classes. Classification of skeletal type into Class I(131), Class II(174), or Class III(195) was based on the ANB angle (SNA and SNB). The ANB angle indicates the magnitude of the skeletal jaw discrepancy, regardless of which jaw is at fault. Skeletal base Class was categorized as follows: angles 2-4 degrees Class I skeletal base; angles more than 4 degrees Class II, and angles less than 2 degrees Class III. The images were divided in to three groups according to age (10-19), (20-29) and (30- 39) years.

**Analysis of Sella Turcica:** linear measurements of Sella Turcica were evaluated according to Silverman<sup>(13)</sup>; all reference lines used are situated in the midsagittal plane (fig. 1).

**Sella Turcica length:** It was measured as the distance from the dorsum sellae (DS) to the tuberculum-sellae (TS).

**Sella Turcica depth:** was measured as a perpendicular line from the line above to the deepest point on the floor of the fossa (FS).

**Sella Turcica diameter:** was measured from the tuberculum sellae (TS) to the remote point on the posterior inner wall of the fossa.

The bridging of Sella Turcica was evaluated by using the method of Leonardi *et al*<sup>(9)</sup>. A standardized scoring scale was established which consisted of comparing measurements of Sella Turcica length and diameter, if the length of Sella Turcica was greater than or equal to three-fourths of the diameter, the Sella was scored as Class I (no calcification); if less than three-quarters (ICL partially calcified) as Class II; and

Class III for a radiographically visible diaphragm Sella (ICL completely calcified), as shown in fig.2 a,b,c.

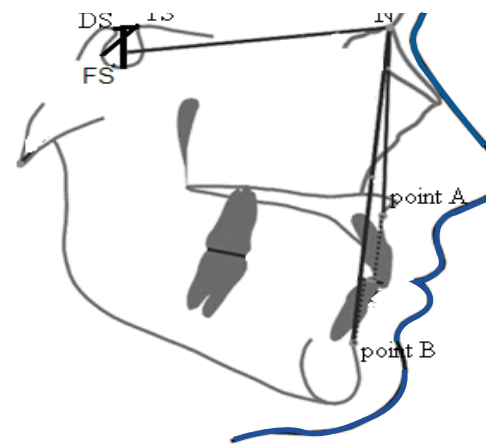


Figure 1: Reference points and plane landmark

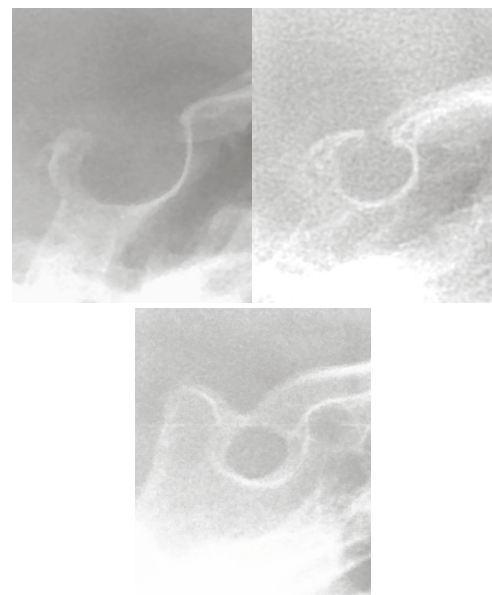


Figure2: Radiographical appearance of Sella Turcica Bridging  
A: no bridging B: partial bridging C: complete bridging

Statistical analyses were computer assisted using SPSS version 13 (Statistical Package for Social Sciences). The frequency distribution and percentage of bridging in each skeletal class were measured and the difference in median of Sella Turcica bridging between the three age groups and skeletal classes were assessed by non-parametric Kruskal-Wallis Test, while between bridging and gender by Mann-Whitney test. Dunn's Multiple Comparison test was performed as post test if the P-value was significant. A student's t-test was used for assessment of male -female difference in linear measurements, while ANOVA used for assessment of difference in linear measurements between age groups and skeletal classes with (LSD) as post test if the result is significant.

## RESULTS

Sella Turcica bridging was found in the three skeletal groups, inskeletal Class I group [33.58% demonstrate class II (partial bridging) of sella turcica and 4.58% demonstrate class III (complete bridging)], while in skeletal class II group [29.31% demonstrate class II (partial bridging) and 6.32% demonstrate class III (complete bridging)], while in skeletal class III group [33.84% demonstrate class II (partial bridging) and 8.71% demonstrate class III (complete bridging)], all the details are demonstrated in table 1. The overall rate of sella turcica bridging was higher in skeletal class III group (42.57%) as shown in figure 3 and the Kruskal –Wallis test show a non-significant difference between the three groups (P-value = 0.7).

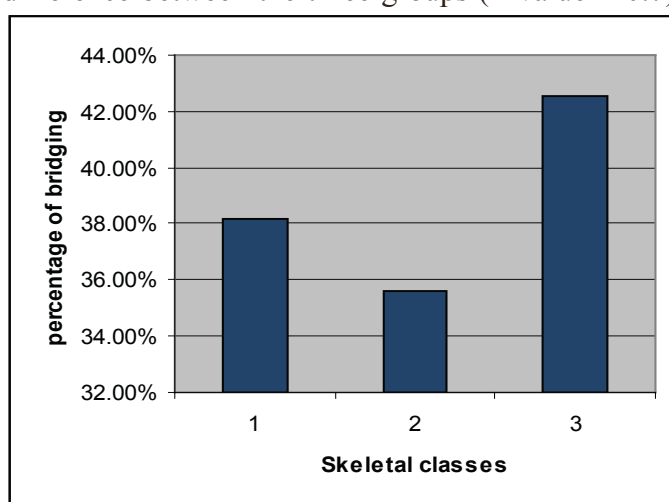


Figure 3: Bar chart demonstrating the over all percentage of bridging in the three skeletal classes.

Sella turcica bridging was higher in female (21.2 %) than male (17.8 %) but the difference was non-significant, while there was a significant difference in sella bridging between three age groups (it was higher in the youngest age group 39.2% ) as shown in tables 1,2.

Regarding the size of sella turcica, all linear measurements of Sella Turcica were within standard range. There was a non-significant difference in linear measurements of sella between skeletal classes, also a non-significant difference between male and female in spite of that male had higher measurements. Size of sella increase with age especially in the first and second age group but the difference was non-significant between the three age groups (the details of sella turcica linear measurements were found in tables 3, 4, 5).

## DISCUSSION

In this retrospective study, the bridging and size of Sella Turcica was measured on pre-treatment stan-

dardized digital lateral cephalometric radiographs.

The presence of Sella Turcica bridging in normal individual is not uncommon and is seen in 5.5% -22 % of the subjects<sup>(14)</sup>, however there is increase in occurrence in patients with craniofacial deviation. In anatomical studies with direct inspection of autopsy tissue, the prevalence of Sella Turcica bridge was found to be 1.75 to 6% without a distinctive craniofacial anomaly<sup>(11, 12)</sup>. The differences between direct anatomical studies and data from lateral cephalometric radiographs have been attributed to superimposition of the overlapping clinoid processes of the sella turcica. Therefore, only three-dimensional imaging such as computed tomography or digital volume tomography could give more precise information about the sella area. However, routine use of these imaging techniques in orthodontic patients is not indicated due to the higher exposure to radiation, particularly with computed tomography.

There was two studies that analyzed the prevalence of Sella Turcica bridge in relation to skeletal Class, the first one was conducted in Germany, by Meyer-Marcotty *et al.* <sup>(5)</sup>, he examined 400 pre-treatment lateral cephalograms of adult patients (over 17 years of age) with a skeletal Class (I and III) he found that Skeletal Class III patients presented a significantly higher rate of sella bridging comparison with skeletal Class I patients, and a non-significant difference between genders were detected for linear measurements of sella. These results are consistent with the results of the current study.

The second study was done by Shah *et al.*<sup>(2)</sup>, he examined 180 lateral cephalometric radiographs; he found that 66.7 % of the subjects presented with normal morphology and the others had different morphological shapes but the bridging was not found in any subject. There is an agreement with Shah *et al.* in the percentage of normal morphology but not in the percentage of bridging and this may be due to different measuring technique of bridging, because he depends on visual evaluation of sella bridging and not on mathematical measurement. Also he reported a non-significant difference in linear measurements of sella between genders and skeletal classes, these results are consistent with the results of the current study.

There is an agreement with our previous study which conducted on group of patients with malposed maxillary canine<sup>(10)</sup>, the result showed a significant difference in sella bridging between age groups (the younger age group had high bridging magnitude).

Axelsson *et al.* <sup>(14)</sup> measured Sella Turcica size and morphology in Norwegian subjects (6-21 years),



he found that sella size increase with age with no differences between males and females, and female subjects had slightly more morphological aberration of Sella Turcica. These results are consistent with the results of the current study.

Few studies have compared the skeletal type of individuals with their Sella Turcica size to determine if a relationship exists. Alkofide<sup>(15)</sup> conclude that sella size increase with age and the diameter was higher in skeletal class III subjects with no differences in linear measurements between males and females. These results are consistent with the results of the current

study.

In this study non-significant differences in Sella Turcica length, depth and diameter were detected between genders and skeletal classes, these results are agreed with those reported by yassir *et al.*<sup>(16)</sup>, Obayis and Al-Bustani<sup>(17)</sup>, these studies conducted on Iraqi patients and measured the dimensions and morphology of Sella Turcica, but both of them depend on visual evaluation of sella to determine their morphology so there is in conformity with their result dealing with bridging magnitude.

**Table 1: The frequency and percentage of Sella bridging in three skeletal classes and genders**

Sella Bridging	Skeletal Class						Gender				Total	
	CI I		CI II		CI III		Male		Female			
	N	%	N	%	N	%	N	%	N	%	N	%
CI I	81	61.84	112	64.36	112	57.43	134	26.8	171	34.2	305	61
CI II	44	33.58	51	29.32	66	33.84	73	14.6	88	17.6	161	32.2
CI III	6	4.58	11	6.32	17	8.73	16	3.2	18	3.6	34	6.8
Total	131	26.2	174	34.8	195	39	223	44.6	277	55.4	500	100
P-value	0.7 (n.s)						0.3 (n.s)					

\* n.s (non-significant difference) P-value > 0.05

**Table 2: The frequency and percentage of Sella bridging in three age groups**

Sella Bridging	10-19 year		20-29 year		30-39 year		P-value
	N	%	N	%	N	%	
CI I	109	21.8	57	11.4	14	2.8	0.04 (S)
CI II	149	29.8	65	13	10	2	
CI III	47	9.4	39	7.8	10	2	
Total	305	61	161	32.2	34	6.8	

**Table 3: Sella turcica linear measurements (mm) in different skeletal classes**

Size	Skeletal class I			Skeletal class II			Skeletal class III			P-value
	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	
Length (mm)	4.13-13.97	8.93	1.74	5.24-13.36	8.9	1.82	5.03-14.01	8.81	1.85	0.8 (n.s)
Depth (mm)	4.64-10.85	7.52	0.92	4.73-10.63	7.6	1.02	4.51-9.82	7.45	1.02	0.3 (n.s)
Diameter (mm)	8.81-14.81	11.5	1.21	8.93-15.15	11.49	1.24	7.65-15.55	11.66	1.35	0.3 (n.s)

**Table 4: Sella turcica linear measurements (mm) for males and females**

Size	Male			Female			P-value
	Range	Mean	SD	Range	Mean	SD	
Length (mm)	4.13-13.42	8.95	1.82	5.02-14.01	8.81	1.8	0.3 (n.s)
Depth (mm)	4.73-10.08	7.51	0.95	4.51-10.85	7.35	1.03	0.8 (n.s)
Diameter (mm)	8.85-15.55	11.64	1.3	7.65-15.15	11.5	1.26	0.2 (n.s)

**Table 5: Sella turcica linear measurements (mm) by age group**

Size	10-19 years			20-29 years			30-39 years			P-value
	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	
Length (mm)	4.13-13.97	8.81	1.93	5.02-14.01	9.03	1.75	4.13-12.97	8.56	1.7	0.2 (n.s)
Depth (mm)	4.64-9.91	7.43	1.05	4.51-10.85	7.6	1.02	4.51-9.55	7.84	0.82	0.2 (n.s)
Diameter (mm)	7.65-15.55	11.53	1.46	8.93-15.15	11.62	1.2	7.65-14.85	11.45	1.09	0.7 (n.s)

## REFERENCES

1. Weems RA. Radiographic Cephalometry Technique. In: Jacobson A, L.Jacobson R, editors. Radiographic Cephalometry from basics to 3-D Imaging. Chicago: Quintessence books; 2006. p. 33-43.
2. Shah AM, Bashir U, Ilyas T. The shape and Size of The SellaTurcica in Skeletal Class I, II & III Patients Presenting at Islamic International Dental Hospital, Islamabad. Pakistan Oral & Dental J 2011; 31(1): 104-110.
3. Becktor JP, Einersen S, Kjær I. SellaTurcica Bridge in subjects with severe craniofacial deviations. Europ J of Orthod 2000; 22: 69 – 74.
4. Kjær I, Keeling J W, Fischer-Hansen The prenatal human cranium—normal and pathologic development. Munksgard, Copenhagen B 1999.
5. Meyer-Marcotty P, Reuther T, Stellzig-Eisenhauer A. Bridging of the SellaTurcica in Skeletal Class III Subjects. Europ J Orthod 2010; 32:148-153.
6. Kantor ML, Norton LA. Normal radiographic anatomy and common anomalies seen in cephalometric films. Am J Orthod Dentofac Orthop 1987; 91(5): 414-26.
7. Childers NK, Wright JT. Dental and craniofacial anomalies of Axenfeld- Rieger syndrome. J Oral Pathology 1986; 15: 534–9.
8. Koshino T, Konno T, Ohzeki T. Bone and joint manifestations of Rieger's syndrome: a report of a family. J Pediatric Orthopedics 1989; 9: 224–230.
9. Leonardi R, Barbato E, Vichi M, Caltabiano M.A sellaturcica bridge in subjects with dental anomalies. Europ J Orthod 2006; 28: 580–585.
10. Najim AA, Al-Nakib L. A cephalometric study of sella turcica size and morphology among young Iraqi normal population in comparison to patients with maxillary malpose canine. J Bagh Coll Dent 2011; 23(4):53-58.
11. Busch W. Die Morphologie der Sellaturcica und ihreBeziehungzurHypophyse. Virchows Archiv 1951; 320: 437–58.
12. Platzer W. ZurAnatomie der Sellabrücke und ihrerBeziehungzur A. carotisinterna. Fortschritte auf demGebiet der Roentgenstrahlen und der Nuklearnmedizin 1957; 87: 613–616.
13. Silverman FN. Roentgen standards for size of the pituitary fossa from infancy through adolescence. Am J Roentgenol 1957; 78(3): 45-60.
14. Axelsson S, Storhaug K, Kjaer I. Post-natal size and morphologyof the sellaturcica. Longitudinal cephalometric standardsfor Norwegians between 6 and 21 years of age. Eur J Orthod 2004; 26:597-604
15. Alkofide EA. The shape and size of the sellaturcica in skeletal Class I, Class II, and Class III Saudi subjects. Eur J Orthod 2007; 29(5): 457-63.
16. Yassir YA, Nahidh M, Yousif HA. Size and Morphology of SellaTurcica in Iraqi Adults. Al-Mustansiria Dent J 2010; 7(1):23-30.
17. Obayis KA., Al-Bustani A. Clinical significance of sellaturcica morphologies and dimensions in relation to different skeletal patterns and skeletal maturity assessment. J Bagh Coll Dent 2012; 24(2):120-126.

# *The Inhibition Effect of 940 nm Diode Laser on Some Microorganisms Associated With Gingivitis*

**Muhammed Ibrahim Hazeem**

BDS, MSc Lecturer , Department of Periodontology, College of Dentistry / Tikrit University

**Muthenna Shaban Rajab**

BDS, MSc. Assistant professor, Department of Conservative Dentistry, College of Dentistry / Tikrit University

**Hadeel Mizher Younis**

BDS, MSc. Lecturer, Department of Basic Sciences, College of Dentistry / Tikrit University

## ABSTRACT

**Background :** Poor oral hygiene lead to gingival inflammation due to the accumulation of plaque and microorganisms. Scaling and polishing was considered as an effective treatment of gingivitis. Several systemic and local antimicrobials were found to enhance the mechanical treatment. However, these antimicrobial agents may lead to bacterial resistance and systemic side effects in addition to limitation in the accessibility to the affected areas. The aim of this study is to explore the effect of diode laser (940nm) in combination to the traditional mechanical treatment.

**Materials and methods:** twenty patients with bilateral gingivitis were selected. For each patient, one side of the mouth was treated traditionally. The other side was treated with 2 W diode laser (940nm) after scaling and polishing. Smears were taken from deepest points of the gingival sulci of both sides. The collected bacterial samples were inoculated in brain-heart infusion and inoculated into blood agar plates and MacConkey agar plates for 24 hours aerobically and 24-48 hours anaerobically (using jar and CO<sub>2</sub> gas pack) at 37°C. The collected data of bacterial identification were tabulated in excel tables. Means, standard deviations, ANOVA test and p value were calculated.

**RESULTS** there is highly significant decrease in the identification of aerobic bacteria after using diode laser. Anaerobic bacteria were less identified, but they were completely absent after diode laser treatment.

**Conclusion:** Diode laser (940nm) could be successfully used adjunctive to mechanical scaling and polishing to integrate the antimicrobial action within the gingival sulci.

**Keywords:** Diode laser, Gingivitis, bacteria .

## INTRODUCTION

Gingivitis is the most common form of oral diseases, which is often caused by poor oral hygiene. It can progress to the destruction of bone and loss of teeth.<sup>(1)</sup> If good oral hygiene is restored, gingivitis is usually eradicated and the tissues become clinically normal again. Estimates of the incidence of gingivitis are difficult to determine but probably the whole dentate population is affected by this condition at some stage. Generally, gingivitis is regarded as resulting from a non-specific proliferation of the normal gingival crevice micro-flora due to poor oral hygiene.<sup>(2)</sup> Oral cavity is colonized by over 1000 different types of microorganisms during our lifespan. The key factor for oral health is the normal balance among these microorganisms. These bacteria are most often found in oral mucosa, on dental surfaces, in saliva and gingival fluid. Dental plaque is formed by these microorganisms (which is an adherent complex structure) functions as a multicellular organism with over 100 microorganisms in one cubic millimeter.<sup>(3)</sup>

Although gingivitis is a reversible inflammatory condition, continuous accumulation of microbial biofilm due to impaired or poor oral hygiene results in the clinical manifestation of gingivitis and may precede periodontitis.<sup>(4)</sup> Pathogenic occurrences during

this inflammatory process in the gingival tissue enhance the release of pro-inflammatory mediators, such as cytokines and prostaglandins, which cause damage the periodontal tissue. This biofilm is an independent entity with a strong ability to survive, and together with its bacteria and their byproducts (lipopolysaccharides), results in damage to the periodontal tissue.<sup>(5)</sup> Gingival diseases can also be modified by systemic factors. The clinical signs are exaggerated and the gingivae are more edematous and inflamed in individuals undergoing hormonal disturbances (e.g. during puberty or pregnancy). Certain drug therapies (e.g. immunosuppressive drugs) can also result in gingivitis.<sup>(2)</sup> On the other hand, there is significant effects of periodontal microorganisms on certain systemic conditions and diseases, like myocardial infarction, atherosclerosis, stroke, osteoporosis, premature birth and low-birth-weight babies; and by increasing the damage caused by diabetes mellitus and chronic respiratory diseases.<sup>(6)</sup>

Conventional treatment of periodontal disease is based on reduction of pathogenic microbiota by scaling and root planing.<sup>(7)</sup> However, conventional periodontal treatment are not equally effective in removal of all types of perio pathogens and their toxins from

infected sites. Thus adjunctive treatment plans have evolved to manage periodontal diseases<sup>(8)</sup> Under specific circumstances systemic antimicrobials may be used as adjuncts to treatment, leading to significant bacterial reduction and additional clinical benefits to the mechanical procedure. On the other hand, systemic antimicrobials may have potential for adverse reactions and development of resistant bacteria strains.<sup>(9,10)</sup> The local antimicrobial agents have wider applications, since they create higher concentrations of the effective agent within the pocket and compared to systemic antimicrobials, they cause less side effects. The main problem associated with the use of these local agents is the difficulty of maintaining therapeutic concentrations of antimicrobials in the affected sites.<sup>(8)</sup>

Because of these shortages of antimicrobials, the use of laser irradiation has become a topic of much interest and is a promising field in periodontal therapy.<sup>(11)</sup> Antimicrobial effect of laser is considered as a safe coadjutant in nonsurgical treatment of gingivitis, as it has been proved to reduce the signs of inflammation and microbial infection without any harmful effects on adjacent periodontal tissues.<sup>(12)</sup> The most common laser wavelengths used in periodontics include those of diode, neodymium:yttrium-aluminium-garnet (Nd:YAG), erbium:yttrium-aluminium-garnet(Er:YAG) lasers and carbon dioxide (CO<sub>2</sub>) laser.<sup>(13)</sup> Diode lasers are solid-state semiconductor lasers (800-980 nm) poorly absorbed in water, but highly absorbed in hemoglobin. Since diodes basically do not interact with dental hard tissues, the FDA approved the use of a diode laser for soft tissue surgery in 1995 and for sulcular debridement in 1998.<sup>(14)</sup>

The goal of the current study was to evaluate the efficacy of diode laser (940 nm) as a coadjunct to conventional scaling and polishing to achieve bacterial reduction in chronic gingivitis.

## MATERIALS AND METHODS

**Study design and population:** A randomized, split mouth design double blind controlled trial was conducted at the periodontics education clinic of Tikrit University/College of dentistry. Prior to the beginning of this study, the patients were assessed for eligibility. The subjects should had presence of chronic gingivitis on both right and left sides. One side used to test and the other side used as control. The exclusion criteria were: (1) patients with systemic diseases or conditions that might interfere with oral health; (2) patients who had undergone previous periodontal treatment or had received antibiotics during the past

three months. Before inclusion in this study, informed consents were obtained from all patients, according to Helsinki declaration (ethical principles for medical research involving human subjects).

Twenty patients (10 males and 10 females) with ages ranged between 25 to 35 years old were selected for this study. The patients complained of chronic gingivitis bilaterally with moderate plaque and calculus accumulation.

**Treatment procedure:** On the control side, the affected area was scaled by using manual and ultrasonic device. Polishing was performed with low speed hand-piece, rubber cup and pumice powder. The experimental side underwent the same listed steps. In addition, 940 nm diode laser (Ezlase, Biolase, USA) were used with 2 W output power and 0.5 ms pulse duration within the gingival sulcus for 20-30 seconds. The treated area on both sides (experimental and control) were isolated with cotton roll and dried by using triple syringe. Smears were taken from both sides, but introduction of sterile paper points into the deepest points of the gingival sulci.

**Microbiological examination:** The collected bacterial samples were inoculated in brain-heart infusion aerobically and anaerobically and incubated for 24 hours at 37°C. After that the samples were inoculated into blood agar plates and MacConkey agar plates for 24 hours aerobically and 24-48 hours anaerobically (using jar and CO<sub>2</sub> gas pack) at 37°C. The isolated bacterial strains were identified by Api-20A for anaerobic bacteria and ApiEnterobacteriaceae, Api Staph and Apistrept for aerobic bacteria (Biomeriaex Co., France).

