



بسم الله الرحمن الرحيم

∞∞∞∞

تم رفع هذه الرسالة بواسطة / سلوي محمود عقل

بقسم التوثيق الإلكتروني بمركز الشبكات وتكنولوجيا المعلومات دون أدنى

مسئولية عن محتوى هذه الرسالة.

ملاحظات: لا يوجد





The Effect Of Four Implants Versus Two Implants Connected With Bar Retained Mandibular Overdenture On Biting Force.

Submitted to the Faculty of Dentistry, Ain-Shams
University in partial fulfillment of the requirements for
Doctoral Degree in oral and maxillofacial
Prosthodontics.

Submitted by:

Omayma Ahmad Mohamad

Assistant Lecturer at Fayoum University

B.D.S 2008

M.D.S 2014

Cairo University

**Faculty of Dentistry
Ain Shams University
2022**



Supervised by:

Prof. Dr. Mahmoud Hasan El Afandy

Professor of oral and maxillofacial Prosthodontic
Faculty of dentistry
Ain shams university

Dr. Amr Salah El Din Abd El Shafy

Assistant professor of oral and maxillofacial
Prosthodontics
Faculty of dentistry
Fayoum University

Dr. Marwa kothayer Abd El Hakim

Assistant professor of oral and maxillofacial
Prosthodontics
Faculty of dentistry
Ain shams University

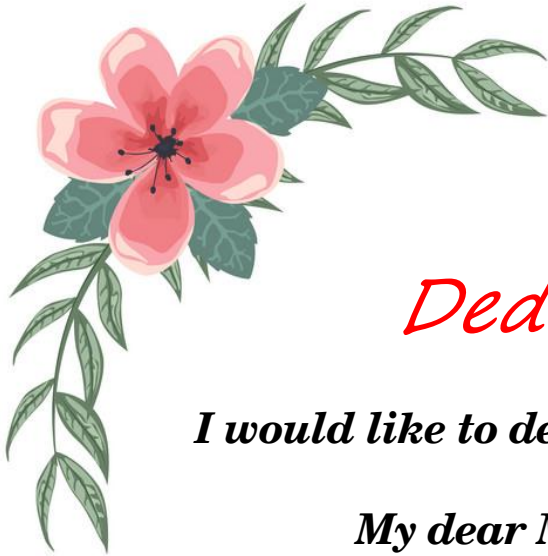
Acknowledgment

*I'm very grateful to **ALLAH** for without his graces and blessings, this study would not have been possible.*

Immeasurable appreciation and deepest gratitude to *Prof. Dr. Mahmoud Hasan El Afandy* Professor of oral and maxillofacial Prosthodontics, Faculty of Dentistry, Ain Shams University, under whose supervision I had the honor to proceed with this study, for his guidance and constant supervision, as well as for his support and words of encouragement.

I would like to express my deepest thanks to *Dr. Amr Salah El Din* Assistant Professor of oral and maxillofacial Prosthodontics, Faculty of Dentistry, Fayoum University, for his intensive supervision, kind help, valuable comments, and advice, will always be sincerely remembered. and also the staff members of prosthodontics department, Ain Shams University.

Omayma Ahmad Mohamad



Dedication

I would like to dedicate this thesis to:

My dear Mother's soul

My lovely husband Hossam

My sister Aml and her family

As well as my little young kids

Fatma and Khadija.



List of Contents

Title	Page No.
List of Figures.....	i
List of Tables	iv
List of Abbreviations	v
Introduction.....	1
Review of Literature	3
Problems of complete edentulism and conventional treatmentr	3
Implant Overdentures	4
Implant supported overdenture classified into:.....	4
Implant overdenture may be classified according to prosthesis movement (PM) into:.....	5
The first option (OD-1).....	6
The second option (OD-2).....	7
The third option (OD-3).....	7
The fourth option (OD-4)	7
The fifth option (OD-5)	7
Surgical Protocols	10
Loading Protocols.....	10
Overdenture Attachments	11
Classification of Attachments.....	12
According to the method of fabrication:.....	12
According to the function or movement:.....	12
According to mode of retention:.....	12
According to the design:	13
Types of stud attachments:	13
I) Types of bars based on resiliency:	18