Statistical analysis: collected data including identification of microorganisms from both control and experimental sides were tabulated in excel tables (Microsoft office 2010). Means, standard deviations, ANOVA test and p values were calculated using IBM SPSS 19.0.0 statistical package for windows.

## RESULTS

In this study, five aerobic bacteria (*E coli*, *Klebsiellapneumonia*, *Serratia sp.*, *Staph aureus* and *Viridans streptococci*) as well as three anaerobic bacteria (*Villonilla sp.*, *Fusobacterium sp.* and *Peptostreptococcusniger*) were isolated and identified. The results obtained from MacConkey and blood agar media for identification of bacterial species isolated from gingival sulci of both experimental and control samples are shown in table (1). Regardless the method of identification, all bacterial species were less identified from the experimental samples.

Table (2) shows the means and the standard deviations of the identified aerobic bacterial strains in



both control and experimental samples. The isolated aerobic bacteria showed very highly significant decrease in experimental samples ( $p < 0.001$ ).

Anaerobic bacterial strains and their means and standard deviations of identification are listed in table (3). The three strains (*Villonilla sp.*, *Fusobacterium sp.* and *Peptostreptococcus niger*) were identified in control samples. However, they were completely absent in experimental samples.

## DISCUSSION

Several studies have shown a close relationship between the appearance of gingivitis and oral hygiene.<sup>(4)</sup> Bacterial accumulation on the tooth surface is the main cause of the gingival inflammation. These bacteria are in equilibrium with the gum tissues. Plaque related gingival disorders occur when this balance is altered.<sup>(15)</sup> Early diagnosis and treatment of the initial gingival inflammation is important to reduce the prevalence and severity of subsequent periodontitis.<sup>(4)</sup> The limited access of topical and systemic antimicrobial agents to dental plaque and the development of bacterial resistance toward antibiotics have led to search alternative strategies to control dental biofilm and to treat periodontal diseases.<sup>(16)</sup> For the past decades, many lasers have been investigated in the treatment of periodontal diseases among other oral conditions.<sup>(17)</sup> The use of modern laser technology in periodontal therapy has the advantage of reaching areas that are almost not accessible to conventional treatment. In addition, periodontal studies show that the bactericidal effect of the lasers is the main purpose for their use as adjuncts to conventional periodontal treatment.<sup>(18)</sup> So the inhibition of the bacteria within the gingival sulcus is the deciding factor for the choice of the laser parameters. However, it has not been found, in previous literature, any standardization of these parameters.<sup>(17)</sup>

The result of current study demonstrated that 940 nm diode laser associated with conventional scaling and polishing promote additional enhancement of the conventional scaling and polishing treatment alone, as regard of microbiological inhibition. There is very compelling evidence in the dental literature that the addition of diode laser irradiation to conventional mechanical treatment has a significant bactericidal and detoxifying effect in periodontal therapy.<sup>(8)</sup> It is difficult to compare the results of our study with the previous studies because of differences in the laboratory settings and irradiation constants. Although most of these studies used diode laser, they do not mention which laser wavelength, energy density, duration,

mode or frequency used. It seems that the differences in these factors led to different results. Another limitation is that most of the previous studies were performed on the effect of lasers on periodontitis. This study used laser on gingivitis which precedes periodontitis. That means that our study is more conservative and absolutely better in preventive measures. In agreement with the current study findings, Mortizet *al.* reported significant bacterial inhibition with diode laser therapy compared to conventional treatment.<sup>(19)</sup> Several other studies have revealed that diode laser may significantly suppress microorganisms related to periodontal diseases.<sup>(20-22)</sup> In contrast, another study reported that the use of diode laser had no significant additional effects on bacterial inhibition.<sup>(23)</sup> An interesting study stated that the low power diode laser could stimulate, instead of inhibit, the viability of *Klebsiella pneumoniae*.<sup>(24)</sup> However, in the present study the significant inhibition to this bacteria is less than that to other studied species. Other study stated that mechanical treatment alone has been shown to be clinically and microbially effective. The clinical benefits are derived from the removal of subgingival plaque and disruption of bacterial counts.<sup>(25)</sup> In our study, diode laser was used as an adjunctive treatment to conventional mechanical treatment, but not as a primary treatment of gingivitis. It should be kept in mind that the diode laser therapy used to perform decontamination to the previously scaled and polished areas and conventional mechanical treatment should not be discarded.

The mechanism of diode laser inhibition of bacteria has not been determined. Two possible mechanisms were suggested. In the first mechanism, the laser light considered to be absorbed by the substrate onto which the bacteria adhere. The resultant heating causes high local rise in temperature and lead to death of the attached bacteria. The second mechanism suggested that the laser light is absorbed directly by the bacteria which causes damage of the bacterial cell structures.<sup>(26)</sup>

The presence of bacteria in the gingival sulcus and periodontal connective tissues is a determinant factor in the development of periodontitis. In areas of difficult access, the use of manual or ultrasonic instruments is not enough to ensure the eradication of periodontal pathogenic bacteria. Likewise, antibiotic resistant strains may also damage the efficacy of conventional treatment.<sup>(27)</sup> This gives laser therapy a great advantage over systemic antibiotic therapy, since laser radiation does not negatively affect the rest of the body and does not cause resistance. The minimal risk

of creating resistant bacterial strains is laser therapy's greatest advantage.<sup>(6)</sup> According to previous reports, there are many other advantages of diode laser gingival therapy like the positive effects on wound healing.<sup>(28)</sup> Moreover, diode laser therapy may significantly enhance patient comfort during the post-operative healing phase because it involves minimal pain.<sup>(29)</sup>

ing.<sup>(28)</sup> Moreover, diode laser therapy may significantly enhance patient comfort during the post-operative healing phase because it involves minimal pain.<sup>(29)</sup>

**Table 1: Isolated microorganisms from the gingival sulci.**

Isolated microorganisms	MacConkey agar		Blood agar	
	control	experimental	control	experimental
<i>E coli</i>	20	0	1	2
<i>Klebsiellapneumonia</i>	20	16	20	14
<i>Serratia sp.</i>	20	0	19	0
<i>Staph aureus</i>	3	0	19	0
<i>Viridans streptococci</i>	0	0	19	9
<i>Villonilla sp.</i>	-	-	1	0
<i>Fusobacterium sp.</i>	-	-	3	0
<i>Peptostreptococcusniger</i>	-	-	1	0

**Tables 2: Means and standard deviation of identified aerobic bacterial strains from the experimental and control group using MacConkey and blood agar.**

Group	<i>E coli</i>		<i>Klebsiellapneumonia</i>		<i>Serratia sp.</i>		<i>Staph aureus</i>		<i>Viridans streptococci</i>	
MacConkey agar	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD
Control	1	0	1	0	1	0	0.15	0.134211	0	0
Experimental	0	0	0.8	0.1684	0	0	0	0	0	0
Blood agar	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD
Control	0.05	0.05	1	0	0.95	0.05	0.95	0.05	0.95	0.05
Experimental	0.1	0.0947	0.7	0.2210	0	0	0	0	0.45	0.2652

(p<0.001)

**Tables 3: Means and standard deviation of identified anaerobic bacterial strains from the experimental and control group.**

Group	<i>Villonilla sp.</i>		<i>Fusobacterium sp.</i>		<i>Peptostreptococcusniger</i>	
Blood agar	mean	SD	mean	SD	mean	SD
Control	0.05	0.218	0.15	0.3571	0.05	0.218
Experimental	0	0	0	0	0	0

## REFERENCES

1. Azadeh M, Kermanshahi RK, Sadat naghavi N, Ghalayani P, Salamat F. The profile of pathogenic bacteria isolated from dental plaque induced gingivitis. International Journal of Molecular and Clinical Microbiology 2011;1:36-39.
2. Marsh PD, Martin MV. Oral microbiology. Fifth edition. Elsevier Limited 2009.p120.
3. Sánchez MC, Liama-Palacios A, Blanc V. Structure, viability and bacterial kinetics of an in vitro biofilm model using six bacteria from subgingival microbiota. J Periodontal Res 2011;46:252-260.
4. Igić M, Kesic L, Lekovic V, Apostolovic M, Mihalovic D, Kostadinovic L, Milasin J. Chronic gingivitis: the prevalence of periodontopathogens and therapy efficiency. Eur J Clin Microbiol Infect Dis 2012;31:1911-1915.
5. Hojo K, Nagaoka S, Oshima T, Maeda N. Bacterial interactions in dental biofilm development. J Dent Res 2009;88(11):982-990.
6. Atanasovska-Stojanovska A. Modern approach to the identification and elimination of periodontal infection. Macedonian Journal of Medical Sciences 2012;5(2):215-221.
7. Theodoro LH, Silva SP, Pires JR, Garcia Soares-GH, Pontes AEF, Zuzu EP, Spolidó DMP, Correa de Toledo BE, Garcia VG. Clinical and microbiological effects of photodynamic therapy associated with nonsurgical periodontal treatment. A 6-month

- follow-up. *Lasers Med Sci* 2012;27:687-693.
8. Birang R, Yaghini J, Adibard M, Kiany S, Mohammadi Z, Birang E. The effect of diode laser (980 nm wavelength) and chlorhexidin gel in the treatment of chronic periodontitis. *Journal of Lasers in Medical Sciences* 2011;2(4):131-138.
9. Walker CB. Selected antimicrobial agents: mechanisms of action, side effects and drug interaction. *Periodontology* 2000;12-28.
10. Quirynen M, Teughels W, van Steenberghe D. Microbial shifts after subgingival debridement and formation of bacterial resistance when combined with local or systemic antimicrobials. *Oral Dis* 2003;9(Suppl 1):30-37.
11. Sennhenn-Kirchner S, Klaue S, Wolff N, Mergeryan H, Borg von Zepelin M, Jacobs HG. Decontamination of rough titanium surfaces with diode lasers: microbiological findings on in vivo grown biofilms. *Clin Oral Implants Res* 2007;18:126-132.
12. Luan XL, Qin YL, Bi LJ, Hu CY, Zhang ZG, Lin J, Zhou CN. Histological evaluation of the safety of toluidine blue-mediated photosensitization to periodontal tissues in mice. *Lasers Med Sci* 2009;24(2):162-166.
13. Romeo U, Palaia G, Botti R, Leone V, Rocca JP, Polimeni A. Non-surgical periodontal therapy assisted by potassium-titanyl-phosphate laser: a pilot study. *Lasers Med Sci* 2010;25:891-899.
14. Aoki A, Saski KM, Watanabe H, Ishikawa I. Lasers in nonsurgical periodontal therapy. *Periodontal* 2004;36:59-97.
15. Liebana J, Castillo AM, Alvarez M. Periodontal diseases: microbiological consideration. *Med Oral Cir Bucal* 2004;9(Suppl):75-91.
16. Schneider M, Kirfel, Berthold M, Frentzen M, Kraus F, Braun A. The impact of antimicrobial photodynamic therapy in an artificial biofilm model. *Lasers Med Sci* 2012;27:615-620.
17. Alves VTE, de Andrade AKP, Toaliar JT, Conde MC, Zezell DM, Cai S, Pannuti CM, De Micheli G. Clinical and microbiological evaluation of high intensity diode laser adjunct to non-surgical periodontal treatment: a 6-month clinical trial. *Clin Oral Invest* 2013;17:87-95.
18. Kamma JJ, Vasdekis VGS, Romanos GE. The effect of diode laser (980 nm) treatment on the survival rate of gingival fibroblast cell cultures. *Lasers Surg Med* 2011;28:445-450.
19. Morteza A, Schoop U, Goharkhay K, Schauer P, Doetbudak O, Wernisch J. Treatment of periodontal pockets with a diode laser. *Lasers Surg Med* 1998;22:302-311.
20. Nussbaum EL, Lilge L, Mazzualli T. Effects of 810 nm laser irradiation on in vitro growth of bacteria: Comparison of continuous wave frequency modulated light. *Lasers Surg Med* 2002;31:343-351.
21. Wilson M. Lethal photosensitization of oral bacteria and its potential application in the photodynamic therapy of oral infections. *PhotochemPhotobiolSci* 2004;3:412-418.
22. Morteza A, Gutknecht N, Doertbudak O, Goharkhay K, Schoop U, Schauer P. Bacterial reduction in periodontal pockets through irradiation with a diode laser: a pilot study. *J Clin Laser Med Surg* 1997;15:33-37.
23. Ryden H, Persson L, Perber H, Bergstorm J. Effect of low level energy laser irradiation on gingival inflammation. *Swed Dent J* 1994;18:35-41.
24. Hassan LM, Gizar R, Majeed LJ. Effect of diode laser 805 nm on the viability of some types of gram negative and gram positive pathogenic bacteria. *Iraqi Journal of Science* 2010;51(4):665-669.
25. Qadri T, Miranda L, Tuner J, Gustafsson A. The short-term effects of low-level lasers as adjunct therapy in the treatment of periodontal inflammation. *J ClinPeriodontol* 2005;32:714-719.
26. Pirnat S, Lukac M, Ihan A. Study of direct bactericidal effect of Nd:YAG and diode laser parameters used in endodontics on pigmented and nonpigmented bacteria. *Lasers Med Sci* 2011;26:755-761.
27. Eduardo Cd, de Freitas PM, Esteves-Oliveira M, Aranha ACC, Ramalho KM, Simões A, Bello-Silva MS, Tunér J. Laser phototherapy in the treatment of periodontal disease. A review. *Lasers Med Sci* 2010;25:781-792.
28. Savafi SM, Kazemi B, Esmaeili M, Fallah A, Modarresi A, Mir M. Effects of low-level He-Ne laser irradiation on the gene expression of IL-1beta, TNF-alpha, IFN-gamma, TGF-beta, Bfgf, and PDGF in rats gingiva. *Lasers Med Sci* 2008;23:331-335.
29. Andersen R, Loebel N, Hammond D, Wilson M. Treatment of periodontal disease by photodisinfection compared to scaling and root planning. *J Clin Dent* 2007;18:34-38.

## *New technologies in dentistry*

When I was preparing my article about laser in dentistry I notice a picture of dentist clinic on the net, the picture was about the using of new technologies in dentistry ( new devices , materials and instruments ) and they name the picture information technology environment in dental practice. I thought to write series about the new technologies in dentistry and of course laser in dentistry is one of them.

One who is watching the Extreme makeover shows or any other show about changing the face and smile of the donors has witnessed some of the miracles of modern dentistry. It's now possible to go into the dentist's office toothless and come out with a full set of teeth. Or you can change a crowded teeth to a bright straight Hollywood smile in one visit. Or you can view digital images of your teeth the instant they're captured by the X-ray machine. And also thanks to a dental laser that make you able to have cavities filled painlessly.

All of this is happening so fast that what couldn't be done during your last checkup might be possible when you return 6 months to a year later. When it comes to dentistry, the term "space-age technology" is literally true. For instance, one of the adhesives used by NASA on the exterior of the space shuttle is now being applied as a dental bonding material to make repairs that used to be impossible.

And we think that these advances come with a high price tag, (this is true) whoever its expensive for a period of time before it becomes accessible to everyone, I cannot say that every dentist must owns expensive new machines. But at least he can keep pace with the times for the benefit his patient and also his own benefit at the end because the trend in dentistry is utilizing technology to make dentistry more comfortable, durable, efficient and natural-looking for the patient as possible.



***Alan H. Mawlood Al\_Qassab***

B.D.S, H.D.D (Ortho), M.Sc (OMFS), MOMSRCPS (Glasgow)



# The Relation Between Trismus And Difficulty Of Mandibular 3rd Molar Impaction (Clinical & Prospective Study)

**Rozh M. Hussien**

*BDS, MSc*, Assistant lecturer, Oral and Maxillofacial Surgery Department, College of Dentistry, Hawler medical university

**Dilman N. Muhammad**

*BDS, MSc*, Assistant lecturer, Oral and Maxillofacial Surgery Department, College of Dentistry, Hawler medical university

**Alan H. Mawlood**

*BDS, HDD(Ortho), MSc, MOMSRCPS(Glasgow)*, Assistant lecturer, Oral and Maxillofacial Surgery Department, Hawler University, Dentistry College.

## ABSTRACT

**Objective:** The purpose of this clinical study was to evaluate the relation of trismus in association with removal of impacted mandibular third molars and several clinical variables (degree of impaction and difficulty of extraction & gender effect).

**Method:** Data were collected for all patients who underwent extraction of an impacted third molar in college of dentistry, Department of Oral and Maxillofacial Surgery, Hawler Medical University. A variety of data were collected for each patient, including age, sex, medical status at the time of the procedure, degree of mouth opening, type of impaction and type of procedure performed. All extractions were performed under local anesthesia by the same dental surgeon. Maximal inter-incisor distance were measured preoperatively, at first, second and third day following surgery to record the occurrence and degree of trisms.

**RESULTS** A total of 54 patient comprising 23 male and 31 female. The age range of patients was 20-30 mean (25); statistical analysis showed that there was highly significant relation between type of impaction and preoperative opening, and showed that there was very highly significant relation between gender and preoperative opening.

**Conclusion:** the degree of mouth opening after surgical removal of impacted third molar is related to the difficulty of impaction, as in class A of impaction the trismus was less than that class B and class C, and degree of trismus was more in class C than that of class B and class A.

**Key words:** Impaction, trismus, Lower wisdom, Complications, Gender

## INTRODUCTION

The mandibular third molars are the most frequently impacted teeth and surgical extraction has become one of the commonest dentoalveolar surgeries. This procedure is usually associated with post-operative complications as direct and immediate consequence of surgical procedure. Pain, swelling and trisms are the most common complications, followed by sensory nerve damage, dry socket, infection and hemorrhage. Less common complications are severe trisms, iatrogenic damage to adjacent second molar and iatrogenic mandibular fracture<sup>(1)</sup>.

The Pell and Gregory classifications were used to document the position of the impacted mandibular third molars. These classifications were used to predict the surgical difficulty and to evaluate the risk of postoperative complications, in particular limitation of mouth opening, according to the type of impaction.

In Pell and Gregory classification, the difficulty is measured by the thickness of the overlying bone; that is: the degree difficulty increases as the depth of the impacted tooth increases. As the tooth becomes less accessible become more difficult to section the tooth and to prepare purchase point<sup>(2)</sup>.

Class A impaction is one in which the occlusal surface of the impacted tooth is level or near level with the occlusal plane of the second molar.

Class B impaction is an impacted tooth with an occlusal surface between the occlusal plane and the cervical line of the second molar.

Class C impaction is one in which the occlusal surface of the impacted tooth is below the cervical line of the second molar.<sup>(3)</sup>

## PATIENTS AND METHODS

Data were collected from 54 patient attended the oral and maxillofacial surgery department, college of dentistry between the December 2011 till March 2013, age of patient were between (31), female and (23) male.

**Measurement procedure** Maximal mouth opening was measured using calibrated calipers; all patients were measured with their heads supported in a neutral position. Patients were asked to open their mouth as wide as possible, while avoiding excessive pain<sup>(4)</sup>. The maximal inter-incisal distance measured in four separated readings, the first measurement was before the surgery, the measurements were recorded in millimeters which ranged from (35mm-39mm) in female, and (35mm-40mm) in male in pre-operative day, the second reading was at the first post-operative day which ranged from (24mm-35mm) in female and (24mm-38 mm) in male, the third measurement was at second postoperative day which ranged from

(24mm-38mm) in female and (28mm-39mm) in male ,the fourth measurement was at the third post-operative day which ranged from(33mm-39mm)in female and (33mm-40mm)in male. All patients had panoramic image prior to surgery. Medical history was taken, all patient were healthy.

**Surgical procedure:** All patients were given local anesthesia, inferior alveolar nerve block technique with long buccal nerve block technique. An envelope incision is made which extended from the mesial papilla of the mandibular second molar around the neck of the tooth, to the disto-buccal line angle of the same tooth and then posteriorly and laterally to the anterior border of the mandibular ramus .If the impacted tooth was deeply imbedded in the bone and requires more extensive bone removal, a releasing incision was made. After flap reflection, bone was removed using straight surgical hand piece with external cooling system, the amount of bone removed and tooth sectioning depended on the degree of difficulty of tooth impaction. After tooth extraction, wound was debrided, irrigated with normal saline and sutured, Post-operative instruction was given to all patients. In The first post-operative day the inter-insical distance was taken using calibrated caliber following the same criteria of taking the inter-incisal distance prior to surgery, and then was repeated at the second and third postoperative day, the 4 measurement were documented for all patients.

**Statistical analysis:** t- Test and chi-square test were used in this study

## RESULTS

Regarding the preoperative mouth opening day , The statistical analysis showed there was high significant difference between type A and B (.003) ( $p \text{ VALUE} \leq 0.05$ ), very highly significant difference, between type A and type C (.000) and significant difference between type B and C (.022).

In the 1<sup>st</sup> post-operative mouth opening day, there was very highly significant difference between type A and B(.000), very highly significant difference between type A and C(.000), and very highly significant difference between type B and C(.000).In the 2<sup>nd</sup> postoperative mouth opening day, there was very highly significant difference between type A and B(.000), there was very highly significant difference between type A and C(.000) and no significant difference between type B and C (.201)In the 3<sup>rd</sup> postoperative mouth opening, there was highly significant difference between type A and type B (.004). There was very highly significant difference between type A and C (.000), and significant difference between type B and type C (.050). As shown in table (1)

**Table (1) relation between type of impaction and postoperative mouth opening**

Type of Impaction		Mean	Std. Deviation	t-test P-Value	Decision
Preoperative Opening (mm)	Type A	39.73	.799	.003	HS
	Type B	38.22	1.734		
Post Operative Opening (mm) 1st Day	Type A	37.40	.910	.000	VHS
	Type B	30.33	3.881		
Post Operative Opening (mm) 2nd Day	Type A	37.80	.676	.000	VHS
	Type B	32.22	3.766		
Post Operative Opening (mm) 3rd Day	Type A	38.67	.724	.004	HS
	Type B	37.50	1.339		
Preoperative Opening (mm)	Type A	39.73	.799	.000	VHS
	Type C	36.95	1.532		
Post Operative Opening (mm) 1st Day	Type A	37.40	.910	.000	VHS
	Type C	25.62	1.596		
Post Operative Opening (mm) 2nd Day	Type A	37.80	.676	.000	VHS
	Type C	30.71	3.408		
Post Operative Opening (mm) 3rd Day	Type A	38.67	.724	.000	VHS
	Type C	36.48	1.806		
Preoperative Opening (mm)	Type B	38.22	1.734	.022	S
	Type C	36.95	1.532		

Type of Impaction		Mean	Std. Deviation	t-test P-Value	Decision
Post Operative Opening (mm) 1st Day	Type B	30.33	3.881	.000	VHS
	Type C	25.62	1.596		
Post Operative Opening (mm) 2nd Day	Type B	32.22	3.766	.201	NS
	Type C	30.71	3.408		
Post Operative Opening (mm) 3rd Day	Type B	37.50	1.339	.050	S
	Type C	36.48	1.806		

The statistical analysis showed presence of highly significant difference between 1<sup>st</sup> and 2<sup>nd</sup> postoperative mouth opening(.004),very highly significant difference between 1<sup>st</sup> and 3<sup>rd</sup> (.000) and very highly significant difference between and 3<sup>rd</sup> (.000) as shown in t (table 2)

**Table (2) Relation between mouth opening and the days following surgery**

GRP		Mean	Std. Deviation	t-test P-Value	Decision
Post Operative Opening (mm)	1st Day	30.46	5.379	.004	HS
	2nd Day	33.19	4.221		
Post Operative Opening (mm)	1st Day	30.46	5.379	.000	VHS
	3rd Day	37.43	1.655		
Post Operative Opening (mm)	2nd Day	33.19	4.221	.000	VHS
	3rd Day	37.43	1.655		

The chi-square test showed presence of significant relation between preoperative mouth opening and 1<sup>st</sup> day postoperative mouth opening (.011), significant relation between preoperative mouth opening and 2<sup>nd</sup> day postoperative mouth opening (.015), and very highly significant relation between preoperative mouth opening and 3<sup>rd</sup> day postoperative mouth opening (.000).The chi-square test showed presence of highly significant relation between per -operative mouth opening and all types of impaction (.004) as shown in table (3)

**Table (3) relation between per -operative mouth opening and all types of impaction**

	Chi-Square Value	Df	P-Value	Decision
Post Operative Opening (mm) 1st Day Preoperative Opening (mm)	116.499 <sup>a</sup>	84	.011	S
Post Operative Opening (mm) 2nd Day * Preoperative Opening (mm)	114.749 <sup>a</sup>	84	.015	s
Post Operative Opening (mm) 3rd Day * Preoperative Opening (mm)	129.737 <sup>a</sup>	49	.000	VHS
Gender * Preoperative Opening (mm)	27.713 <sup>a</sup>	7	.000	VHS
Type of Impaction * Preoperative Opening (mm)	32.020 <sup>a</sup>	14	.004	HS

Regarding gender, in preoperative mouth opening day, statistical analysis t-test showed present of highly significant difference between male and female(.000),in 1<sup>st</sup> post-operative day mouth opening showed present of highly significant difference between male and female(.000),2<sup>nd</sup> post operative mouth opening day showed present of highly signif-

icant difference between male and female(.000),3<sup>rd</sup> post –operative day mouth opening day showed present of highly significant difference between male and female(.000).and there highly significant difference between male and female and type of impaction(.000) as shown in table( 4)

**Table (4) Relation between gender and mouth opening**

<i>Gender</i>		<i>Mean</i>	<i>Std. Deviation</i>	<i>t-test P-Value</i>	<i>Decision</i>
Preoperative Opening (mm)	Male	39.36	1.350	.000	VHS
	Female	37.10	1.496		
Post Operative Opening (mm) 1st Day	Male	33.40	5.401	.000	VHS
	Female	27.93	3.927		
Post Operative Opening (mm) 2nd Day	Male	35.48	3.676	.000	VHS
	Female	31.21	3.658		
Post Operative Opening (mm) 3rd Day	Male	38.36	1.319	.000	VHS
	Female	36.62	1.498		
Type of Impaction	Male	1.64	.757	.000	VHS
	Female	2.52	.634		

## DISCUSSION

The extraction of mandibular third molars is one of the most common surgical events. Thus, despite the diversified demands of practice, dental surgeons still face the problem of the removal of impacted mandibular third molars. Both the patient and dentist must therefore have scientific evidence-based information concerning the estimated degree of surgical difficulty in each case <sup>(5)</sup>

There are a number of previous studies carried out to evaluate surgical difficulty in the extraction of impacted mandibular third molars. However,

most of these studies are only based on dental factors determined through radiologic assessments. While opinions may vary, most authors agree that these radiologic factors play some role in estimating difficulty. Other authors believe it is difficult to estimate difficulty through radiologic methods alone and that actual difficulty can only be estimated intraoperatively<sup>(6)</sup>. This study improve the idea that preoperative radiograph will give the surgeon a clue about difficulty of extraction but actual difficulty will be estimated intraoperatively.

Normal mouth opening Range is 40-60 mm



(average 35mm) There was also a relation between tooth position based on the Gregory classification and the appearance of post-operative trismus. Oral surgical procedures especially extraction of lower molar teeth may cause trismus as a result either of inflammation involving muscles of mastication or direct trauma to the TMJ <sup>(7)</sup>

The most common postoperative complications found in this study were swelling, pain and trismus. Similar results were reported by Khan *et al* and Jaffar *et al*. Some authors consider them as transient complications and are expected with surgery. Although transitory, these conditions can be a source of anxiety for the patient. <sup>(8)</sup>

Deeper impaction leading to greater likelihood of tissue disturbance and longer operation times, which explained the tendency for more complications than other positions <sup>(9)</sup>

Susarla SM *et al* reported in their study that Trismus is often the result of surgical trauma, secondary to masticatory muscle and facial inflammation. Trismus gradually resolves and the ability to open the mouth returns to normal by 7-10 days post-operatively. <sup>(10)</sup>

All patients with surgical extraction impacted lower third molar experienced post-operative inflammatory discomfort in form of pain, trismus and swelling <sup>(11)</sup>

## CONCLUSION

the degree of trismus is strongly correlated to the difficulty of impaction, as in class A of impaction the trismus was less than that class B and class C, and degree of trismus was more in class C than that of class B and class A.

## REFERENCES

1. Woldenberg Y, Gatot I, Bodner L. (2007) iatrogenic mandibular fracture associated with third molar removal. Can it be prevented? Med Oral Patol Oral Cir Bucal. 12: 70-2.
2. François Blondeau, Nach G. Daniel (2007), Extraction of Impacted Mandibular Third Molars: Postoperative Complications and Their

- Risk Factors, CAD-ADC j. Vol. 73, No.
3. Hupp JR, Ellis III E, Tucker MR.(2008) Contemporary oral and maxillofacial surgery, 5th ed, St. Louis, Missouri, Mosby Elsevier 153-78.
4. Hira Ayaz, Atta-Ur-Rehman, Fahim-Ud-Din (2012) Oral & Dental Journal Vol 32, No. 3
5. Thiago de Santana-Santos, Jadson A. de Souza-Santos, Paulo R. Martins-Filho, Luiz C. da Silva, Emanuel D. de Oliveira e Silva, and Ana C. Gomes (2012). Prediction of postoperative facial swelling, pain and trismus following third molar surgery based on preoperative variables Published online December 10. doi: 10.4317/medoral.18039
6. Gbotolorun OM, Arotiba GT, Ladeinde AL. (2007) Assessment of factors associated with surgical difficulty in impacted mandibular third molar extraction. J Oral Maxillofac Surg. 65:1977-83.
7. McGrath C, Comfort MB, Lo ECM, Luo Y(2003) Changes in life quality following third molar surgery- the immediate postoperative period. Dent J 194: 265-68.
8. Khan A, Khitab U, Khan MT. (2010) Impacted mandibular third molars: Pattern of presentation and post operative complications. Pak Oral Dent J. 30: 307-12
9. Kim JC, Choi SS, Wang SJ and Kim SG (2006). Minor complications after mandibular third surgery: type, incidence, and possible prevention. Oral Surg Oral Med Oral Pathol Oral Radiol Endod, 102(2): e4-e11.
10. Susarla SM, Blaeser BF, Magalnick D. Oral Maxillofacial Surg Clin N Am 2003; 177-86.
11. Obitade S. Obimakinde (2012) An audit of impacted mandibular third molar surgery Orient Journal of Medicine, Vol 24 (1-2).

## Calcium Renal Stone in Relation to Salivary and Urinary Constituents

**Shaimaa Kh. Yaser**

*B.D.S., H.D.D., M.Sc.* Master of Science in preventive dentistry, The Iraqi Ministry of Health.

**Mohammed S. Al-Casey**

*B.D.S., M.P.H., M.S.P.H., USA.* Professor, Dental department, Al-Yarmook College of Dentistry.

**Ali Y. Majid**

*M.B.Ch.B, M.Sc., FICMS.* Consultant, Poisoning Consultation Center, Baghdad.

### ABSTRACT

**Background:** Renal stone which is actually renal calculi commonly termed as kidney stone may contribute to the development of chronic kidney disease and its incidence is rising rapidly; this study conducted to investigate the ability of using saliva as an indicator of susceptibility to calcium renal stone formation by investigating some salivary and urinary constituents among patients with idiopathic calcium renal stone then comparing the results with healthy looking subjects.

**Materials and Methods:** The study group selected of thirty patients with idiopathic calcium renal stone with an age range (25-30) year's old and 30 gender and age matched healthy looking subjects selected as control. Stimulated salivary samples in addition to fasting second morning urinary samples collected then chemically analyzed to determine the concentrations of salivary and urinary calcium, phosphate, magnesium in addition to urinary creatinine.

**RESULTS** High significant elevation in the concentration of salivary phosphate with high significant reduction in salivary magnesium concentration recorded within study group compared control one while for salivary calcium concentration, found higher in study group but with no significant difference between them. The calcium stone formers found to have no hypercalciuria but they had higher level of urinary phosphate/creatinine ratio with high significant difference compared with the non stone formers while they had a high significant reduction for urinary magnesium/creatinine ratio compared with the control group.

**Conclusion:** Saliva may provide an investigative tool for calcium renal stone disease by using the salivary magnesium concentration as an indicator of susceptibility to calcium renal stone formation for both males and females.

**Key Words:** Saliva, salivary composition, idiopathic calcium renal stone, kidney stones, urolithiasis.

### INTRODUCTION

Renal stone is a major cause of morbidity due to its association with renal colic, urinary tract obstruction, urinary tract infection, and increase the risk of: Renal parenchymal damage <sup>(1)</sup>, bone disease, and hypertension. Although many inherited and systemic diseases are associated with calcium renal stones, most of such stones are idiopathic <sup>(2)</sup>. The process of stone formation is complex. It begins with urine that becomes supersaturated with stone-forming salts, such that dissolved ions or molecules precipitate and form crystals or nuclei. Once formed, crystals may flow out with the urine or become retained in the renal system at anchoring sites that promote growth and aggregation leading to stone formation <sup>(3)</sup> that the type of stone formed correlates with the supersaturations found in the urine <sup>(4)</sup>. Calcium-containing renal stones make up 90% of all stones and are generally composed of a mixture of calcium oxalate and calcium phosphate. In mixed stones, calcium oxalate usually predominates; pure calcium oxalate stones are more common than pure calcium phosphate stones <sup>(1, 5)</sup>.

Saliva is the glandular secretion which constantly bathes the teeth and the oral mucosa. It is consti-

tuted by the secretions of the three paired major salivary glands (parotid, submandibular and sublingual) and minor salivary glands; the complex physical and chemical composition of salivary secretion performs a considerable number of protective functions which are part of the total body's ability to maintain homeostasis <sup>(6)</sup>. Saliva through its flow rate and constituents may play an essential role in maintaining the integrity of soft and hard tissues in the oral cavity <sup>(7, 8)</sup>. Many oral and systemic conditions manifest themselves as changes in the flow and composition of saliva <sup>(9)</sup>. Saliva represents a useful auxiliary means of diagnosis that used to diagnose systemic illnesses, monitoring general health, and as an indicator of risk for diseases creating a close relation between oral and systemic health <sup>(9, 10)</sup>.

### MATERIALS AND METHODS

In the present study, the study group composed of thirty patients (15 females and 15 males) with an age range (25- 30) years according to the last birthday <sup>11</sup>. They were diagnosed as having calcium renal stone (in renal pelvis, the ureter, or the bladder) based on new X-ray with general urine examinations; they were attending the Specialized Surgeries Hospital in

Baghdad city for their treatment; the design of the study was illustrated in Figure 1. The study group was fulfilled the following criteria:

- No presence of another medical problem and the cases of pregnancy, bone fractures, immobilization, previous bowel resection and cases under calcium or vitamin D supplements were also excluded. By that the study group was with idiopathic type renal stone.
- The size of renal stone is equal or less than 2 Cm (20 mm).
- The study group presents in fasting condition.

The control group also composed of thirty subjects and they were in healthy condition (normally looking) according to their medical history matching with age and gender the study group, they were subjects who working near and at the same hospital where the study done; the control group was fulfilled the following criteria:

- No history of previous renal stone and without familial history from the first relative degree.
- No presence of serious medical problems.
- Presence of a new ultrasound examination to ensure that there is no renal stone.
- The control group presents in fasting condition.

#### Collection of Salivary Samples

Stimulated salivary samples <sup>(12)</sup> were collected in this study at (9-12 AM). Each salivary sample was centrifuged at 3000 r.p.m for 10 minutes then the clear supernatants was separated by micropipette and then stored at (-20°C) in a deep freeze till the time of biochemical analysis.

#### Collection of Urinary Samples

Fasting second morning specimens were collected in which all individuals that participated within this study were in fasting condition from 9 PM on the evening preceding the study. At morning, the subject emptied his bladder (this specimen being discarded) and fasting was continued until second morning specimen taken at (9-12) AM. By using this technique, it can be assumed that the influence of recently ingested food on the excretion is minimal <sup>(13)</sup>. Also each urinary sample was centrifuged at 3000 r.p.m for 10 minutes then the clear supernatant was separated by micropipette and then stored at (-20°C) in a deep freeze till the time of biochemical analysis.

#### Biochemical Analysis

Frozen saliva and urine samples were allowed to thaw and come to room temperature. There after, they were subjected to biochemical analysis for the

common calculi promoters and inhibitor. This was done by using colorimetric method for determination of salivary and urinary (Calcium, phosphate) and urinary Creatinine concentrations while for salivary and urinary Magnesium ions concentration, it was determined by Flame Atomic Absorption Spectrophotometer using standardized procedure by air-acetylene gas. The concentration level of each salivary and urinary constituent was expressed as (mg/dL) unit except for urinary creatinine that was expressed as (g/L) unit and the final expression of urinary constituents' concentration was expressed as a ratio (mg/gm creatinine); in this ratio creatinine serves as a reference standard by virtue of its relatively constant excretion rate throughout the 24 hours <sup>(13)</sup>.

#### Statistical Analysis

Data processing and analysis were carried out using SPSS version 18 (Statistical Package for Social Sciences) which provided calculation and presentation of statistical parameters, means and standard deviation of the means for the biochemical variables examined in the study. The statistical test that used in this study was student's t-test.

\* The level of significance was accepted at  $P < 0.05$ , highly significance at  $P < 0.01$  and very highly significance at  $P < 0.001$ .

## RESULTS

Values of inorganic salivary constituents (means and standard deviation) among study and control groups are presented in Table 1. For both study and control groups including males (M) and females (F), phosphate was found to be the highest value followed by calcium and then magnesium. The concentration of phosphate was found higher in study group with statistically very highly significant difference in comparing to control group ( $t = 4.87$ ,  $P < 0.001$ ,  $df = 58$ ) while for concentration of magnesium ions, it was found higher in control group in comparing to study group with also very high significant difference between them ( $t = -13.71$ ,  $P < 0.001$ ,  $df = 58$ ). For calcium ions concentration, it was found higher in study group compared to control group but with no significant difference between them ( $P > 0.05$ ).

Concerning gender differences, salivary phosphate concentration was recorded higher within males than females among study group with a significant difference between them ( $t = 2.35$ ,  $P < 0.05$ ,  $df = 28$ ) while among the control group the difference was statistical-

ly not significant ( $P>0.05$ ) with higher concentration of salivary phosphate within males also. Statistical results revealed that females among study group had higher salivary magnesium concentration than males but with not significant difference ( $P>0.05$ ) while among control group, salivary magnesium concentration within females found to be equal to that within males, so there is no significant difference between them ( $P>0.05$ ). For salivary calcium concentration, it was found higher within males than females among study group in contrast to that found among control group that this concentration found to be higher within females than males with statistically not significant difference among both groups ( $P>0.05$ ).

Mean and standard deviation of urinary constituents which was expressed as a ratio (Calcium, Phosphate and Magnesium)/ Creatinine illustrated in Table 2. The highest mean value of urinary constituents was recorded for phosphate/creatinine ratio which was recorded in the study group with statistically high significant difference compared with control group ( $t= 3.59$ ,  $P<0.01$ ,  $df= 58$ ), in urine this value was followed by magnesium/creatinine ratio which was found higher in control group with very high significant difference compared to study group ( $t= -9.26$ ,  $P<0.001$ ,  $df=58$ ). For calcium/creatinine ratio, it was found higher in study group compared to control group but with not significant difference between them ( $P>0.05$ ).

Concerning gender differences in each group, among study group, within males, statistical analysis found that the mean value of urinary phosphate/creatinine ratio is higher than that of females with statistically highly significant difference ( $t= 3.15$ ,  $P<0.01$ ,  $df=28$ ) in contrast to the control group in which that this ratio recorded higher within female than males but with very high significant difference ( $t= -6.21$ ,  $P<0.001$ ,  $df= 28$ ). For the mean value of urinary magnesium/creatinine ratio, it was recorded to be higher within females than males among study group with statistically high significant difference ( $t= -3.10$ ,  $P<0.01$ ,  $df= 28$ ), among control group this ratio also recorded higher within females than males but with statistically not significant difference ( $P>0.05$ ). Among males within study and control group, it was found that the mean values of urinary calcium/creatinine ratio are higher than females within the two groups with very high significant difference and high significant difference respectively between them ( $t= 4.33$ ,  $P<0.001$ ,  $df= 28$ ;  $t= 3.88$ ,  $P<0.01$ ,  $df=28$ , re-

spectively).

## DISCUSSION

Renal stone has been studied extensively but unfortunately, there was no Iraqi study able to be found about its influence on salivary and urinary composition and to examine the ability of using saliva as an indicator of susceptibility to calcium renal stone formation, for that this study was designed.

The concentration of salivary phosphate was investigated in this study and the result is higher level of salivary phosphate concentration was recorded among calcium stone formers with highly significant differences than non stone formers. The high level of salivary phosphate among calcium stone formers may be interpreted by that phosphate regulation is primarily achieved by the kidneys <sup>(14)</sup> which they expected to be affected by presence of stone, so more phosphate secreted in saliva which may be a reflect to their increase in serum. Since saliva is act as a mirror of serum <sup>(15, 16)</sup> when there is increased in its secretion <sup>(16)</sup>. Other explanation for this result will discussed later on. In addition to salivary phosphate, other salivary elements including calcium and magnesium were evaluated in the present study and found that there was no significant difference between calcium stone formers and non stone formers in regarding to salivary calcium but with higher level among the stone formers. However, highly significant difference was recorded among males within study group in compared to males within the control one while among females; there was no significant difference between two groups. For salivary magnesium, present study revealed highly significant reduction in salivary magnesium concentration among calcium stone formers in compared to non stone formers. Regarding gender differences, it was found that there were no significant differences among males and females in concerning to salivary calcium and magnesium while the males in this study had higher concentration of salivary phosphate than females with significant difference. One can notice from the result of salivary magnesium among control group that the numerical value of salivary magnesium concentration is similar among males and females which it is (1.24) mg/dL. Since saliva offers an alternative to serum as a biologic fluid <sup>(15, 16)</sup> when there is increased in its secretion <sup>(16)</sup>, so these differences in the inorganic salivary constituents (Calcium, phosphate and magnesium) among calcium stone formers as compared to non stone formers may



be related to differences in their level in serum as a result in which that the majority of patients with idiopathic stones have metabolic abnormalities <sup>(2)</sup>.

Similar to that found in saliva about phosphate concentration, present study revealed present of higher level of urinary phosphate/creatinine ratio among study group with high significant difference in compared to control one this may be related to dietary factors that the excretion of urinary phosphate in normal adults is related to the amount of dietary phosphate <sup>(17)</sup> and may be related also to metabolic abnormalities which present among the majority of idiopathic stone formers <sup>(2)</sup>. About gender differences, similar to that revealed in saliva in regarding salivary phosphate, higher level of urinary phosphate/creatinine ratio was recorded among males within study group with high significant difference compared to females. This difference among males and females may expect to be due to differences in dietary habits, since it must be considered that the urine composition is directly related to diet <sup>(18)</sup>. For urinary magnesium/creatinine ratio, present study revealed a result also similar to that found about the concentration of magnesium in saliva. It was revealed a reduction in this ratio among study group with high significant difference compared to control one. The reduction in magnesium/creatinine ratio is an indicator for insufficient magnesium intake <sup>(13)</sup> and also may relate to intestinal malabsorption, since the majority of idiopathic stone formers have metabolic abnormalities <sup>(2)</sup>. Regarding gender differences and among the study group, females had higher level of urinary magnesium/creatinine ratio than males with high significant difference. This may consider one of explanations for why males have higher renal stone incidence than females, since the magnesium is an inhibitor for calcium stone formation <sup>(1, 19)</sup>. This gender differences may also related to differences in dietary habits <sup>(18)</sup>. Similar to that revealed for salivary calcium in present study, the concentration of urinary calcium/creatinine ratio is in higher level among study group in compared to control one but with no significant difference. Regarding gender differences, males found to have higher level of urinary calcium/creatinine ratio than females in both groups with high significant difference. This result may be due to differences in dietary habits among both genders <sup>(18)</sup>.

One can notice from urinary results of present study that calcium stone formers didn't have hypercalciuria but they had high urinary level of phosphate which is consider one of calcium stone promoters <sup>3</sup> and highly reduction in urinary magnesium level which is one of calcium stone inhibitors <sup>(20)</sup>, so one can conclude that the calcium renal stone to be formed the hypercalciuria may be not a condition to be formed but the supersaturation with other urinary stone minerals like phosphate and oxalate which found to be correlates better with the activity of stone disease than urinary calcium <sup>(21)</sup>, and lack of adequate levels of inhibitors like magnesium and citrate in the presence of calcium, all these factors may play an important role for formation of calcium renal stone rather than hypercalciuria <sup>(20)</sup>.

In contrast to other ions, serum  $Mg^{2+}$  concentration is not under tight hormonal regulation. Bone, the major intracellular  $Mg^{2+}$  reservoir, does not readily exchange with extracellular  $Mg^{2+}$ , and equilibration with bone stores may take several weeks <sup>(22)</sup>, so for that and for the result that revealed by current study, one can notice for urinary magnesium/creatinine ratio that this value is higher for both males and females among control group compared to males and females among study one, so one may be use the magnesium/creatinine ratio as an indicator of susceptibility to calcium renal stone formation. On other words, the salivary magnesium concentration may be used as an indicator of susceptibility to calcium renal stone formation due to the similarities that revealed by results of current study in regarding magnesium between saliva and urine among calcium stone formers compared with the non stone formers. This conclusion will need further studies to improve and to use saliva as one of tools that used in primary and secondary preventive programs to avoid the risk of calcium renal calculi and also dental calculi. Since magnesium is an inhibitor of the calcification process <sup>(18, 23)</sup>.

The measurement of concentration of magnesium in saliva will be easier than that in urine, since that in urine; it needs 24 hours urine collection or at least a fasting second morning urine specimen with measurement of urinary creatinine, since urine composition is directly related to diet <sup>(18)</sup>.

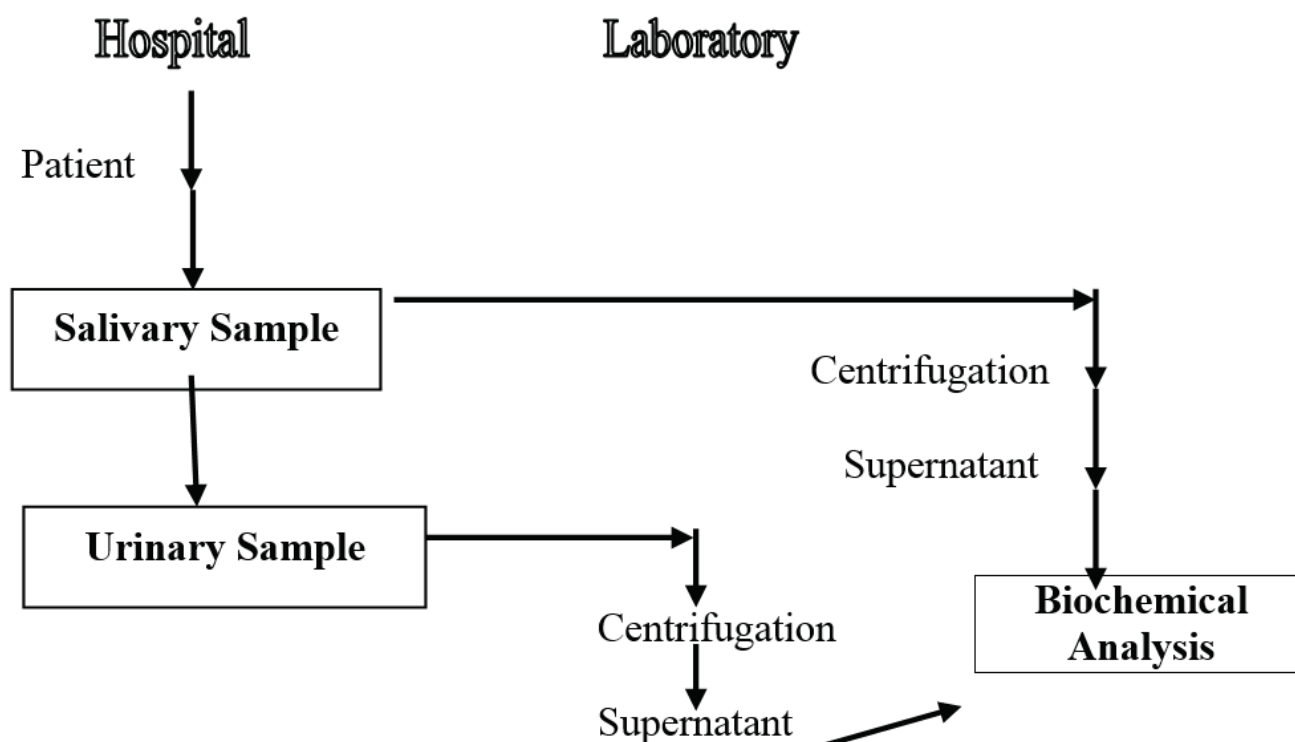


Figure 1: The design of the study.

Table 1: Inorganic Salivary Constituents (Calcium, Phosphate and Magnesium) (Mean and Standard Deviation) among Study and Control Groups.

Elements (mg/dL)	Gender	Study (Mean $\pm$ SD)	Control (Mean $\pm$ SD)	P-value
Calcium	M	5.48 $\pm$ 2.76	2.84 $\pm$ 1.44	P<0.01**
	F	4.56 $\pm$ 2.32	4.88 $\pm$ 4.20	P>0.05
	T	5.00 $\pm$ 2.56	3.88 $\pm$ 3.24	P>0.05
Phosphate	M	13.21* $\pm$ 1.95	9.77 $\pm$ 3.63	P<0.01**
	F	11.66 $\pm$ 1.64	8.59 $\pm$ 2.48	P<0.001***
	T	12.43 $\pm$ 1.95	9.18 $\pm$ 3.10	P<0.001***
Magnesium	M	0.56 $\pm$ 0.12	1.24 $\pm$ 0.22	P<0.001***
	F	0.61 $\pm$ 0.15	1.24 $\pm$ 0.24	P<0.001***
	T	0.58 $\pm$ 0.15	1.24 $\pm$ 0.22	P<0.001***

\* Significant P&lt;0.05 \*\* Highly significant P &lt; 0.01 \*\*\* Very highly significant P &lt; 0.001

Table 2: Urinary (Calcium, Phosphate and Magnesium)/ Creatinine ratios (Mean and Standard Deviation) among Study and Control Groups.

Urinary variables	Gender	Study (Mean $\pm$ SD)	Control (Mean $\pm$ SD)	P-value
Calcium/ Creatinine (mg/g)	M	69.60*** $\pm$ 21.60	57.60** $\pm$ 16.80	P>0.05
	F	39.20 $\pm$ 16.40	34.80 $\pm$ 15.60	P>0.05
	T	54.40 $\pm$ 24.40	46.40 $\pm$ 19.60	P>0.05
Phosphate/ Creatinine (mg/g)	M	469.03** $\pm$ 37.20	310.93 $\pm$ 62.00	P<0.001***
	F	409.82 $\pm$ 62.31	434.93*** $\pm$ 46.19	P>0.05
	T	439.58 $\pm$ 58.59	372.93 $\pm$ 82.77	P<0.01**
Magnesium/ Creatinine (mg/g)	M	27.46 $\pm$ 7.05	63.18 $\pm$ 19.93	P<0.001***
	F	35.24** $\pm$ 6.80	72.66 $\pm$ 19.68	P<0.001***
	T	31.35 $\pm$ 8.02	68.04 $\pm$ 20.17	P<0.001***

\*\* Highly significant P &lt; 0.01 \*\*\* Very highly significant P &lt; 0.001

## REFERENCES

1. Reilly R. The patient with kidney stones. In: Schrier R, ed. *Manual of nephrology*, 6<sup>th</sup> ed. Lippincott Williams and Wilkins. 2005: 79-91.
2. Worcester E, Coe F. Calcium kidney stones. *N Eng J MED* 2010; 363: 954- 963.
3. Pearle M, Lotan Y. Urinary lithiasis. In: Wein A, Kavoussi L, Novick A, Partin A, Peters C, eds. *Campbell-Walsh Urology*, 9<sup>th</sup> ed. Saunders. Philadelphia. 2007.
4. Worcester E, Coe F. Nephrolithiasis. In: Lerma E, Berns J, Nissenson A, eds. *Current diagnosis and treatment nephrology and hypertension*, 2<sup>nd</sup> ed. Mc Graw Hill Lange. New York. 2009: 345-352.
5. Pattison J, Goldsmith D, Hartley B, Fervenza F, Grand J. *A color handbook of renal medicine*. 1<sup>st</sup> ed. Manson Publishing. London. 2004: 110-113.
6. Nanci A. *Ten Cate's Oral Histology: development, structure, and function*. 6<sup>th</sup> ed. USA, Mosby. 2003
7. Puy C. The role of saliva in maintaining oral health and as an aid to diagnosis. *Med Oral Patol Oral Cir Bucal* 2006; 11: 449-455.
8. Stooky G. The effect of saliva on dental caries. *J Am Dent Assoc* 2008; 139(2): 11-17.
9. DeAlmeida P, Gregio A, Machado M, Lima A, Azevedo O. Saliva composition and function: a comprehensive review. *J Contemp Dent Pract* 2008; 3(9): 72-80.
10. Malamud D. Salivary diagnostics: the future is now. *J Am Dent Assoc* 2006; 137:284-286.
11. World Health Organization. *Oral health surveys-basic methods*. 4<sup>th</sup> ed. WHO. Geneva, Switzerland. 1997.
12. Tenovuo J, Lagerlof F. Saliva. In: Thylstrup A, Fejerskov O, eds. *Text book of clinical cariology*. 2<sup>nd</sup> ed. Munksgaard. Copenhagen. 1996: 17-44.
13. Jawalekar S, Kulkarni U, Surve V, Bhutay A. Evaluation of different urinary constituent ratios in renal stone formers. *Scholars Research Library, Annals of Biological Research* 2010; 1 (3): 50-55.
14. Quigley R. Disorders of calcium and phosphate regulations. In: Kiessling S, Goebel J, Somers M, eds. *Pediatric nephrology in the ICU*, 1<sup>st</sup> ed. Springer. Berlin. 2009: 55-65.
15. Kaufman E, Lamster I. The diagnostic application of saliva. *Crit Rev Oral Biol Med* 2002; 2(13): 197-212.
16. Tso P. Gastrointestinal secretion, digestion and absorption. In: Rhoades R, Tanner G, eds. *Medical physiology*, 2<sup>nd</sup> ed. Lippincott Williams and Wilkins. Philadelphia, London. 2003: 482-483.
17. Caramia G. Uric acid, phosphate and oxalate stones. *Urol Int* 2004; 72: 24.
18. Grases F, Bauza A, Preito R. Renal lithiasis and nutrition. *Nutrition Journal* 2006; 5:23.
19. Schwartz B, Bruce J, Leslie S, Stoller M. Rethinking the role of urinary magnesium in calcium urolithiasis. *J Endourol* 2001; 15: 233.
20. Abrahams H, Meng M, Stoller M. Urinary stone inhibitors. In: Stoller M, Meng M, eds. *Urinary stone disease*, 1<sup>st</sup> ed. Humana Press. Totowa, New Jersey. 2007: 157-168.
21. Pahira J, Pevzner M. Nephrolithiasis. In: Hanno P, Wein A, Malkowicz S, eds. *Penn clinical manual of urology*, 1<sup>st</sup> ed. Saunders company. Philadelphia. 2007: 235-257.
22. Samsonov D. Abnormalities in magnesium metabolism. In: Kiessling S, Goebel J, Somers M, eds. *Pediatric Nephrology in the ICU*, 1<sup>st</sup> ed. Springer. Verlag Berlin Heidelberg. 2009: 69-85.
23. Su Y, Zhang K, Ke Z, Zheng G, Chu M, Liao G. Increased calcium and decreased magnesium and citrate concentrations of submandibular/sublingual saliva in sialolithiasis. *Oral Biology J* 2010; 1(55): 15-20.

# Effect of Garlic Extracts on Streptococci and Mutans Streptococci, in Comparison to Chlorhexidine Gluconate (A comparative in vitro and in vivo study)

Jinan M. Rashad

B.D.S., M.Sc., Lecturer, Dental preventive department, Technical medical institute, Baghdad.

Sulafa K. El-Samarrai

B.D.S., M.Sc., Ph.D. - Prof. - Department of Pedodontic and preventive dentistry, College of Baghdad.

## ABSTRACT

**Background:** Garlic is a medicinal plant with anti-inflammatory, antimicrobial and immune-boosting properties. The aim of the present study was to assess and compare the effect of garlic extracts with those of chlorhexidine gluconate and de-ionized water against viability counts of Streptococci and *Mutans Streptococci*.

**Materials and Methods:** The effect of different concentrations of garlic extracts (water and ethanol) on growth and viability counts of *Mutans Streptococci* in comparison to 0.2% chlorhexidine gluconate and de-ionized water were evaluated through a series of in vitro experiments. Water garlic extract (10%), were tested in comparison to chlorhexidine (0.2 %) and de-ionized water, regarding the effect on viability counts of salivary *Mutans Streptococci* and Streptococci, among a group of volunteers.

**Results** In vitro experiments; Statistically non significant reduction in the viable counts was recorded when garlic extracts (water and ethanol) were used at concentration 5%, while at higher concentrations both types of garlic extracts showed statistically significant reduction in the counts of *Mutans Streptococci* ( $P < 0.05$ ).

Rinsing with any one of these agents resulted in a slight decrease in the salivary counts of bacteria, while chlorhexidine showed a sharp reduction in the counts of bacteria which was highly significant ( $P < 0.001$ ). For *Mutans Streptococci*, a highly significant differences were found between the three mouth rinses ( $P < 0.001$ ) in the counts of bacteria in the following time points (after 30 minute, after one hour and after two hours of rinsing). Within these times chlorhexidine was shown to be the most effective in reducing the counts of these bacteria followed by water garlic extract.

**Conclusion:** Garlic extract was effective against *Mutans Streptococci* when tested both in vitro and in vivo.

**Key words:** Garlic extracts, chlorhexidine, Streptococci, *Mutans Streptococci*.

## INTRODUCTION

Dental caries can be reduced by eliminating established *Mutans Streptococci* population from the oral cavity through mechanical plaque control (tooth brushing and inter dental cleaning), increasing the acid-resistance of teeth through effective use of fluorides and control of the carbohydrate composition of the diet <sup>(1-3)</sup>.

Recently, there has been a dramatic increase in the use of plant products and herbs like Siwak, green and black tea, and *Myrtus communis* <sup>(4-7)</sup>. Garlic (*Allium Sativum*) is one of these herbs which have been used for a wide variety of diseases and health conditions like periodontal diseases and dental caries <sup>(8,9)</sup>. However, there is a lack of studies regarding its specificity against cariogenic bacteria especially Streptococci which may prove its potency against this bacteria. The aim of the present study was to assess and compare the effect of garlic extracts with those of chlorhexidine gluconate and de-ionized water against the viability counts of Streptococci and *Mutans Streptococci*.

## MATERIALS AND METHODS

This study was conducted in the laboratory of College of Dentistry/ University of Baghdad. Garlic

was extracted by two methods which were:

1. **Water Garlic Extract:** This was prepared according to the method described by Tsao *et al.*, <sup>(10)</sup>. A 200 gm was taken and sliced then homogenized in 200 ml of sterile de-ionized water in a blender at high speed for two minutes; garlic was kept in a large bottle which was sealed with aluminum foil for two hours at room temperature. The extract was filtrated using Whatman No. one filter paper, then left to dry at 40°C in hot air oven for evaporation of water. A thick paste was obtained this was kept in small bottles in refrigerated conditions until use.
2. **Ethanol Garlic Extract:** It was prepared according to the method described by Onyeagba *et al.*, <sup>(11)</sup>, about 200 gm of garlic was taken and soaked in one liter of 99% ethanol in a large bottle sealed with foil and allowed to stand for 72 hour then this was filtrated by Whatman filter paper No. one. The extract then left to dry at 40°C in hot air oven, then the extracted paste was kept in a small bottle in the refrigerator until use.

*Isolation of Mutans Streptococci:* stimulated salivary samples were collected from five healthy looking dental student aged 22- 23 years for isolation of



bacteria, collection of saliva from voluntaries were performed under standardized condition. Samples were homogenized by vortex mixer for two minutes, and then ten- fold dilution was performed by transferring 0.1 ml of saliva to 0.9 ml of phosphate buffer saline (pH 7.0). From dilution  $10^{-3}$  of salivary samples 0.1 was taken and spread in duplicate on the Mitis Salivarius Bacitracin agar media, the plates were incubated an aerobically using a gas pack or candle for 48 hour at  $37^{\circ}\text{C}$  then aerobically for 24 hr. at room temperature <sup>(12)</sup>.

#### **Experiment One:**

##### **Sensitivities of *Mutans Streptococci* to Different Concentrations of Garlic Extracts, Chlorhexidine and Deionized Water, *In Vitro*.**

Different concentrations of water and ethanol garlic extracts in addition to chlorhexidine gluconate (0.2%) were used in this experiment, they were as follow:

Water garlic extract 5%,10%,15%,20%,25%,30%,35%,40%,45%,50%.

Ethanol garlic extract 5%,10%,15%,20%,25%,30%,35%,40%,45%,50%.

A volume of 25 ml of Mueller Hinton Agar was poured into sterile glass petri dishes, left at room temperature for 24 hour. To each plate 0.1 ml of *Mutans Streptococci* inoculums was spread, left for 20 minute at room temperature then wells of equal size and depth were prepared about, each well was filled with 0.2 ml of the test agent. Plates were left at room temperature for one hour then incubated an aerobically for 24 hr. at  $37^{\circ}\text{C}$ ; zone of inhibition was measured across the diameter of each well.

#### **Experiment Two:**

##### **Effects of Garlic Extracts, Chlorhexidine, and Deionized Water on Viability Counts of *Mutans Streptococci*, *In Vitro*.**

Different concentrations of garlic extracts were prepared. Brain Heart Infusion broth (pH 7.0) were prepared and distributed in test tubes by 8.9 ml in each one. One ml of the test agent was added to each tube. After that 0.1 ml of bacterial inoculums was added to both study and control tubes. From the control tube 0.1 ml was transferred to 0.9 ml of sterile Phosphate Buffer Saline (pH 7.0) and a ten-fold dilution was performed. From dilutions  $10^{-3}$ , 0.1ml was taken and spread in duplicate on MSB agar plates, the plates then incubated an aerobically at  $37^{\circ}\text{C}$  for 48 hr. Then colony forming unit per milliliter (colony forming unit/ml) was counted, this value was considered as the initial count of bacteria. Study and control were incubated aerobically at  $37^{\circ}\text{C}$  for 24 hr. From each

tube of the control and study 0.1 ml was transferred to 0.9 ml of PBS and a ten fold dilution was performed. From dilutions  $10^{-3}$ , 0.1 ml was taken and spread in duplicate on Mitis Salivarius Bacitracin agar plates, the plates then incubated anaerobically at  $37^{\circ}\text{C}$  for 24 hr. The colony-forming unit per milliliter was counted (colony forming unit/ ml) for all the plates.

#### **Experiment Three:**

##### **Effects of Water Garlic Extract, Chlorhexidine and De-ionized Water on Salivary Counts of *Streptococci* and *Mutans Streptococci*, *In Vivo*.**

The effects of these agents were tested on the saliva of a group of volunteers, the volunteers participated in this experiment were 18 subject, they were divided into three groups six in each one. The first group was the experimental group that used water garlic extract as a mouth rinse (10%), while the second group was the control positive group rinsing with chlorhexidine gluconate (0.2%), the last group which was the control negative rinsed with de-ionized water. All the volunteer participated in this experiment were healthy looking with no medical history, did not receive any antimicrobial agents during the last two weeks prior to the study, not wearing any fixed or removable prosthesis or orthodontic appliance, the age range was 25-30 years. The procedure was conducted at 9.00 a.m. which was at least two hours following their breakfast, the volunteers were asked to suspend their usual oral hygiene practice at the day of experiment <sup>(13)</sup>.

**Procedure:** Each volunteer was given a piece of Arabic gum (0.5gm) and asked to chew it for one minute only, then stimulated saliva was collected in sterilized screw capped bottles <sup>(14)</sup>. After one minute, each volunteer was asked to rinse with 10 ml of test agent for one minute then expectorate. Stimulated saliva were recollected in the following points: after one minute of rinsing, 30 min, one hour, and, two hours during this time, the volunteers were asked not to eat or drink anything except water, pH and flow rate for each salivary sample was tested. Salivary samples were dispersed for two minutes by vortex mixer, then 0.1 ml of saliva transferred to 0.9 ml of sterile Phosphate Buffer Saline (pH 7.0), and ten-fold dilutions were performed. From the dilution  $10^{-3}$ , 0.1 ml was taken and spread in duplicate on Mitis Salivarius Bacitracin agar plates, these plates were incubated an aerobically for 48 hr. at  $37^{\circ}\text{C}$  then aerobically for 24 hr. at room temperature, colonies were counted by colony counter. The number of colonies was expressed as colony-forming units multiplied by the dilution factor per

milliliter of saliva (colony forming unit/ml).

Statistical analysis performed using SPSS for calculation of the statistical parameters, mean and standard deviation. Student's t-test applied for calculating the significance of differences between the different variables, accepted at 0.05.

## RESULTS

### Sensitivities of *Mutans Streptococci* to Different Concentration of Garlic Extract (Water and Ethanol), Chlorhexidine gluconate and De-ionized Water, *In Vitro*.

A highly significant difference was shown between Chlorhexidine gluconate and different concentrations of water garlic extract (Table 1), as the sensitivity of *Mutans Streptococci* was higher to chlorhexidine compared to different concentrations of water garlic extract ( $P < 0.001$ ). On comparison of chlorhexidine to different concentrations of ethanol garlic extract, a highly significant difference was shown at concentrations 5%, 10%, 15% at ( $P < 0.001$ ), at these concentrations sensitivities of *Mutans Streptococci* to ethanol garlic extract was lower than that of chlorhexidine, while at concentrations 25%, and 30% no significant difference in sensitivities between the two agents was found. As the concentration of ethanol garlic extract was increased the sensitivity of bacteria to this agent became more compared to chlorhexidine and at concentrations 35%, 40%, 45%, 50% the difference was highly significant, (Table 2).

### Effect of Garlic Extracts (Water and Ethanol), Chlorhexidine gluconate and De-ionized Water on Viability Count of *Mutans Streptococci*, *In Vitro*

The counts of bacteria after 24hr. were compared with that after the application of different agents, results showed that there was no significant reduction in the counts of bacteria at concentration of 5% water garlic extract and 5% ethanol garlic extract, the same result was shown for de-ionized water. A significant reduction in the counts of bacteria at concentrations 10% and 15% of water garlic extract ( $P < 0.05$ ) was also seen, the same result was illustrated for ethanol garlic extract at conc. 10% and 15%, concerning chlorhexidine gluconate there was a highly significant reduction in the counts of bacteria in comparison to the control after 24hr. (Table 3).

### Effects of Garlic Extract, Chlorhexidine gluconate and Deionized Water on the Viability Counts of Salivary Streptococci and *Mutans Streptococci*, *In Vivo*

#### Salivary Streptococci:

Mean counts of bacteria estimated before and

after rinsing with 10% garlic water extract, chlorhexidine gluconate, and de-ionized water at each time interval is seen in (Figure 1), there was a slight reduction in the mean counts of bacteria after one minute of rinsing with water garlic extract or chlorhexidine, in contrast de-ionized water showed a slight increased in the counts of bacteria. After 30 min. a slight reduction in the counts of bacteria was illustrated by de-ionized water and water garlic extract which tended to increase gradually after one hour, until reached to the baseline after two hours. For chlorhexidine there was a marked decrease in the counts of bacteria after 30 min. which continued after one hr. then the counts of bacteria were gradually increased but still lower than the baseline. (Table 4) illustrates values of standard deviations of the mean counts of bacteria.

*Mutans Streptococci*: Mean counts of bacteria estimated before and after rinsing with 10% garlic water extract, chlorhexidine gluconate, and de-ionized water at each time interval is seen in (Figure 2). For de-ionized water there was a slight reduction in the counts of bacteria immediately after rinsing, which continued after 30 minute, then the counts of bacteria raised after one hour, then showed a slight reduction which continued for two hours and remained less than that of the baseline. Immediately after rinsing with water garlic extract or chlorhexidine gluconate a slight reduction in the counts of bacteria was seen followed by sharp reduction after 30 minutes, then the count was gradually increased for the following time points but remained less than that of the baseline. The greatest reduction was shown by chlorhexidine gluconate followed by garlic extract; de-ionized water showed the highest bacterial counts. (Table 5) illustrates values of standard deviations of the mean counts of bacteria.

## DISCUSSION

Sensitivities of *Mutans Streptococci* to different concentrations of garlic extracts in comparison to chlorhexidine gluconate (0.2%) and de-ionized water was tested using Agar Well Technique. For water garlic extract a minimum concentration needed to produce inhibition zone was 10%, while for ethanol garlic extract a lower concentration was needed to inhibit the growth of bacteria which was (5%). Processed garlic contains a variety of oil and water soluble sulfur compounds for which many biological activities of garlic attributed<sup>(15)</sup>; in this study variation in the amount and types of these antimicrobial compounds present in the two types of garlic extracts may explain the variation in the sensitivity of bacteria. The zone

of inhibition was found to increase as the concentration of garlic extracts was increase for both types with highly significant differences between most of these concentration, for ethanol garlic extract, zones of inhibition were much higher than that of water garlic extract of the same concentration, this may be related to that the active chemical constituents that might have the ability to dissolve better in ethanol than in water, as will be discussed later.

Sensitivities of *Mutans Streptococci* to chlorhexidine was tested and compared to garlic extracts (water and ethanol), these bacteria were more sensitive to chlorhexidine gluconate compared to both types of garlic extracts. It is well known that chlorhexidine is an effective agent especially against *Mutans Streptococci* the mode of action of chlorhexidine on these bacteria varies with its concentration, more specific effects have been observed with lower (bacteriostatic) concentrations which is based on disturbance of bacterial cell functions, enzymes and cell receptors <sup>(16)</sup>. As the concentration increased, ethanol garlic extract was much more effective than chlorhexidine in this study, this may be difficult to explain, and one can assume that *Mutans Streptococci* are more sensitive to ethanol garlic extract at high concentrations than chlorhexidine or the permeability of bacterial cell wall by ethanol garlic extract with these concentrations might be better than chlorhexidine.

The effect of garlic extracts (water and ethanol), chlorhexidine gluconate, and de-ionized water on the

viability counts of *Mutans Streptococci* *in vitro* were tested, a significant reduction in the counts of these bacteria was shown at concentration of 10% and 15% for both types of garlic extracts compared to the control after 24 hour. Mechanisms where by garlic extract inhibit growth of bacteria especially against *Mutans Streptococci* are still unclear, most explanations concerning the antibacterial effect of garlic in general related the inhibitory effect of the main antimicrobial constituent of garlic which has been identified as the oxygenated sulfur compound, thio-2-propene-1-sulfinic acid S-allyl ester referred to as allicin, it was shown that this compound react very rapidly with free thiol groups via thiol-disulphide exchange, therefore, it is thought that the main mechanism of action of allicin against bacteria is through interaction with thiol containing enzymes including cysteine proteases and alcohol dehydrogenases <sup>(17, 18)</sup>.

The effect of de-ionized water and chlorhexidine on the viability counts of *Mutans Streptococci* were tested separately, results showed that there was no significant difference in the counts of bacteria for de-ionized water compared to the control after 24 hour, this could be explained by the complete resistant of these bacteria to de-ionized water, where as chlorhexidine showed highly significant reduction in the counts of bacteria in comparison to the control after 24 hour and garlic extracts. It is well known that chlorhexidine is a potent antibacterial agent particularly against *Mutans Streptococci* <sup>(19, 20)</sup>.

**Table1: Statistical Test between Chlorhexidine and Concentrations of Water Garlic Extract.**

Concentration of Garlic Water Extract	t-test	P-Value	Description
5%	-	-	-
10%	24.42	0.000	HS
15%	21.08	0.000	HS
20%	18.58	0.000	HS
25%	20.01	0.000	HS
30%	18.22	0.000	HS
35%	16.98	0.000	HS
40%	14.03	0.000	HS
45%	8.00	0.000	HS
50%	7.28	0.000	HS

**Table 2: Statistical Test between Chlorhexidine and Concentration of Ethanol Garlic Extract.**

Concentration of Garlic Ethanol Extract	t-test	P-Value	Description
5%	24.36	0.000	HS
10%	13.40	0.000	HS
15%	8.68	0.000	HS

Concentration of Garlic Ethanol Extract	t-test	P-Value	Description
20%	3.38	0.003	S
25%	1.58	0.133	NS
30%	0.70	0.494	NS
35%	4.91	0.000	HS
40%	5.52	0.000	HS
45%	8.91	0.000	HS
50%	10.68	0.000	HS

Considering *in vitro* data obtained in the present garlic extract has been shown to be effective against Streptococci and *Mutans Streptococci*. Further studies are needed regarding the effect of garlic extracts on other cariogenic determinants of *Mutans Streptococci* such as adherence and ability to form extracellular polysaccharide, also future studies are needed concerning the effect of garlic extracts on other types of cariogenic bacteria as lactobacilli and Actinomyces.

The effectiveness of water garlic extract (10%) on salivary Streptococci and *Mutans Streptococci* was tested among a group of volunteers, in comparison to chlorhexidine gluconate and de-ionized water. A slight reduction in the counts of Streptococci recorded for garlic extract, while a sharp reduction in *mutans streptococcal* counts was noticed, this was in

coincidence with Groppo *et al* <sup>(21)</sup> who showed that garlic mouth rinse had antimicrobial activity against *Mutans Streptococci*, but not against other oral microorganisms, this may give an indication for specificity of garlic extract on *Mutans Streptococci*. The presence of resistant strains of oral Streptococci to this agent probably might explain its ineffectiveness against Streptococcal bacteria. The result of the present study showed the effectiveness of garlic especially against *Mutans Streptococci*, although it was less than chlorhexidine gluconate, but it can be use as effective anti caries agent, however, many problems should be solved before such strategy can be accomplished which associated with reducing the strong odor of garlic and eliminating of burning sensation that could occur during or following rinsing.

**Table 3: Statistical Test between Different Concentration of Garlic Extracts (Water, Ethanol), Chlorhexidine, and De-ionized Water in Comparison with the Counts of *Mutans Streptococci* after 24 hour.**

Agents	Count of bacteria after 24 hr. $\times 10^3$		Description
Water garlic extract 5%	0.113	0.913	NS
Water garlic extract 10%	2.355	0.046	S
Water garlic extract 15%	3.927	0.004	S
Ethanol garlic extract 5%	2.304	0.05	NS
Ethanol garlic extract 10%	4.047	0.004	S
Ethanol garlic extract 15%	5.293	0.001	S
Chlorhexidine 0.2%	19.45	0.000	HS
De-ionized water	0.257	0.804	NS

**Table 4: Values of Standard Deviation of Mean Count Streptococci by Time Points.**

Time	Garlic water extract	CHX	DW
	SD	SD	SD
Baseline	45.806	76.033	83.250
One min.	72.644	76.904	85.854
30 min.	77.017	67.036	77.787



Time	Garlic water extract	CHX	DW
	SD	SD	SD
One hr.	91.821	59.642	91.934
Two hr.	56.266	64.272	106.432

Table 5: Values of Standard Deviation of Mean Counts *Mutans Streptococci* by Time Points.

Time	Garlic water extract	CHX	DW
	SD	SD	SD
Baseline	71.306	54.302	72.496
One min.	65.879	79.792	55.029
30 min.	54.160	47.744	82.250
One hr.	56.337	16.363	87.113
Two hr.	85.490	46.908	87.618

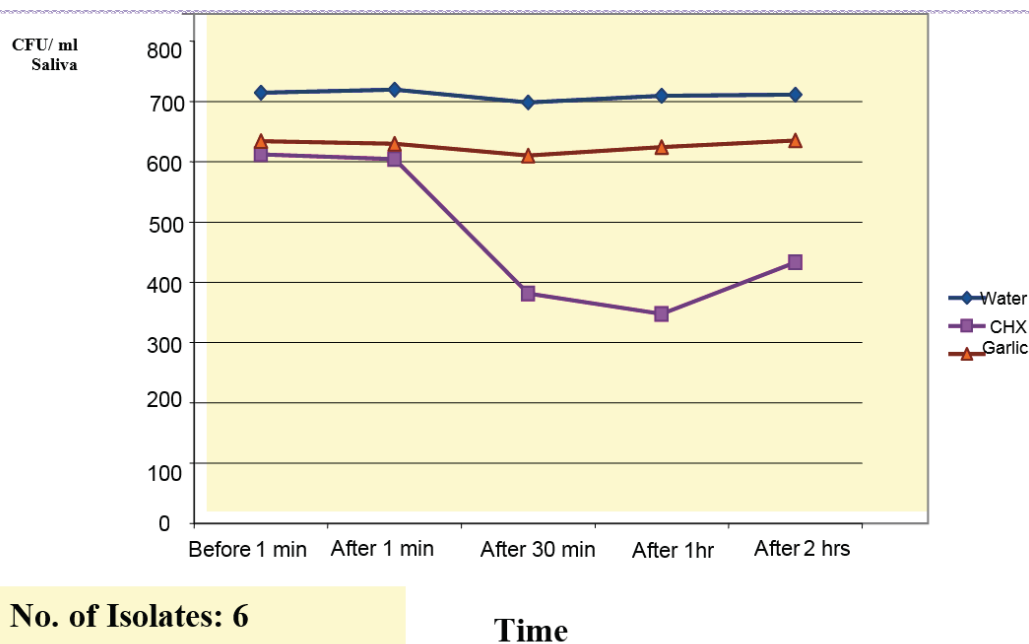


Figure 1: Mean Counts of Salivary Streptococci  $\times 10^3$  of Volunteers Before and After Rinsing With 10% Garlic Water Extract, Chlorhexidine Gluconate, and De-ionized Water at Different Time Points.

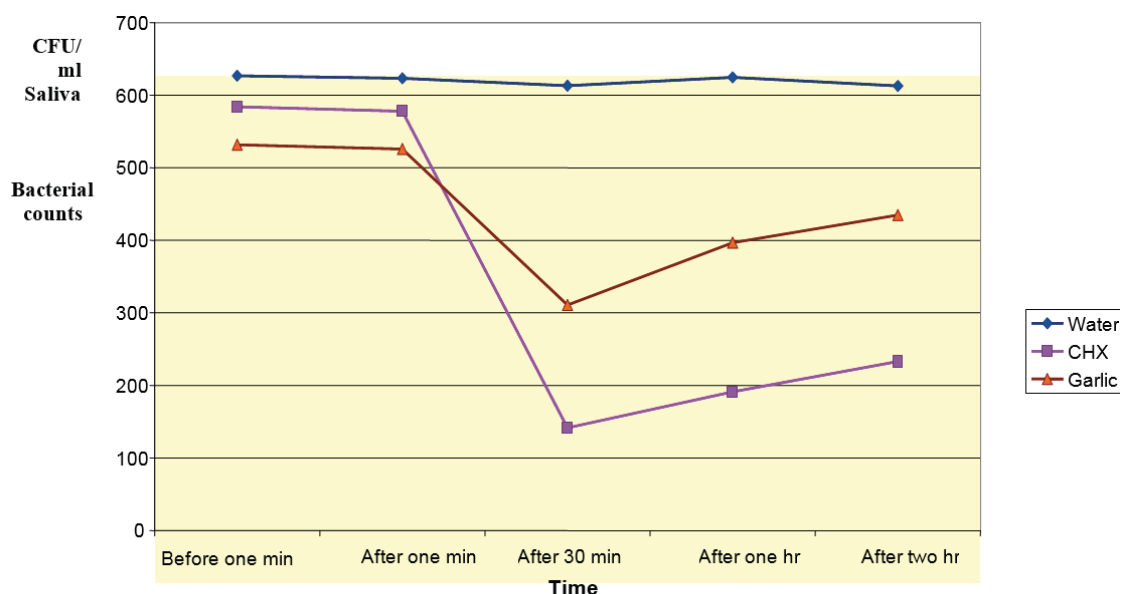


Figure 2: Mean Counts of Salivary *Mutans Streptococci*  $\times 10^3$  of Volunteers Before and After Rinsing With Garlic Water Extract, Chlorhexidine Gluconate, and Deionized Water at Different Time Points.

## REFERENCES

1. Moynihan P, Petersen P. Diet, nutrition and prevention of dental diseases. Public health nutrition 2004; 7:201-26.
2. Weyant R. Seven systematic reviews confirm topical fluoride therapy is effective in preventing dental caries. J Evid Dent Base Pract 2004; 3:129-135.
3. Palmer C, Wolfe SH. Position of the American Dietetic Association: the impact of fluoride on health. J Am Diet Assoc 2006; 105:1620-1628.
4. El-Samarrai S, Al-Deen and Al-Azawi L. Comparative effects of Siwak and tooth-brush on plaque index and gingival index among groups of dental students. Iraq Dent J 1997; 19: 169-181.
5. Al-Nidawi A. Effect of Siwak extracts on *Mutans Streptococci*, in comparison to selected antimicrobial agents (*in vitro* and *in vivo* study). M.Sc.Thesis, College of Dentistry, University of Baghdad, 2004.
6. Al-Izzy M. Antibacterial effects of black and green tea extract on *Mutans Streptococci* and *Lactobacilli* (*in vitro* and *in vivo* study). M.Sc. Thesis, College of Dentistry, University of Baghdad, 2005.
7. Al-Anburi D. Effect of Myrtus communis extracts on *Mutans Streptococci* (*in vitro* and *in vivo* study). M.Sc. Thesis, College of Dentistry, University of Baghdad, 2006.
8. Bakri I and Douglas C. Inhibitory effect of garlic extract on oral bacteria. Archives of Oral Biology 2005; 50: 645-651.
9. Groppo F, Ramacciato J, Motta R, Ferraresi P, Sartoratto A. Antimicrobial activity of garlic against oral streptococci. Int J Dent Hyg 2007;5(2):109-15.
10. Tsao S, Hsu C, Yin M. Garlic extract and two diallyl sulphides inhibit methicillin-resistant *Staphylococcus aureus* infection in BALB/Ca mice. J of Antimicrobial Chemotherapy 2003; 52: 974-980.
11. Onyeagba R, Ugbogu O, Okeke C, Iroakasi O. Studies on the antimicrobial effects of garlic (*Allium sativum* Linn.), ginger (*Zingiber officinale* Roscoe) and lime (*Citrus aurantifolia* Linn). J of African Biotechnology 2004; 3(10): 552-554.
12. Holbrook W and Beighton D. Streptococcus mutans levels in saliva and distribution of serotypes among 9-year-old Icelandic children. J of Scan Dent Res 1986; 95: 37-42.
13. Jenkins S, Addy M, Wade W, Newcombe R. The magnitude and duration of the effects of some mouth rinse products on salivary bacterial counts. J Clin Periodontol 1994; 21: 397-401.
14. Thylstrup A and Fejerskov O. Text book of cariology 1<sup>st</sup> ed. Munksgaard, Copenhagen, 1996.
15. Amagase H, Petesch B L, Matsuura H, Kasuga S, Itakura Y. Intake of garlic and its bioactive components. J Nutrition 2001; 131:955S-962S.
16. Grönroos L, Mättö J, Luoma A R and Alaluusua S. Chlorhexidine susceptibility of mutans streptococcal serotypes and ribotypes. Antimicrobial agents and chemotherapy 1995; 39(4): 894-898.
17. Ankri S, Miron T, Rabinkov A, Wilechek M, Mirelman D. Allicin from garlic strongly inhibits cysteine proteinases and cytopathic effects of *Entamoeba histolytica*. Antimicrob Agents Chemother 1997; 41:2286-8.
18. Bachrach G, Jamil A, Naor R, Tal G, Ludmer Z, Steinberg D. Garlic Allicin as a Potential Agent for Controlling Oral Pathogens. J Med Food. 2011; 6.
19. Emilson C. Potential efficacy of chlorhexidine against *Mutans Streptococci* and human dental caries. J Dent Res 1994; 73(3): 682-691.
20. Kulkarni V, Damle S G. Comparative evaluation of efficacy of sodium fluoride, chlorhexidine and triclosan mouth rinses in reducing the *Mutans Streptococci* count in saliva: an *in vivo* study. J Indian Soc Pedo Prev Dent 2003; 21 (30): 98-104.
21. Groppo F C, Ramacciato J C, Simoes R P, Florio F M, Sartoratto A. Antimicrobial activity of garlic, tea tree oil, and chlorhexidine against oral microorganisms. J Int Dent 2002; 52(6): 433-7.

# Oral Factors Predisposing To Injury Of Permanent Incisors In School Children In Al-Ramadi City

Lamia I.S AL-dulayme

B.D.S :M.Sc pedodontic Lecturer, department of POP, college of dentistry, AL-Anbar University,

## Abstract

Dental trauma is a serious public problem causing psychology, aesthetic, social and therapeutic problems and its irreversible pathology that after occurrence is characterized by life-long debilitating effects.

This study aimed to investigate the oral risk factors for injury to maxillary permanent incisors among Al-Ramadi schoolchildren aged 6-13 years, the result clarified frequency of traumatically injured teeth increase in class II division I, lip incompetent with increase over jet and overbite value more than 4mm but only the over jet more than 4mm and lip incompetent reach the level of significant ( $p < 0.01$ )

Thus, special preventive program and correction of predisposing risk factors should be carried out in early mixed dentation

**Key words:** Traumatic teeth, occlusion, overbite, over jet, lip position

## INTRODUCTION

One of the greatest assets a person can have is a "smile" that shows beautiful, natural teeth. An untreated and unsightly fracture of an anterior tooth can affect the behavior of a child, his progress in school, and can have more impact on their daily living.<sup>(1)</sup> Traumatic dental injury has become the most serious dental public health problem in children since a remarkable decline in the prevalence and severity of dental caries in many countries.<sup>(2)</sup>

Nearly all studies that conducted around the world concerning traumatic dental injury showing that boys more affected by incisor trauma than girls.<sup>(3)</sup>

While other studies demonstrated that there were non-significant difference in prevalence of traumatic injuries with gender.<sup>(4)</sup>

On other hand, some studies found that there was significant difference in the prevalence of traumatic dental injury with class II division 1 malocclusion<sup>(5)</sup>, and also found higher prevalence traumatic dental injury in relation to increase over jet more than 4 mm<sup>(6)</sup> while other found no relation.<sup>(3)</sup>

Further more the prevalence of traumatic dental injury was highly greater in subjects with over bite more than 4mm compared with normal.<sup>(7)</sup>

Lip position has been previously studied by many authors some authors showed that children with inadequate lip coverage were at greater risk to trauma,<sup>(5, 8)</sup> while other found no relation<sup>(3)</sup>

In Al-Anbar, there is only one published literature is available on the prevalence of traumatic injuries to anterior teeth in mixed dentition period<sup>(9)</sup>. Hence, this study was carried to determine the predisposing risk factors of fractured anterior teeth among 6-13 years school children of Al-Ramadi city.

## MATERIAL AND METHOD

Clinical oral examination were carried out in a chair with a tall back and examination were conducted under an artificial light, standardization was made

according to (WHO, 1997)<sup>(10)</sup>

A study involving 1830 students between the age (6-13) years old were participated in the study, after clinical examination, 310 student had sustained traumatic crown fracture for their maxillary permanent incisor, 180 (58.07) were boy, 130 (41.93) were girls. All students with chronic disease or permanent body deforming or non traumatic dental injuries or student with restored anterior teeth whom the causes of restoration was not due to traumatic fracture of the tooth were excluded from the sample.

Visual and tactile examination were performed, root fracture were not recorded, as routine dental per apical radiographs were not taken due to technical difficulties

Type of occlusion (incisal relation ship) was recorded according to British standard classification<sup>(11)</sup>

A tooth to lip relation ship assumed by Daskalogiannakis 2000 was followed in the current study<sup>(12)</sup>, while the maxillary anterior over jet was assessed practically definition by mcgivery and gastleberry 994, Mckee, 1997<sup>(11, 12)</sup>

Recording of the over bite value was according to the definition by Smith and Bailit 1979<sup>(13)</sup> and Drakers direct method of measuring overbite value had been used in the current study<sup>(14)</sup>

Data analysis included descriptive statistics (frequency distribution, statistical tables)

Statistical significance for the association between the occurrence of crown fracture and gender, age and other variables was carried out by using t-Test for paired observation, Z-test between two proportions.

For the previous tests -p- level more than 0.05 was considered as not significant, p-values equal to or less than 0.05 and less than 0.01 were regarded as significant,

## RESULT

The level of traumatic injuries in boys (58.07%) was significantly higher than girls (41.93%) ( $P=0.02$ ). The difference in the prevalence of coronal fracture between boys (7.8%) and girls (7.5%)

**Table (1) The distribution of children with traumatized teeth by gender**

<i>Gender</i>	<i>Total NO %</i>		<i>Prevalence (%)</i>
<b>Boys</b>	180	58.07	7.8 *
<b>Girls</b>	130	41.93	7.5
<b>Total sample</b>	310		15.3 Z=21.5*

\* Significant  $p < 0.05$

The distribution of children with traumatized teeth in relation to the type incisal relation ship showed that class II division I malocclusion (protrusion) was more prominent (84.4%) in boy than girl (61.5). For

total sample, children with class II division I malocclusion were more common than children with other class incisal relation ship. As show in table (2)

**Table (2) The Distribution of children with traumatized teeth in relation to type of occlusion (incisal relation ship)**

<i>Gender</i>	<i>Class I occlusion NO %</i>		<i>Class II Division I NO %</i>		<i>Class II Division 2 NO %</i>		<i>Class III mal occlusion NO %</i>		<i>Total</i>	<i>Sig</i>
Boys	18	10	152	84.4	7	3.88	3	0.1.66	180	NS
Girls	40	30.76	80	61.5	10	7.69	0	0	130	
Total sample	50	18.7	232	74.8	17	5.48	3	0.96	310	

Table (3), the result referred that short upper lip (in adequate lip coverage) occupied higher percentage among boys (55.55%) than boys of adequate lip coverage (44.44%).statistically reach the level of

Significant .For the total sample, in adequate upper lip coverage was the commonest among the subjects (55.17%) than adequate upper lip coverage but statistically not reach the level of significant.

**Table (3) The Distribution of children according to lip position**

<i>Gender</i>	<i>Inadequate lip position NO %</i>		<i>Adequate lip position NO %</i>		<i>Total</i>	<i>Sig.</i>
Boys	100	55.55	80	44.44	180 *	
Girls	17	54.61	59	45.38	130	
Total sample	171	55.17	139	44.83	310	

\* Significant  $p < 0.05$

For the total sample in table (4), children with an over jet value more than 4mm, recorded high percentage of traumatized teeth increased to (52.9%) while the least prevalent group was recorded among those with zero mm over jet (edge to edge) had which reg-

istered only (5.80%) .Statistically a significant difference was recorded between both genders

The result revealed that an overbite value more than 4mm registered higher percentage (48.7%) com-



pared with zero mm overbite (4.19%), statically no difference was found between boys and girls

**Table (4) The Distribution of children with traumatized teeth according to over jet and overbite**

Gender	over jet									
	Zero mm		<2mm		2-4mm		>4mm		Total sig.	
	NO	%	NO	%	NO	%	NO	%		
Boys	13	7.22	21	11,66	44	24.4	102	56.4	180 *	
Girls	5	3.84	16	12.3	47	36.15	62	97.69	130	
Total sample	18	5.80	37	11.93	91	29.35	164	52.9	310	
Overbite										
Boys	5	2.77	45	25	40	19.130	100	55.55	180	NS
Girls	8	6.15	23	17.69	48	36.92	51	39.23	130	
Total sample	13	4.19	68	21.93	88	28.38	151	48.7	310	

\* Significant  $p < 0.01$  , NS Non significant  $P > 0.05$

## DISCUSSION

Traumatic dental injury is not a result of disease but a consequence of several factors that will accumulate throughout life if not properly treated.<sup>(15)</sup>

finding that boys (58.07%) experienced dental trauma more frequently than the girls (41.93%), agrees with other similar studies from across the world.<sup>(16,3)</sup> The relatively low prevalence of trauma in girls can be explained by the fact that girls are generally more mature in their behavior than boys, who tend to be energetic and inclined toward vigorous outdoor activities.<sup>(16)</sup> Vandas and papagianoulis pointed out higher level of epinephrine, dopamine and emotional stress in boys<sup>(17)</sup>

The prevalence of traumatized teeth was found to be high percentage with class II mal-occlusion particular division I compared to class I occlusion, this was in line with AL-Kassab and Kania *et al*<sup>(5,18)</sup>.

Result may be explained by the fact that in case of normal occlusion the energy of trauma is decreased by the larger contact area, the incisal contact of upper and lower teeth and the protecting effect of the lip closure, while in case with class II mal occlusion, the lack of incisal contact, or the location of this contact in the cervical part of the upper incisor or the uncompleted lip closure all these increase the risk of being traumatized in children with class II mal occlusion<sup>(5, 18)</sup>.

The significant difference between the adequate and inadequate lip position (55.17%, 44.83%) respec-

tively because inadequate lip coverage may provide less protection to mal occlusion incisor and thus easily contribute to the increased risk of coronal fracture and mostly when there is incompetent lips there is proclaine anterior teeth<sup>8</sup>, and this was in line with AL-Kassab and Celehk *et al*.<sup>(5,19)</sup>

An over jet more than 4mm was more obvious crown fracture in children than other rang values of the total sample, this finding corroborated other studies that found children with increased over jet were more likely to have dental injuries than other children<sup>(6)</sup>, but disagreed with Marcenes *et al*<sup>(20)</sup>. and this finding can explained by the prominent position of incisor teeth and lack of contact between these teeth with corresponding of lower jaw and presence of short upper lip, all these can robust the over jet to be principle modifiable risk factor for maxillary incisor trauma.<sup>(21)</sup>

Prominent association was found between increased over bite more than 4mm and coronal fracture. This was in accordance with previous finding like Shuluman and Peterson<sup>(7)</sup>. Overtly as the deep bite may usually be association with class II malocclusion<sup>(22)</sup>, so the high prevalence of coronal fractures may be confined to this type of malocclusion rather than increased overbite.

The present study observe the children in mixed dentition period as the population at risk. Hence, prevention through health promotion and correction of predisposing risk factors should be carried out in early mixed dentition period to reduce the prevalence of

dental injury and to avoid the financial costs of treatment. An effort can be made to reduce the prevalence of traumatic injuries by taking into consideration the following measures.

- The use of intraoral and extraoral devices which protects the face and teeth from trauma.
- Elimination or reduction of predisposing factors in the form of orthodontic treatment.
- Educational programs where by the children and their parents are given information regarding the preventive and treatment aspects of this commonly occurring condition.

## REFERENCES

1. Cortes MIS , Marcenes W, Sheiham A. Impact of traumatic injuries to the permanent teeth on the oral health-related quality of life in 12-14-year old children. *Community Dent Oral Epidemiol* 2002;30:193-8.
2. Petersson HG, Bratthall D. The caries decline: A review of reviews. *Eur J Oral Sci* 1996;104:436-43.
3. Shirin Al-Asmar Karlsson: Overjet and incisor position as predisposing factors for dental trauma Aretrospective study in orthodontically Treated children. 2006. Master of Medical Science in Stockholm
4. Adekoya Sofowora, Comfort A; desina, Olufemi A.; Nasir, Waked Olabamiji Oginni, Adeleke Oke; Ugboko, Vincent I : Prevalence and causes of fractured permanent incisors in 12 year-old suburban Nigerian school children : *Dental Traumatology*, 2009. Volume 25, Number 3, , pp. 314-317(4): Blackwell Publishing
5. Agharred G AL-Kassab: Evaluation of primary schools students with traumatized anterior permanent incisor in relation to different variables in mosul city. Master thesis submitted to college of dentistry, 2005, University of Baghdad
6. Harry R., and Sandy J. Orthodontic .Part I: Who needs Orthodontics. *J* .; 2003, 195(8) :433-438.
7. Shulman-JD .And Peterson J. : The association between incisor trauma and occlusal characteristics in individual's 8-50 years of age .*Dent. Traumatol.* 2004. 20(2):67-72
8. Cortes MI., Marcenes W., Sheiham A: Prevalence and correlates of traumatic injuries to the permanent teeth of school children aged 9-14 years in Belo Horizonte ,Brazil. *Endod. Dent. Traumatol.*; 2001, 17:22- 26
9. Soud L. I., Abdul Jabbar M.R ,Ahamed N.R : (Evaluation of primary schools students with traumatized anterior permanent incisor teeth in al-amadi city/iraq. *Egyptian dental journal*, 2010, vol. 56, number 2(part 111) :935-938 10-World
10. Health Organization (WHO): Oral health surveys .Basic method .4<sup>th</sup> .Geneva, 1997.
11. Mills J.R: Principle and practice of orthodontics, Churchill living stone Company . 1987, 2<sup>nd</sup> ed ., Ch.1 , PP18-32.
12. Daskalogiannakis J. Glossary of orthodontic terms .text book .Berlin : Quintessence Publishing CO., Inc .2000.; pp 212-213, 267.
13. McGiverny P., Castleberry D.: McCracken removable partial denture ,U. S.A., 1994. 8 th ed., Ch. 1 'pp 5-45.
14. McKee JR. : Comparing condylar position repeatability for standardized versus non standardized methods of achieving centric relation .*J. of Prosthetic .Dent.* 1997. 77(3):280-287.
15. Soriano EP, Caldos Jr AF, Carvalloh MV, Amorium Filho HA. Prevalence and risk factors related to traumatic dental injuries in Brazilian school children. *Dent Traumatol* 2007;23:232-40
16. Cortes MIS , Marcenes W, Sheiham A. Impact of traumatic injuries to the permanent teeth on the oral health-related quality of life in 12-14-year old children. *Community Dent Oral Epidemiol* 2002;30:193-8. ↑
17. Vanderas AP. and Papagianuolis L. : Incidence of dento-facial injurie in children: a2-year longitudinal study .*End .Dent. Traumatol.* 1999;15:235- 238
18. Kania MJ., Keeling SD., McGorray SP., Wheeler TT., King GJ: Risk factors associated with incisor injury in elementary school children .*Angle Orthod.* ; 1996. 66(6)423 -432
19. Celenk S., Sezging B., Ayna B., Atakul F: Causes of dental fracture in the early permanent dentition : a retrospective study. *J. Endod.* 2002. 28 (3):208-210.
20. Marcenes W., AL-essi ON., Traebbet J: Causes and prevalence of traumatic injuries to the permanent Incisors of school children aged 12 years in jaragua dosul ,Brazil .*Int. Dent. J.* ; 2000, 50:87-92
21. O Mullane D.M. some factors predisposing to injury of permanent incisors in school children. *Br dent j*: 1973; 134:328-32
22. Jarvinen S : Incisal over jet and traumatic injuries to upper permanent incisors-A retrospective study .*Acta Odontol Scand.* 1978;36(6)359-362

# The Role of Local Injection of Tnf- $\alpha$ Antagonist on Orthodontic Tooth Movement in Rabbits

**Anees M. Mudhir**

BDS and M.Sc in orthodontic science - School of dentistry/faculty of medical science/department of POP

**Rafah H. Al-Marroof**

B.D.S., M.Sc., PhD. Oral histology - Assist. Prof. - Oral diagnosis depart., college of dentistry, Hawler medical university

**Fadhil Y. Jasim**

B.D.S., C.E.S., D.S.O. Orthod. - Assist. Prof. - Ortho. depart. college of dentistry, Hawler medical university

## ABSTRACT

**INTRODUCTION** Orthodontic tooth movement supposed to be mediated by several host mediators such as interleukin-1 and tumor necrosis factor- $\alpha$ . The **aim** of this study was to investigate the effect of infliximab (tumor necrosis factor- $\alpha$  antagonist) local injection on orthodontic tooth movement.

**Methods:** orthodontic appliance was placed on the upper central incisors of 22 adult male local bred rabbits for 18 days to create a space between the two central incisors. The rabbits were divided into two equal groups, the experimental group received 5mg/kg subperiosteal injection of tumor necrosis factor-alpha antagonist (infliximab) in the labial side of the upper central incisor in three time intervals (0,7,13 days) of the study period. The control group received equivalent volume of normal saline in the same location as in experimental group. Clinical measurement of the space between the central incisors were done in (5, 9, 13, 18) days.

**RESULTS** There was a significantly smaller rate of tooth movement in experimental group than control group represented by smaller spaces created.

**Conclusions:** local injection of infliximab decreases the movement of the tooth during orthodontic treatment.

**Keywords:** infliximab, TNF- $\alpha$ , Orthodontics, tooth movement

## INTRODUCTION

The purpose of orthodontic treatment is to move teeth as efficiently as possible with minimal adverse effects for the teeth and supporting tissue. During orthodontic tooth movement, bone resorption can be initiated at the periodontal surface of the alveolar bone.<sup>(1)</sup>

Many attempts have been done to decrease bone resorption during orthodontic treatment using different systemic and local application of medications and the intake of dietary supplements, such as minerals<sup>(2)</sup>, hormones<sup>(3)</sup>, proteins<sup>(4)</sup> and immunomodulators<sup>(5)</sup>. Gamberio *et al* 2008<sup>(6)</sup> used celecoxib, a nonsteroidal anti-inflammatory drug (NSAID), as an intra pre-torial injection (10 mg/kg) in wistar rats with orthodontic moved teeth. The amount of tooth movement was significantly reduced in rats submitted to short and long term celecoxib administration. Decreased tooth movement was also recorded by Liu *et al* 2004<sup>(7)</sup> after local injection of Clodronate solution in subperiosteal area adjacent to the upper molar of rats in a dose of 2.5, 10 and 40 mM. The same results was obtained by Venkataramana *et al* 2012<sup>(8)</sup> when they examined the influence of local administration of bisphosphonate (pamidronate) as an anti-resorptive drug, and by Seifi *et al* 2004<sup>(9)</sup> who studied the effect of Aspirin (NSAIDs) 100 mg/kg in one dose per day on the rate of orthodontic tooth movement in albino Newzealand rabbits. When the orthodontic appliance was inserted between 1st molar and incisors of the mandible, there was a significant decrease in the rate of tooth movement. Diclofenac have been shown to inhibit ortho-

dontic tooth movement totally in a wistar male rat (10 mg/kg at days 1 and 3), in which mesial tipping of the first molars by coil spring was induced by a force of 50 and 100 cN.<sup>(10)</sup>

The orthodontic loading leads to a focal tissue injury and consequently, an aseptic inflammatory response characterised by the release of several important inflammatory mediators on periodontal tissues such as the cytokine.<sup>(11)</sup>

Tumor necrosis factor-alpha (TNF- $\alpha$ ) is a potent immunomediator and proinflammatory cytokine that is rapidly upregulated in the brain after injury and secreted by macrophage, monocyte, and neutrophile<sup>(12)</sup>. Tumor necrosis factor-alpha functions as a pro-inflammatory mediator contributing to the development of such diseases as rheumatoid arthritis<sup>(13)</sup>, multiple sclerosis<sup>(14)</sup> and periodontitis<sup>(15)</sup>.

The pro-inflammatory cytokines, including TNF- $\alpha$ , are thought to play a role in bone remodeling and osteoclast differentiation. In rats and in humans, TNF- $\alpha$  modifying processes directly associated with tooth movement, and it may also induce mediators of the inflammatory process, which will then influence osteoclast recruitment and function. Thus orthodontic tooth movement increases the levels of TNF- $\alpha$  in the periodontal tissues<sup>(16)</sup>

Bletsa *et al* 2006<sup>(17)</sup> showed that increased expression of IL-1  $\alpha$  and TNF- $\alpha$  occurred as early as one day after mechanical force application at both compression and tension areas.

Tooth movement experiments in rats showed that

excessive orthodontic force induced the expression of TNF- $\alpha$  in periodontal tissues. In addition, orthodontic tooth movement increases the levels of TNF- $\alpha$  in the gingival sulcus in humans, suggesting an important role for TNF- $\alpha$  in orthodontic tooth movement.<sup>(18)</sup>

TNF- $\alpha$  antagonists block TNF- $\alpha$  released by activated monocytes, macrophages, and T-lymphocytes, which are essential for inflammatory responses following force application<sup>(19)</sup>.

One type of TNF- $\alpha$  antagonists is Infliximab and its use has now expanded to inflammatory bowel disease, ankylosing spondylitis, plaque psoriasis, rheumatoid arthritis, and Crohn's Disease<sup>(20)</sup>.

A study was done on *Macaca fascicularis* monkey by Assuma *et al* 1998<sup>(21)</sup> with induced periodontitis and alveolar bone loss through tying porphyromonas gingivalis-soaked suture ligatures around the posterior mandibular teeth. The animals received local injection of soluble receptors to IL-1 and TNF to sites of induced periodontal destruction three times each week for 6 week. The results indicate inhibition of the inflammatory cells in close proximity to bone by approximately 80% and the formation of osteoclasts was reduced by 67% at the experimental sites compared with that at the control sites, and the amount of bone loss was reduced by 60%.

In an attempt to decrease the proinflammatory effect of TNF- $\alpha$  on orthodontic tooth movement, this study was done to investigate the role of local inflix-

imab (TNF- $\alpha$  antagonist) injection on orthodontically moved teeth in rabbits.

## METHOD

This study used 22 male local bred rabbits weighing 1.5-2 kg. At the beginning of the experiment, all rabbits were kept under standardized laboratory conditions of light-and-dark schedule and relative humidity for 7days, fed ad libitum with commercial pellets and water from thick-walled glass dishes. At day of orthodontic appliance insertion, the rabbits were anaesthetized by intramuscular injections of xylazine 2%(4mg/kg B.W.)and Ketamine hydrochloride (40mg/kg B.W)mixture <sup>(22)</sup> , and orthodontic appliances were placed for all rabbits for 18 days. The orthodontic appliance consisted of two mini buccal tubes bonded to the labial surface of the upper central incisors vertically positioned parallel to long axis of the incisors in the cervical third of clinical crown. L-shaped wire consist of 2 pieces of 0.017\*0.025 inch stainless steel wires, was inserted in the both tubes . The force was applied by light strength nickel-titanium open coil spring which was fitted over the two horizontal wires sections between the two upper central incisors(fig.1 and 2). The force level after activation was approximately 35gm measured using Bolye gauge. This force resulted in distal movement of each upper central incisors gaining median space between the two central incisors.

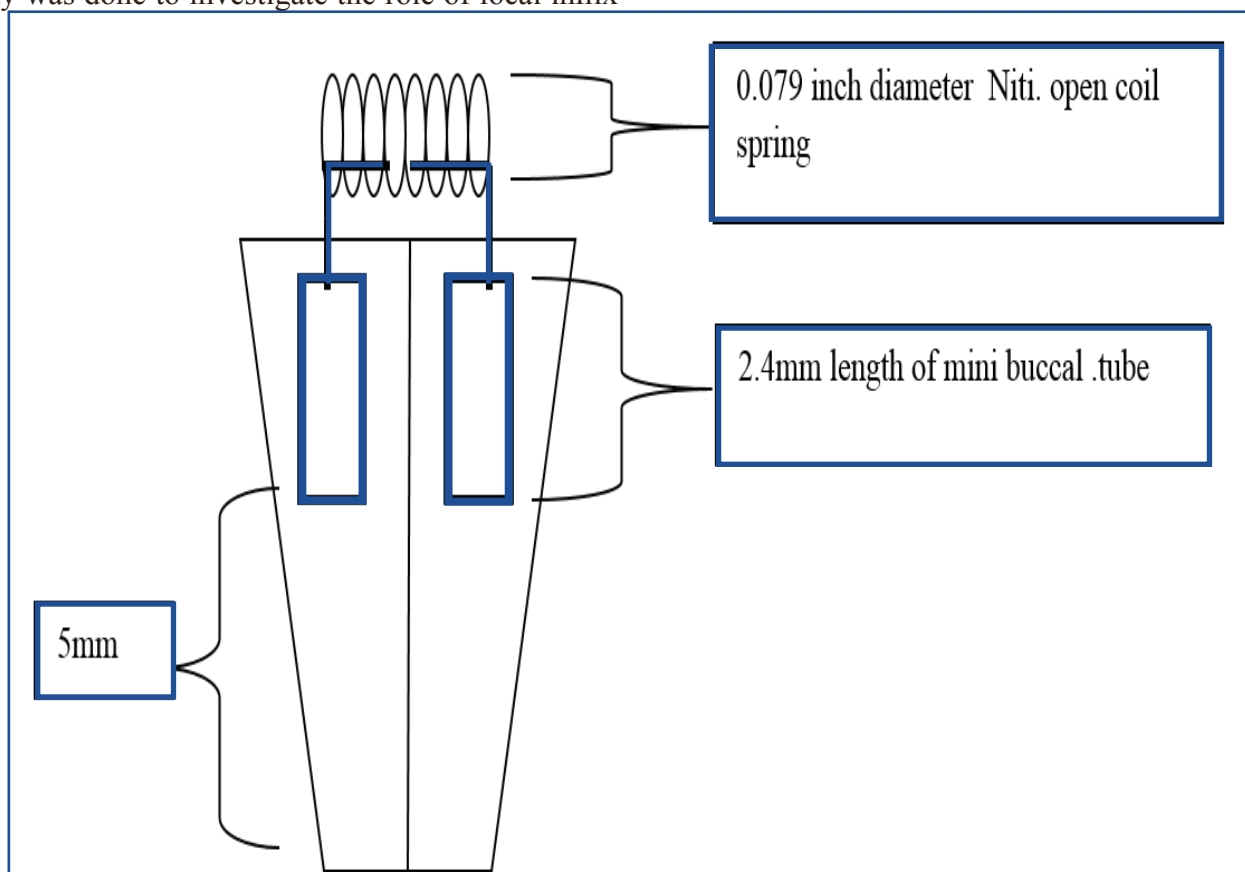


Figure 1: diagram showing the orthodontic appliance used in the study



The rabbits were divided equally into 2 groups (11 rabbit for each): an experimental group which received subperiosteal injection of 0.1 ml of TNF- $\alpha$  antagonist (infiximab 5 mg/ kg) in the labial side cervically<sup>(23)</sup> (fig.3). The remaining 11 rabbits were considered as control group which received 0.1ml normal saline injection in the same site as experimental group. The local injection of both infiximab and normal saline was given in three different time

intervals (1st, 7th and 13th day) following insertion of the appliance. To quantify and record the amount of tooth movement, four measurements were performed for each rabbit by measuring the distance between the two mid-point of the mesial surface at cervical line of central incisors at (5th, 9th, 13th, 18th day) using digital vernier sensitive to 0.01 mm. This point was chosen in order to stick to a fixed point during measurement.



Figure.2:orthodontic appliance on upper central incisors before activation



Figure 3: infiximab injection site.

statistics: means and standard deviations were calculated for both groups. Unpaired student t-test, showing differences in means of spaces between control group and experimental group at different times. Measurements were in mm, (P value  $\leq 0.05$  was considered statistically significant).

## RESULTS

The insertion of the designed orthodontic appliance resulted in distal movement of the two central incisors with minimum distortion for the gingival tissue and for the appliance in both experimental and control group. (fig.4)



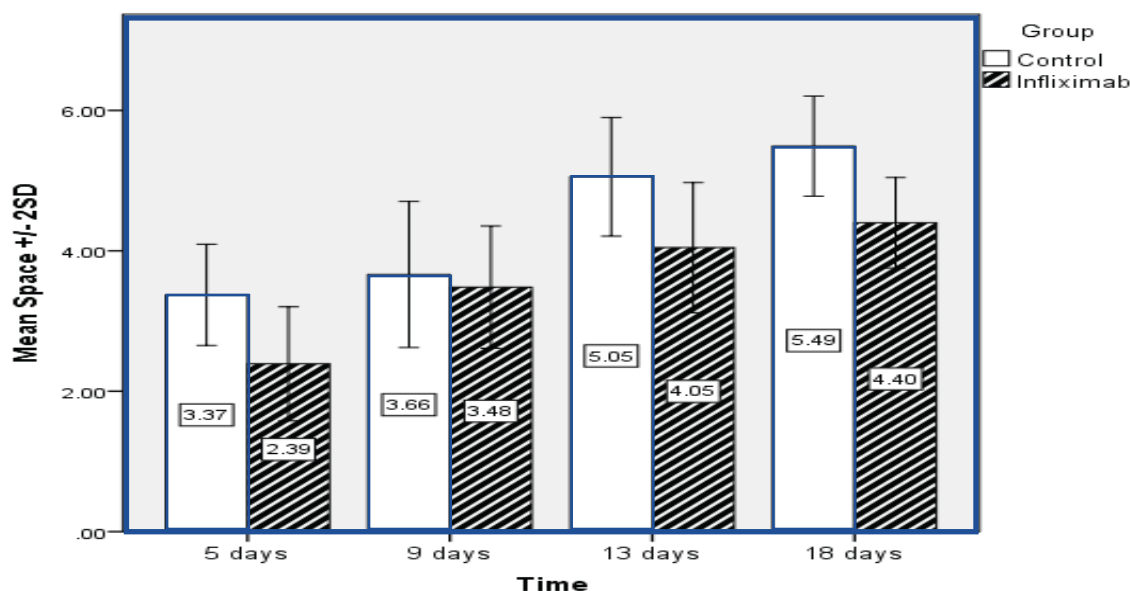
Figure 4:Orthodontic appliance on upper central incisors at the end of the study.

The injection of infiximab in the labial side of experimental group resulted in an obvious differences from the control group which were recorded and

measured clinically. The statistical analysis of the clinical measurement in day(5,13,18) revealed a significant difference between experimental and control

groups ( $P < 0.001$ ). There was highly significant difference in mean of the space between the two groups in day 5, where the mean space was ( $2.391 \pm 0.406$  mm) in experimental group, while in control group it was ( $3.373 \pm 0.361$  mm). On the other hand, there was no significant difference between experimental and control group at day 9, where the mean of space in the experimental group was ( $3.482 \pm 0.435$  ), while

in control group was ( $3.664 \pm 0.520$  ). In day 13, the mean of space was ( $4.046 \pm 0.463$  mm) in experimental (infiximab given) group, while in control group it was ( $5.055 \pm 0.423$  mm). In day 18 the mean space was ( $4.400 \pm 0.322$  mm) in experimental group, while in control group it was ( $5.491 \pm 0.356$  mm). as shown in (figure:5)



**Figure 5: Unpaired student t-test of means and standered deviation( $\pm$ S) of spaces between controls and infiximab(experimental) group.**

## DISCUSSION

Orthodontic tooth movement occurs by the remodeling of alveolar bone as a result of the force that is exerted on the periodontium. In this study, a non-human primate model was used to assess the effect of local administration of TNF- $\alpha$  antagonist (infiximab) on the rate of tooth movement in an attempt to interfere with cytokines which are usually elevated during orthodontic tooth movement<sup>(17)</sup>. Up to our knowledge there is no previous clinical study on the effect of local infiximab injection on orthodontic tooth movement. The results of this study are comparable with those obtained by Andrade *et al*, 2007<sup>(16)</sup> in a nonhuman primate model which use the orthodontic appliance of NiTi coil spring between the maxillary right first molar and the incisors in Wild-type mice (WT) and p55-or TNF-RI deficient mice (p55-/-). The levels of TNF- $\alpha$  and chemokines were evaluated in the periodontal tissues with a significantly smaller rate of tooth movement, and lower number of TRAP-positive osteoclasts in p55-/- mice than that observed in Wild type mice.

The obtained results of this study is similar to the results obtained by Liu *et al* 2004<sup>(7)</sup> who injected Clo-

dronate into the sub-periosteum area adjacent to orthodontically moved tooth. The clodronate injection caused a significant and dose dependent reduction in tooth movement in the rats.

The intramuscular application of certain substances also affect the orthodontic tooth movement. Poosti *et al* 2009<sup>(24)</sup> studied the effect of long-term progesterone administration in 24 prepubertal female albino rabbits for nine weeks after insertion of orthodontic appliance between upper two central incisors for 18 days. A significant decrease in orthodontic tooth movement was recorded.

On the other hand, the finding of this study differ from the finding of the study carried out by Cağlaroğlu and Erdem 2012<sup>(25)</sup> who injected Prostaglandin E2 (10  $\mu$ g/mL) intravenous, submucosal, and intra ligamentous to experimental rabbits with fitted springs in between the maxillary incisors, and the study by Siefi *et al* 2003<sup>(26)</sup> who also studied the effect of submucosal inaction of prostaglandin on maxillary 1st molar movement in rats. Both studies recorded significant increases in orthodontic movement.

The result of the present study demonstrate

that, the local injection of infliximab caused a significant reduction in tooth movement in the day 5, which is considered to be due to the effect of infliximab that block the inflammatory effect of  $\text{TNF-}\alpha$ <sup>(18)</sup>. In accordance with results obtained by Andrade *et al* 2007,<sup>(16)</sup>.

After that the initial movement was followed by a plateau phase (lag period) between day 5 and 9 with no significant difference between experimental and control group. Recent studies demonstrated that tooth movement may be delayed by the development of hyalinized areas and protracted osteoclast recruitment, as in accordance to search of electronic databases as well as hand searching retrieved 70 publications concerning the subject of hyalinization in search strategy from Medline, PubMed, and Embase on rat, mouse, rabbits, dog, and monkey done by Von Böhl and Kuijpers-Jagtman 2009<sup>(28)</sup> who reported that the appearance of hyalinization was recorded after 5 days. A number of explanations have been postulated for the presence of a lag period. Some have suggested that the lag is caused by nonvitalization (hyalinization) of the PDL in areas of maximal stress and that no tooth movement can occur until the area of nonvitalization has been removed by cellular processes. Others believe that the lag period may represent the interval required for absorption of the thicker compact bone of the lamina dura. hence the rate of tooth movement is reduced<sup>(29)</sup>.

After day 9, the tooth movement was re-initiated and increased steadily until day 18 in both control and experimental groups. The movement was significantly reduced in the experimental group than in control group. This result reflected the time accumulation effect of the continuous infliximab injection at day 7th and 13th till the end of orthodontic movement.

When alveolar bone loss is induced, there is a dramatic increase in leukocyte recruitment in close proximity to bone. The presence of blockers to IL-1 and TNF, decrease the recruitment of leukocytes substantially. This suggests that bone loss and periodontal disease is initiated when the inflammatory stimulus spreads to the deep gingival connective tissue, stimulating the recruitment of leukocytes. Thus, blocking  $\text{TNF-}\alpha$  activities may inhibit bone loss both directly and indirectly; the latter occurring via decreased recruitment of mononuclear cells in the area of bone<sup>(21)</sup>.

The decreasing in tooth movement in this study may be related to decrease in bone resorption, since infliximab binds to soluble and membrane-bound  $\text{TNF-}\alpha$  with high affinity, impairing the binding of  $\text{TNF-}\alpha$  to its receptor<sup>(30)</sup>. Another action for infliximab which may play a role in the reduction of the

inflammatory reaction through killing cells that express  $\text{TNF-}\alpha$  through antibody-dependent and complement-dependent cytotoxicity<sup>(31)</sup>.

The clinical result of this study need to be confirmed histologically and ultrastructurally prior to the recommendation of using local infliximab injection as an adjunctive in orthodontic treatment to reduce tooth movement especially in anchorage tooth or to control tooth movement in medically compromised patients.

## REFERENCES

1. Xie R, Kuijpers-Jagtman AM, Maltha JC. Osteoclast differentiation and recruitment during early stages of experimental tooth movement in rats. *Eur J Oral Sci* (2009); 117: 43-50
2. Sabuncuoglu FA and Esenlik E. Influence of drugs on orthodontic tooth movement. *Pakistan oral dent j* (2010); 30: 398-401.
3. Ong CK, Joseph BK, Waters MJ, Symons AL. Growth hormone receptor and IGF-I receptor immunoreactivity during orthodontic tooth movement in the prednisolone-treated Rat. *Angle Orthod* (2001); 71: 486-493.
4. Kim JY, Kim BI, Jue SS, Park JH, Shin JW. Localization of osteopontin and osterix in periodontal tissue during orthodontic tooth movement in rats. *Angle Orthod* (2012); 82: 107-114.
5. Gameiro GH, Pereira-Neto JS, Magnani MB, Nouer DF. The influence of drugs and systemic factors on orthodontic tooth movement. *J Clin Orthod*; (2007) 41: 73-78.
6. Gameiro GH, Nouer DF, Pereira Neto JS, Siqueira VC, Andrade ED, Duarte Novaes P *et al*. Effect of short-and Long-Term Celecoxib on orthodontic tooth movement. *Angle Orthod* (2008); 78: 860-865.
7. Liu L, Igarashi K, Haruyama N, Saeki S, Shinoda H and Mitani H. Effects of local administration of clodronate on orthodontic tooth movement and root resorption in rats. *Eur J Orthod* (2004); 26: 469-473.
8. Venkataramana V, Rajasigamani K, Kurunjikumar N, Chidambaram and Arafath M. The Effect of Bisphosphonate [Pamidronate] On Orthodontic Tooth Movement in Rabbits. *JDMS* (2012); 1: 21-26.
9. Seifi M, Ravadgar M, Eslami B. The effect of Acetaminophen, Aspirin and Ibuprofen on the rate of orthodontic tooth movement and root resorption in rabbits. *Iran Center for Dental Research, Beheshti Univ. Dent. J* (2004); 21: 689-700.



10. **De Carlos F, Cobo J, Diaz-Esnal B, Arguelles J, Vijande M, Costales M.** Orthodontic tooth movement after inhibition of cyclooxygenase-2. *Am J Orthod Dentofacial Orthop*(2006);129: 402-406
11. **Salla JT, Taddei SR, Queiroz-Junior CM, Andrade Junior I, Teixeira MM, Silva TA.** The effect of IL-1receptor antagonist on orthodontic tooth movement in mice. *arch oral biol*(2012); 57: 519- 524.
12. **Van Doornum S, McColl G, Wicks IP.** Tumour necrosis factor antagonists improve disease activity but not arterial stiffness in rheumatoid arthritis. *Rheumatology (Oxford).* (2005); 44:1428–1432.
13. **Feldmann M, Brennan FM, Elliott MJ, Williams RO, Maini RN.** TNF alpha is an effective therapeutic target for rheumatoid arthritis. *Ann N Y Acad Sci* (1995);7:272-8.
14. **Raine CS.** Multiple-Sclerosis - TNF Revisited, with Promise. *Nat Med*( 1995);1:211-214.
15. **Pivodova V, Frankova J, Ulrichova J.** Osteoblast and gingival fibroblast markers in dental implant studies. *Biomed Pap Med Fac Univ, Palacky Olomouc Czech Repub*(2011); 155:109-116.
16. **Andrade I, Jr., Silva TA, Silva GAB, Teixeira AL, Teixeira MM.** The Role of Tumor Necrosis Factor Receptor Type 1 in Orthodontic tooth movement. *J Dent Res*(2007); 86 (11): 1089-1094.
17. **Bletsa A, Berggreen E, Brudvik P.** Interleukin-1  $\alpha$  and tumor necrosis factor-  $\alpha$  expression during the early phases of orthodontic tooth movement in rats. *Eur J Oral Sci*;(2006); 114: 423–429.
18. **Yoshimatsu M, Shibata Y, Kitaoura H, Chang X, Moriishi T, Hashimoto F et al.** Experimental model of tooth movement by orthodontic force in mice and its application to tumor necrosis factor receptor- deficient mice. *J Bone Miner Metab*: (2006)24:20–27.
19. **Diravidamani K, Sivalingam SK, Agarwal V.** Drugs influencing orthodontic tooth movement. *J Pharm Bioallied Sci* (2012); 4: 299-303
20. **Jeffrey W. Molloy, Joel Z. Stengel and Hays L. Arnold.** Infliximab: A Review of its Use in the Treatment of Crohn's Disease. *Clin Med: Therapeutics* (2009);1:1351-1365.
21. **Assuma R, Oates T, Cochran D, Amar S, Graves DT.** IL-1 and TNF antagonists inhibit the inflammatory response and bone loss in experimental periodontitis. *J Immunol.*(1998);160:403-409.
22. **Ibrahim S Rudayna.** Effect of low energy laser irradiation on bone healing around intra osseous titanium implant in experimentally diabetic rabbits(2003). Oral histology and biology PhD thesis. University of Baghdad.
23. **Triantafillidis JK, Papalois AE, Parasi A, Anagnostakis E, Burnazos S, Gikas A et al.** Favorable response to subcutaneous administration of infliximab in rats with experimental colitis. *World J Gastroenterol*(2005); 11: 6843-6847.
24. **Poosti M, Basafa M, Eslami N.** Progesterone effects on experimental tooth movement in rabbits. *J Calif Dent Assoc*(2009); 37:483-486.
25. **Cağlaroğlu M and Erdem A.,** Histopathologic investigation of the effects of prostaglandin E2 administered by different methods on tooth movement and bone metabolism; *Korean J Orthod.* (2012) ;42: 118–128.
26. **Seifi M, Eslami B, Saffar AS.** The effect of prostaglandin E2 and calcium gluconate on orthodontic tooth movement and root resorption in rats. *Eur J Orthod*(2003);25:199-204.
27. **Krishnan V and Davidovitch Z.** Cellular, molecular, and tissue level reactions to orthodontic force. *Am J Orthod Dentofacial Orthop.*(2006); 129:1-32.
28. **Von Böhl M and Kuijpers-Jagtman AM.** Hyalinization during orthodontic tooth movement: a systematic review on tissue reactions . *Eur J Orthod*(2009), 31;30–36
29. **Graber T M, Vanarsdall RL, Katherine WL.** Orthodontics, Current Principles and Techniques. Louis, Missouri, USA: Mosby(2012), 5th Ed; 351.
30. **Olsen NJ, Stein CM.** New Drugs for Rheumatoid Arthritis. *N Engl J Med* (2004);350:2167-2179.
31. **Scallon BJ, Moore MA, Trinh H, Knight DM, Ghrayeb J.** Chimeric anti-TNF-alpha monoclonal antibody cA2 binds recombinant transmembrane TNF-alpha and activates immune effector functions. *Cytokine* (1995);7: 251-259.



# Facial Measurements and Maxillary Anterior Teeth Mesio-Distal Dimensions, Is There A Relationship?

**Haider M. A. Ahmed,**

B.D.S., M.Sc. Assistant Lecturer. Department of Orthodontics. College of Dentistry. University of Baghdad.

**Yasir R. A. Al-Labban**

B.D.S., M.Sc. Lecturer. Department of Orthodontics. College of Dentistry. University of Baghdad.

**Mohammed Nahidh**

B.D.S., M.Sc. Lecturer. Department of Orthodontics. College of Dentistry. University of Baghdad.

## ABSTRACT

**Background:** This study aimed to find out a relation between facial measurements and maxillary anterior teeth mesio-distal dimensions.

**Materials and methods:** Seventy one adult subjects (34 males and 37 females), with Class I skeletal and dental relation, were chosen for this study. The mesio-distal dimensions of the maxillary anterior teeth were measured with digital caliper and certain facial measurements were determined on the subjects' photographs using AutoCAD 2008 software. The relation between facial measurements and maxillary anterior teeth mesio-distal dimensions was assessed for both genders.

**Results and Conclusions:** The results showed that there was a significant genders difference in most of the variables measured (higher in males) and there were weak significant relations between incisors width with the facial height in males and with facial width in females. Other facial measurements showed no correlation with dental measurements. Generally, the faces differ in their shapes and the teeth affected by the genetic factor that plays a role in their dimensions and not always the dental and facial measurements have a relation.

**Key words:** Facial analysis, mesio-distal tooth dimension, anthropometry.

## INTRODUCTION

Clinical facial analysis is the method utilized by physicians for evaluating and judging the patient's face; to define its proportions, volume, appearance, symmetry and visible deformities. It is based on direct examination, clinical photographs, and conventional and computerized x-ray imaging. It is essential for many specialists, such as plastic surgeons, facial plastic surgeons, maxillofacial surgeons, ophthalmic plastic surgeons, otorhinolaryngologists, head and neck surgeons, cosmetic surgeons, orthodontists, rehabilitative dentists, and dermatologists, and, generally, for any physicians dealing with facial aesthetics and functions <sup>(1)</sup>.

Facial proportion was defined as the comparative relation of facial elements in profile <sup>(2)</sup>. The golden proportion has been well known for hundreds, perhaps thousands, of years, but Ricketts <sup>(3,4)</sup> might have been the first orthodontist to apply it to the composition of facial hard and soft tissues. He also used the term "golden sectioning." Applying a divider, the divine proportion is the length of the longer side in 2 linear measurements, at 1.618, and the short side is 1.

Proffit *et al.* <sup>(5)</sup> stated that the vertical facial proportions in the frontal and lateral views are best evaluated in the context of the facial thirds, which the Renaissance artists noted were equal in height in well proportioned faces. In modern Caucasians, the lower facial third often is slightly longer than the central third. The lower third has thirds: the mouth should be one third of the way between the base of the nose and the chin.

Many studies tried to relate the mesio-distal dimension of central incisors or the anterior maxillary teeth to the transverse facial measurements to get benefit in selection of the artificial teeth for complete dentures. They used the inter-canthal, inter-alar, inter-pupillary, inter-zygomatic and mouth width and their findings conflicted about the relation between the mesio-distal dimension of anterior maxillary teeth and these variables <sup>(6-12)</sup>.

In orthodontics, facial esthetic is not concentrated on the teeth or jaws separately, but it involves dental and maxillofacial portions. This study aimed to find out the relation between some transverse and vertical facial measurements and maxillary anterior teeth mesio-distal dimensions.

## MATERIALS AND METHODS

### Sample

The sample included 71 Iraqi Arab subjects (34 males and 37 females). Those subjects were chosen from the undergraduate students of the College of Dentistry, University of Baghdad. All of them had full permanent dentition regardless the wisdom teeth, Class I skeletal and dental relations <sup>(13)</sup> with no history of craniofacial malformation or surgeries.

### Methods

Firstly, the subjects were examined clinically both intra-orally and extra-orally to be sure that they fulfilled the inclusion criteria, then they were subjected to facial photographs and taking dental impression.

**Standardization of the facial photographs**

The digital camera (Sony Cyber Shot H 50, 9.1 Mega pixels, 15 X optical zoom, Sony Corporation, Nagoya, Japan) was fixed in position and adjusted in height to be at the level of subject 'eyes with a height adjustable tripod. The distance from the camera to the subject was fixed at a distance of about 1.01m measured from the tripod's column to the ear rods<sup>(14)</sup> that were fit in the external auditory meatus in order to avoid the forward, backward, and tilting of the subject head (Cephalostat based head position). The subject was asked to look to the center of the lens of the camera during taking the photograph.

**Photographic analysis**

Every frontal facial photograph was analyzed by AutoCAD program 2008. Once the picture was imported to the AutoCAD program, it will appear in the master sheet on which the points were determined then the measurements were obtained. The measurements were divided by scale for each picture to overcome the magnification.

The facial measurements<sup>(15)</sup> included: Inter-canthal distance (ICD), Mouth width (MW), Nasal width (NW), Upper lip vermilion (ULV), Lower lip vermilion (LLV), Inter-zygomatic distance (IZD) and Anterior facial height (N-GN).

**Dental cast production**

Impressions were taken for every subject with Alginate impression material then poured with a prepared amount of stone. After setting of the dental stone, Plaster of Paris was prepared and put in the rubber base mold and the poured cast was inverted over it. After the final setting of the gypsum, the cast was opened from the mold and made ready for the measuring procedure.

**Measurement of the teeth dimensions**

The mesio-distal dimensions of the maxillary anterior teeth were measured according to Hunter and Priest<sup>(16)</sup> method. The anatomic mesial and distal contact areas of each tooth were marked by a fine marker on the dental cast and then the greatest mesio-distal crown width was measured for all the maxillary anterior teeth (from the right to the left canine) by means of an electronic digital caliper (Mitutoyo, Japan, with a sensitivity of 0.01 mm.) held parallel to the occlusal plane.

The sum of the width of the six maxillary anterior teeth was obtained by summation the mesio-distal dimensions of these teeth.

**Statistical analysis**

All the data of the sample were subjected to computerized statistical analyses using SPSS computer program. The statistical analysis includes: descriptive statistics (means and standard deviations) and inferential statistics (independent sample t-test: for the comparison between males and females and Pearson's correlation coefficient (r) to determine the relation between facial measurements and maxillary anterior teeth mesio-distal dimensions).

In the statistical evaluation, the following levels of significance are used:

Non-significant	NS	$P > 0.05$
Significant	*	$0.05 \geq P > 0.01$
Highly significant	**	$0.01 \geq P > 0.001$
Highly significant	***	$P \leq 0.001$

**RESULTS AND DISCUSSION**

The results in table 1 showed that the mesio-distal dimension of the maxillary anterior teeth was larger in males than females; that means males have significantly wider anterior teeth than females especially for canines (both sides) and central incisors (right side) and the combined teeth width. The exact reason laying behind this difference is not well understood; however sex-linked inheritance and sex-hormonal influences were suggested<sup>(17)</sup>. Garn *et al.*<sup>(18)</sup> advanced the hypothesis that sexual dimorphism has a genetic basis, but till now this hypothesis is not proved.

Regarding the facial measurements (table 2), all these measurements were significantly higher in males than females. This is because males have larger skeletal, cranial, facial and dental arch dimensions than females.

Table 3 and 4 showed the relation between the facial and dental measurements. The results showed that there was weak significant relation between the facial height and the width of right incisors, left central incisor and the combined width in male group, while there was weak significant relation between the facial width with the width of central incisors in female group. On the other hand, there were no significant relations between facial and teeth measurements. Many authors<sup>(6-9)</sup> found no relation between bi-zygomatic width and central incisor width. Al Wazzan *et al.*<sup>(9)</sup> found no significant relationship between inter-alar width, inter-commisural width and the dimension from distal of canine to distal of canine. While in other study, Al Wazzan<sup>(10)</sup> found a significant relationship between inter-canthal dimension and the maxillary teeth dimensions. The relationship between the inter-pupillary distance and mesio-distal width of maxillary central incisors was suggested and

evaluated by Cesario and Latta <sup>(11)</sup>. Al Wazzan *et al.* <sup>(9)</sup> showed no such correlations. In addition to that Al-El-Sheikh and Al-Athel <sup>(12)</sup> found no correlation between

the maxillary anterior teeth width with inter-alar and inter-pupillary distances in males group while significant correlation was found in females group.

**Table 1: Descriptive statistics and genders differences for mesio-distal dimensions of maxillary anterior teeth**

Variables		Sex	Descriptive statistics		Genders difference	
			Mean	S.D.	t-test	P-value
Right	3	M	7.99	0.52	4.50	0.000 ***
		F	7.47	0.45		
	2	M	6.73	0.65	1.54	0.129 (NS)
		F	6.53	0.46		
	1	M	8.79	0.58	2.05	0.044 *
		F	8.55	0.38		
Left	1	M	8.80	0.50	1.49	0.141 (NS)
		F	8.64	0.43		
	2	M	6.67	0.50	1.10	0.277 (NS)
		F	6.54	0.48		
	3	M	7.86	0.51	4.04	0.000 ***
		F	7.43	0.39		
Sum		M	46.84	2.70	3.00	0.004 **
		F	45.15	2.01		

1= Central incisor, 2= Lateral incisor, 3= Canine

M= Males, F= Females

**Table 2: Descriptive statistics and genders differences for anthropometric facial measurements**

Variables		Sex	Descriptive statistics		Genders difference	
			Mean	S.D.	t-test	P-value
ICD		M	34.34	1.69	3.23	0.002 **
		F	33.25	1.14		
MW		M	57.52	1.91	-0.99	0.03 *
		F	56.47	1.90		
NW		M	34.68	2.34	2.39	0.02 *
		F	33.44	2.04		
ULV		M	8.26	0.77	2.29	0.025 *
		F	7.87	0.66		
LLV		M	10.01	0.99	3.81	0.000 ***
		F	9.25	0.66		
IZD		M	135.40	3.54	2.10	0.039 *
		F	133.58	3.73		
N-GN		M	119.19	4.74	1.21	0.000 ***
		F	117.91	4.18		

1= Central incisor, 2= Lateral incisor, 3= Canine

M= Males, F= Females

**Table 3: Correlation between facial measurements and mesio-distal dimensions of maxillary anterior teeth in male group**

Variables			NGN	IZD	LLV	ULV	NBW	MW	ICD
Right	3	r	0.208	0.103	0.086	-0.048	0.077	0.071	0.101
		P	0.238	0.561	0.630	0.786	0.665	0.690	0.572
	2	r	0.378	0.238	-0.011	-0.076	0.195	0.203	0.290
		P	0.028 *	0.175	0.950	0.669	0.270	0.249	0.096
	1	r	0.341	0.201	0.116	0.034	0.173	0.234	0.142
		P	0.048 *	0.255	0.515	0.847	0.328	0.183	0.424
Left	1	r	0.410	0.169	0.194	0.209	0.189	0.204	0.002
		P	0.016 *	0.339	0.272	0.236	0.284	0.246	0.989
	2	r	0.238	0.066	0.002	-0.255	0.038	0.067	0.224
		P	0.175	0.711	0.989	0.145	0.831	0.706	0.203
	3	r	0.128	0.200	0.002	0.090	0.068	0.136	0.139
		P	0.469	0.257	0.993	0.611	0.704	0.443	0.433
Sum		r	0.349	0.202	0.076	-0.012	0.154	0.189	0.188
		P	0.043 *	0.252	0.671	0.948	0.384	0.284	0.287

**Table 4: Correlation between facial measurements and mesio-distal dimensions of maxillary anterior teeth in female group**

Variables			NGN	IZD	LLV	ULV	NBW	MW	ICD
Right	3	r	-0.098	0.116	0.032	-0.125	-0.237	-0.004	0.228
		P	0.565	0.493	0.850	0.460	0.158	0.981	0.175
	2	r	0.155	0.139	0.038	-0.133	0.115	0.103	0.085
		P	0.360	0.412	0.821	0.432	0.496	0.545	0.616
	1	r	0.046	0.362	-0.072	-0.190	0.209	0.342	0.088
		P	0.787	0.028 *	0.671	0.261	0.214	0.081	0.605
Left	1	r	-0.040	0.343	-0.031	-0.097	0.247	0.218	0.063
		P	0.815	0.038 *	0.857	0.569	0.140	0.195	0.711
	2	r	0.070	0.309	-0.067	-0.031	0.164	0.139	0.196
		P	0.682	0.063	0.695	0.857	0.332	0.412	0.244
	3	r	-0.120	0.165	0.246	-0.123	-0.236	-0.083	0.014
		P	0.480	0.330	0.142	0.470	0.160	0.624	0.934
Sum		r	0.008	0.307	0.027	-0.147	0.061	0.152	0.151
		P	0.965	0.064	0.874	0.387	0.720	0.368	0.374



## CONCLUSION

Generally, the faces differ in their shapes and the teeth affected by the genetic factor that plays a

role in their dimensions and not always the dental and facial measurements have a relation.

## REFERENCES

1. Meneghini F. Clinical facial analysis elements principles techniques. 1<sup>st</sup> ed. Berlin Heidelberg New York: Springer-Verlag; 2005.
2. Peck H, Peck S. A concept of facial esthetics. Angle Orthod 1970; 40(4): 284-317. (IVSL).
3. Ricketts RM. The golden divider. J Clin Orthod 1981; 15(11): 752-9.
4. Ricketts RM. Divine proportion and Fibonacci series. Am J Orthod 1982; 81(5): 351-70.
5. Proffit WR, Fields HW, Sarver DM. Contemporary orthodontics. 5<sup>th</sup> ed. St. Louis: Mosby Elsevier; 2013.
6. Scandrett FR, Kerber PE, Umrigar ZR. A clinical evaluation of techniques to determine the combined width of the maxillary anterior teeth and the maxillary central incisor. J Prosthet Dent 1982; 48(1): 15-22.
7. LaVere AM, Marcroft KR, Smith RC, Sarka RJ. Denture tooth selection: an analysis of the natural maxillary central incisor compared to the length and width of the face. Part I. J Prosthet Dent 1992; 67(5): 661-3.
8. LaVere AM, Marcroft KR, Smith RC, Sarka RJ. Denture tooth selection: an analysis of the natural maxillary central incisor compared to the length and width of the face. Part II. J Prosthet Dent 1992; 67(6): 810-12.
9. Al Wazzan KA, Al Haidan A, Al Madi EM, Al Murfarj A. The relationship between facial references and mesio-distal width of maxillary anterior teeth among Saudi patients. Alexandria Dent J 1995; 20(4): 39-45.
10. Al Wazzan KA. The relationship between inter-canthal dimension and the widths of maxillary anterior teeth. J Prosthet Dent 2001; 86(6): 608-12.
11. Cesario VA Jr, Latta GH Jr. Relationship between the mesio-distal width of the maxillary central incisor and inter-pupillary distance. J Prosthet Dent 1984; 52(5): 641-3.
12. Al-El-Sheikh HM, Al-Athel MS. The relationship of inter-alar width, inter-pupillary width and maxillary anterior teeth width in Saudi population. Odontostomatol Trop 1998; 21(84): 7-10.
13. Foster TD. A textbook of orthodontics. 3<sup>rd</sup> ed. Oxford: Blackwell scientific publications; 1990.
14. Al-Ramahi SCA. Evaluation of buccal corridor in posed smile for Iraqi adults sample with class I normal occlusion. A master thesis, Department of Orthodontics, University of Baghdad, 2009.
15. Farkas LG. Anthropometry of the head and face in medicine. 1<sup>st</sup> ed. New York: Elsevier Science Publishing Co.; 1981.
16. Hunter WS, Priest WR. Errors and discrepancies in measurement of tooth size. J Dent Res 1960; 39(2): 405-14.
17. Garn SM, Lewis AB, Kerewsky RS. X-Linked inheritance of tooth size. J Dent Res 1965; 44(2): 439-41.
18. Garn SM, Lewis AB, Swindler DR, Kerewsky RS. Genetic control of sexual dimorphism in tooth size. J Dent Res 1967; 46(2): 963-72.

# The Prediction Failure for Orthodontic Treatment of Class II Malocclusion

*Alnajar H.A, Alhamadi W.W*

*Hussien Abid Ali Alnajar*

M.Sc. Orthodontics, assistant lecturer - College of dentistry ,Kufa university

*Wisam Wahab Alhamady*

M.Sc. Orthodontics, assistant professor College of dentistry ,Babylon university

## Abstract

**Background:** It is very important to have keys for the prediction of success or failure of orthodontic treatment in the correction of difficult class II malocclusion so Gramling in 1995 introduced the probability index to answer why some class II cases were treated successfully while the others are not depending on the probability index value for each class II patient .

**Objectives:** To determine the percent of class II patients that can be treated orthodontically and the ratio of those who need combination of orthodontic treatment and orthognathic surgery.

**Materials and method:** 750 lateral digital cephalometric radiographs for CI II adult patients (according to ANB angle , ANB  $> 4^{\circ}$  ) were analyzed using AutoCAD 2010 program to measure five cephalometric angles which are (1)FMA (Frankfurt mandibular plane angle) (2)ANB angle (3) occlusal plane Frankfurt plane angle (4) FMIA (Frankfurt mandibular incisor angle) (5) SNB angle .

**RESULTS** 21% of class II patients cannot be corrected successfully by orthodontic treatment only but they also need orthognathic surgery, while the others can be treated orthodontically with special considerations .

**Conclusions:** Most of the class II patients seeking for orthodontic treatment can be treated successfully orthodontically and most of difficult class II cases with high probability index show vertical problems which mean that class II with high angle are difficult to be treated orthodontically without special consideration or orthognathic surgery .

**Key words** : CI II malocclusion ,probability index ,failure in CI II correction.

## INTRODUCTION

Since 1970 Charles H. Tweed International foundation started a series of researches to answer the question that why some Class II cases were corrected successfully while other are not so well corrected . The first research was a study of Charles H. Tweed class II treatment in which a random sample of 54 class II malocclusion were selected from the Tweed library and it showed that Dr. Tweed corrected class II malocclusions 40 years ago as effectively as they are corrected today and some class II cases were corrected quite well while the other are not so well <sup>(2)</sup> . The second research was a study of 150 difficult CI II malocclusion treated by the member orthodontist of Charles H. Tweed international foundation and the study revealed the same finding that a wide variety of class ii malocclusions were corrected ,some better than the others.

The third study was another investigation on the orthodontic treatment of difficult class II malocclusions only the unsuccessfully corrected cases and it appeared that there were some cephalometric keys for prognosis<sup>(3)</sup>, and finally a study done by Gramling in 1993 and edited by Levern Merrifield in 1995 was an effort to discover the predictive element for success or failure for class II correction which was the probability index <sup>(4)</sup>.

## Objectives:

According to the probability index the current study was done to determine the ratio of CI II cases that can be treated orthodontically and those whom need a combination of orthodontic treatment and orthognathic surgery.

## MATERIALS AND METHODS:

The sample includes 750 lateral cephalometric radiographs of skeletal class II adult patients (ANB $>4^{\circ}$ ) <sup>(5)</sup> attending the Orthodontic department of college of Dentistry, University of Baghdad , in addition to under and postgraduate students in the same college and the age of those patients was ranging from 18 to 31 years old . Five angles were measured on each cephalometric radiograph using Auto CAD 2010 software as shown in figure 1 ,and these angles were(1)FMA (Frankfort mandibular plane angle) . (2)ANB (3) occlusal plane Frankfurt plane angle (4) FMIA (Frankfort mandibular incisor angle). (5) SNB. Then by using a special formula described by James & Gramling in 1995 which is based on special statistical formulas to get the probability index value for each patient <sup>(4)</sup> as in table 1.



Figure 1 : cephalometric analysis showing the five angles of the probability index

Table 1: The probability index calculation

angle	Point value	Chephalometric value	Probability index
FMA 20-30	5	35	25
ANB 6 or less	15	8	30
FMIA 60 or more	2	54	12
Occ PL 7 or less	3	10	9
SNB 80 or more	5	75	23
		total	101

To measure the probability index of a given case as described by James and Gramling <sup>(4)</sup> suppose that the chephalometric value of the five angles as was given in table 1 for example the FMA was 35 so if it ranged between 20-30 so it is within normal limit but 35 is about 5 degrees outside the correctable range so this amount of increase (5) will be multiplied by the point value (which is the mathematic factor that was determined by considering the anatomic importance of each cephalometric angle and the arithmetic value of that angle) to get the probability index value of that angle which is 25 for FMA in the supposed case and so on for the other variables (angles) which are calculated in the same manner then totaled to yield the probability index of 101 for the example case .

Then after getting the probability index value

of all lateral cephalometric radiographs they were classified according to table 2 into: impossible, very poor, poor, fair, good and excellent prognosis. Then the percent of each prognosis was obtained by dividing its number to the total number of cases. For example there were 60 radiographs of probability index value more than 100 (impossible prognosis) which mean that 8% of class II cases are impossible to be treated orthodontically successfully without orthognathic surgery.

Table 2: Case prognosis according to the probability index value

Probability index	prognosis	treatment
More than 100	impossible	adjunctive orthognathic surgery
99-90	Very poor	Border line surgery
89-80	poor	Intrusive force control
79-70	fair	Orthodontic correction (excellent appliance control)
60-69	good	Orthodontic correction (minimum effort)
50 and bellow	excellent	Orthodontic correction (minimum effort)

Then according to the probability index value each C1 II case will be classified as in the following table(2) according to James & Gramling in 1995<sup>(4)</sup> .

## RESULTS

The results showed that 8% of class II patients were with impossible prognosis and cannot be treated successfully without adjunctive orthognathic surgery, 13% of the cases were with very poor prognosis and considered as a border line cases for surgery, 14% of class II patients are with poor prognosis can be treated orthodontically with intrusive force control, 27 % of class II patients are with fair prognosis that can be treated successfully orthodontically with excellent appliance control , 18 % of cases are with good prognosis and can be treated successfully orthodontically with minimum effort, and finally 20 % of patients had an excellent prognosis and can be treated successfully orthodontically with minimum effort.

**Table 3: The ratio of class II patients according to probability index:**

<i>Probability index</i>	<i>prognosis</i>	<i>treatment</i>	<i>ratio</i>
More than 100	impossible	adjunctive orthognathic surgery	8%
99-90	Very poor	Border line surgery	13%
89-80	poor	Intrusive force control	14%
79-70	Fair	Orthodontic correction (excellent appliance control)	27%
60-69	good	Orthodontic correction (minimum effort)	18%
50 and bellow	excellent	Orthodontic correction (minimum effort)	20%

## Discussion

38% of the CI II cases can be treated only by orthodontic treatment with minimal effort and without any precautions, also 27 % of CI II patient can be treated orthodontically successfully with excellent appliance control like the use of the Opus closing loop designed by Siatkowski which offers excellent control of forces and moments, so that space can be closed under good control <sup>(11)</sup>. The loop can be fabricated from 16 x 22 or 18 x 25 steel wire, or from 17 x 25 TMA wire. It is activated by tightening it distally behind the molar tube and can be adjusted to produce maximal, moderate, or minimal incisor retraction, but like all closing mechanisms with a long range of action, must be monitored carefully <sup>(12)</sup>.

14% of CI II cases need iIntrusive force control like the use of PG spring which was proven radiographically and clinically to reduce the amount of overbite by upward and backward translation of upper incisors by Gjessing in 1994 <sup>(6)</sup> and tested by Dincer et al in 2000 <sup>(7)</sup>, in addition to the molar intrusion by TAD for over erupted posterior teeth to improve both vertical and sagittal skeletal discrepancy <sup>(8,9, 10)</sup>

## Conclusion

Most of difficult class II cases with high probability index show vertical problems as the values of both FMA and occlusal plane angle were increased which increase the need for surgery but a conclusive judgment of the prognosis of a CI II malocclusion on the bases of FMA alone could not be made <sup>(4)</sup>, again cases with high ANB angle value and others with low ANB angle value showed a very little difference in the successfully treated and unsuccessfully treated CI II samples which mean that the ANB angle alone is not a reliable predictor of the success or failure of CI II corrections, also many difficult cases show deficient mandible in both sagittal and vertical plane which could be corrected in adult patients by surgery. The importance of the probability index came from that it aid in identifying those class II cases that require either adjunctive orthognathic surgery or alternate treatment methods like the extraction of 1<sup>st</sup> or 2<sup>nd</sup> molar in addition to premolars extraction also it

can help in predicting accurately the treatment time necessary to correct a given class II malocclusion thereby enable the orthodontist to assign a fairer and more appropriate fee.

## References

1. Jones ML, Oliver RG. W&H Orthodontic Notes. Oxford: Wright, 2000, p. 1-2, 24, 28-30, 62.
2. Gramling JF. A study of Tweeds CI II correction. Unpublished paper presented to the thirteenth biennial meeting of Charles H. Tweed international foundation Memphis, Tennessee, October, 3, 1980.
3. Gramling JF. A cephalometric appraisal of the results of orthodontic treatment on fifty five un successfully corrected difficult class II malocclusion. J Charless H. Tweed found 1987; 15: 112-24.
4. James F, Gramlling I. The probability index. AM J ORTHOD 1995; 107: 2: 165-171.
5. Jones ML, Oliver GR. Walther and Houston's orthodontic notes. Wright Co 6th ed. 2000; p 1-2, 16-32, and 240.
6. Gjessing P 1994 A universal retraction spring. Journal of clinical orthodontics 18: 222-242.
7. Dincer M, Gulsen A, Turk T. The retraction of upper incisor with the PG retraction system. European Journal of Orthodontics 2000; 22: 33-41.
8. Mizrahi E, Mizrahi B. Mini screw implants (temporary anchorage devices); Orthodontics and pre-prosthetic applications, J Orthod 34; 80-94, 2007
9. Herman R, Cope JB: Miniscrew implants: IMTEC mini ortho implants, Semin Orthod 11: 32-30, 2005.
10. Sugawara J, Nishimura M: minibone plates: the skeletal anchorage system, Semin Orthod 11: 47-56, 2005.
11. Siatkowski RE. Continuous archwire closing loop design, optimization and verification, Parts I and II. Am J Orthod Dentofac Orthop 112: 393-402, 484-495, 1997.
12. Proffit WR, Fields HW, Sarver DM. Contemporary orthodontics. St. Louis: Mosby Elsevier, 2013.



# ***Fabrication of Duplicate Denture With Metal Functional Cusps Using A Sectional Mold Technique***

***Dr. Tariq Jasim Mohamed. \****

D.D.T; B.D.S.; M.Sc. in Prosthodontics. College of Dentistry, University of Tikrit, IRAQ

## **Abstract**

This study describes a method of duplicating denture with metal functional cusps of the occlusal surfaces and heat activated acrylic resin for both teeth and denture base using a sectional mold technique.

**Key words:** Duplicate denture, sectional mold

An accurate duplication of the artificial teeth is an important step in the duplication procedure. For certain duplication the original teeth in the old denture were first used <sup>(1)</sup>. while in others an autopolymerized acrylic resin or ready-made artificial teeth were used <sup>(2-10)</sup>. Heat activated acrylic resin for duplicate the artificial teeth have also been used <sup>(11-12)</sup>.

Metal occlusal surfaces of artificial teeth have been used by many authors in constructing complete denture to patients having one arch with reconstructed gold occlusal surfaces or when there is excessive wearing of teeth surfaces due to heavy bite or bruxism; hence it will stabilize the vertical dimension of the patient <sup>(13)</sup>.

**Procedure:**

*In this work, we followed the same technique being used in our previous article concerning coloring the teeth for duplicate denture using a sectional mold technique. <sup>(13)</sup>*

1. Prepare a well cleaned old denture, then apply a beading wax around the posterior teeth leaving 1.5 mm of the teeth surfaces uncovered (fig.1).
2. Mix casting investing material (Bella vest, SH, Bego, Germany). Then paint carefully the exposed parts of the teeth surfaces and the beading wax giving a thickness of 4 mm (fig.2).



Fig. 1. Posterior teeth of original denture surrounded by beading wax.



Fig. 2. Application of investment material on the occlusal surfaces

3. Remove the investment from the denture after it has been set, then pour melting casting blue wax (crown wax, Bego, Germany) in one half of the index which represent the functional cusps (fig.3).
4. Apply adhesive material and retention pearls (retention-Perlen, Bego, Germany), on the surface of casting wax opposite to the occlusal surface to give retention for the acrylic resin.
5. Sprue the wax pattern by using old burs coated with wax to withstand the weight of the investment (fig.4).



Fig. 3. Casting wax in the investment mold.

\* E.mail: tariq195520001@yahoo.co.uk



Fig. 4. Spruing the wax pattern.

6. Put the prepared investment with its wax pattern and sprues in a casting ring and fill with cool water for 5 minutes to moist the investment. Empty the water and pour the investment in the ring
7. After setting of the investment, burn out completely the wax and remove the burs to leave a way for the melted metal to go through.
8. Use melting casting alloy (Wiron 99, Bego, Germany) to construct the recommended occlusal surface.
9. Finish the metal cast. Certain attention should be applied not to remove a thick layer from the occlusal surface (fig.5).



Fig. 5. Functional cusps changed to metal.

10. Remove the beading wax which was applied to the old denture.

*The same procedure to construct a duplicate denture in our previously referred article was followed to the step no. 13 where the arch wax was prepared and ready for flasking.*

11. Flask the arch wax in another flask, and eliminate the wax, then pack the mold.
12. Apply the prepared metal occlusal surface and fix by adhesive in the stone index (fig.6).



Fig. 6. Fixation of the prepared metal in the mold

13. Now pack with crown and bridge tooth colored heat activated acrylic resin.
14. Finish the prepared acrylic teeth supporting the metal occlusal surfaces in the stone mold cervical and interdental regions.
15. Place the acrylic teeth to the stone mold completing the process of denture construction, as referred to the step no. 23 and 24 in our previous article (fig.7 and 8).



Fig. 7. Finishing and polishing for duplicate denture



Fig. 8. Duplicate and original denture.

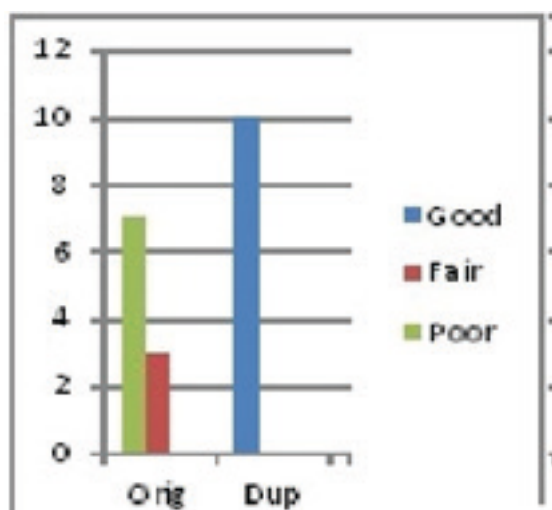
## Results

Retention, stability and vertical dimension for the duplicate denture shows positive results clinically compared with the original denture.

Table (1): Shows the retention obtained in the duplicate and the original denture compared where a comparative of significant exist through the use of Kolomogrov-Simernov"Non parametric" test- (KS) for the two sample which were concerned with a highly significant difference between the original and duplicate denture that shows a positive result for the duplicate denture.

**Table.1: Relation between retention in original and duplicate denture.**

Original			Duplicate			C.S.
Poor	Fair	Good	Poor	Fair	Good	
7	3	-	-	-	10	1.00 HS



**Fig.21: Retention frequencies distribution in original and duplicate denture.**

Table (2): Shows the stability obtained in the duplicate denture compared to the original, where a comparative of significant through the use of statistical test (KS) which gives a highly significant difference between the original and duplicate denture which again shows a positive result toward the duplicate denture.

**Table.2: Relation between stability in original and duplicate denture.**

Original			Duplicate			C.S.
Poor	Fair	Good	Poor	Fair	Good	
6	4	-	-	-	10	1.00 HS



**Fig.22: Stability frequencies distribution in original and duplicate denture.**

Table (3) shows the difference between increasing the vertical dimension between the original and duplicate denture when zinc oxide eugenol wash impression was used. It shows a highly significant difference through the use of statistical test (t-test) at (i.e,  $p < 0.05$ ) level, the measurement ranging between (0.20-0.65) mm.

**Table.3: Increasing vertical dimension between duplicate and original denture.**

Case no.	Increase V.D.	Case no.	Increase V.D.
1-	0.30 mm	6-	0.62mm
2-	0.44mm	7-	0.65mm
3-	0.20mm	8-	0.35mm
4-	0.54mm	9-	0.47mm
5-	0.38mm	10-	0.28mm

## Discussion

Retention and stability of duplicate denture shows better results due to the wash impression that made with the original denture.

The changes in vertical dimension of duplicate den-



ture shows a highly significant difference, which will be a little clinical importance as the free- way space average 3 mm. therefore the increase that will compensate the reduction of vertical dimension of the original denture.

The wearing process of artificial teeth (special- ly acrylic type) can result in reduced vertical dimen- sion of face for completely edentulous patients and this may lead to esthetic ,mechanical ,and biolog- ical effects, such as T.M.J. problems, infection at the corners of the mouth and chin to nose reduced distance.

The construction of metal occlusal surface on artifi- cial teeth is of great advantages since this will give the artificial teeth occlusal strength and protection against wearing process allowing the teeth to work with high efficiency.

The disadvantages of this technique are the ad- ditional laboratory steps and the unusual color of the metal which form the occlusal surfaces of the artificial acrylic teeth.

## References:

- 1.Beckette L.S duplication of existing full upper/ or lower denture.Int.Dent.J.1952; 3:50-2.
- 2.Boos RH, Carpenter HO Jr. Technique for dupli- cating a denture. J Prosthet .Dent 1974; 31:329- 34.
- 3.Lechner S.K. problem solving in removable prosthodontics. Aust. Dent J.1986; 31:273-80.
- 4.Marcroft K.R. Fabrication of identical duplicate dentures.J.Am.Dent.Assoc.1962;64:476-81.
- 5.Thomson H. duplication of complete denture .Dent. Pract. Dent. Rec.1967.17:173-5.
6. Ansari IH. Duplicating an existing complete denture to make a replica. J Prosthet Dent 1994;72:445-7.
- 7.Assery CM, Fakiha Z. A technique for duplicat- ing complete dentures. Dent News J 1997;4:9-12.
8. Lindquist TJ, Narhi TO, Ettinger RL. Denture

duplication technique with alternative materials. J Prosthet Dent 1997; 77:97-8.

- 9.Gorman MC,O'Sullivan M.Fabrication of a du- plicate denture using visible light-polymerized resin as an interim denture base. J prosthet Dent 2006 ; 96 : 374-376 .
- 10.Arora A. Kalra V.Copy denture: A solution to the psychological characteristics of denture patients. AOSR 2012;2(1):37-39.
- 11.Mohamed TJ and Farag SA Duplciation of co- plete denture using a sectional mold technique. J prosthet Dent 2001 ; 85 : 12-4 .
- 12.Mohamed TJ Coloring the teeth for duplicate denture using a sectional mold technique. Poster presented to the34th Annual Conference of the European Prosthodontic Association,2010.Pr- ishtina.
- 13.Mohamed TJ Coloring the teeth for duplicate denture using a sectional mold technique.Tikrit J. for dental Sciences 2011 ; Vol.1,No.1:60-65 .
- 14.Morrow R.M, Rudd K.D,Eissman H.F. Dental laboratory procedures vol.1 complete denture. 1<sup>st</sup> ed.St. Louis:C.V Mosby;1980.p.185-200.