a) Bar joint:	18
b) Bar unit:	19
II) Types of bars according to retention mechanism:	19
a) Bar and clip attachments:	19
b) Bar with stud attachments:	20
c) Milled bar with spark erosion technology:	20
d) Bar with stud attachments:	21
e) Milled bar with spark erosion technology:	22
III) Types of bars according to the manner of connection to the implants:	22
a) Screw retained bars.....	22
b) Cement retained bars	23
Examples of bar attachment:	24
a) Dolder bar attachments:.....	24
b) Hader bar attachments (The Preci-Horix):	24
c) Ackermann bar	24
d) Ceka bar.....	25
e) OT multiuse bar	25
Advantages and disadvantages of bar attachments:.....	25
Implant Surgical Guides:	26
Radiographic Evaluation of Implant.....	28
Phase 1: Pre-surgical Implant Imaging.....	28
Phase 2: Surgical and Interventional Implant Imaging.....	28
Phase 3: Post-prosthetic Implant Imaging	29
Types of imaging modalities	30
1. Periapical Radiography.....	30
2. Panoramic Radiography.....	30
3. Magnetic Resonance Imaging.....	31
4. Computed Tomography	31

5. Cone Beam Computed Tomography	32
T-scan	33
Biting force	36
Devices for recording Bite Force:	36
I. Strain Gauge Transducer	37
II. Piezoelectric Transducers:	37
III. Pressure Transducers:	38
IV. Pressure Sensitive Foils:	38
V. Load cell sensor:	38
Factors affecting biting force:	40
I-Factors related to patient:	40
III-procedure related factors:	47
General consideration for recording Bite Force:.....	48
Aim of the Study.....	49
Materials and Methods	50
Results.....	82
Discussion.....	96
Conclusions.....	104
Recommendations.....	105
References.....	106

List of Figures

Fig. No.	Title	Page No.
Fig (1):	Pre-operative view for one of the selected cases.	53
Fig (2):	Pre-operative radiographic examination using CBCT.	53
Fig (3):	Upper and lower primary alginate impression.	55
Fig (4):	Upper and lower final zinc oxide and eugenol impression.	56
Fig (5):	Mounting upper cast according to maxillary face bow record.	57
Fig (6):	Centric occluding relation record with check bite technique.	57
Fig (7):	Try in stage.	58
Fig (8):	Upper & lower complete dentures in the patient's mouth.	59
Fig (9):	Composite markers on the labial and lingual surface.	60
Fig (10):	Dual scan.	60
Fig (11):	Virtual implant planning.	61
Fig (12):	Stereo lithographic surgical guide.	62
Fig (13):	Root form implant.	63
Fig (14):	Occlusal index.	64
Fig (15):	Fixation of surgical guide with anchorage pins.	65
Fig (16):	Surgical kit.	65
Fig (17):	Punch mucosa through each metal sleeve.	66
Fig (18):	Sequential drilling for each implant through the surgical guide.	66
Fig (19):	Paralleling rods to confirm parallelism between installed implants.	67
Fig (20):	Manual ratchet wrench.	67

List of Figures *(Cont...)*

Fig. No.	Title	Page No.
Fig (21):	Covering screws.....	68
Fig (22):	Cone beam radiograph after implant placement.	68
Fig (23):	Healing abutments.....	69
Fig (24):	Splinting of impression copings.....	70
Fig (25):	Open tray impression with implant analogues.....	71
Fig (26):	Verification jig.	71
Fig (27):	Periapical radiograph with jig.	72
Fig (28):	UCLA abutments& bar attached to implant analogues.	72
Fig (29):	Finished fabricated bar.....	73
Fig (30):	Periapical radiograph with bar.	73
Fig (31):	Checking of the bar in patient mouth.....	74
Fig (32):	New lower denture.	74
Fig (33):	Blocking out under the bar with putty rubber base.	75
Fig (34):	Plastic clips picked up in the final denture.	76
Fig (35):	T scan III system.	76
Fig (36):	Patient clench during recording a scan by T scan device.	77
Fig (37):	T scan III software system interface.....	78
Fig (38):	The I-load star sensor device.	79
Fig (39):	Patient biting on the load sensor.	80
Fig (40):	Load star sensor software interface.....	81
Fig (41):	Scattered chart representing normal bell curve of explored data.	83
Fig (42):	Biting forces of group A at baseline & after 1 month & after 3 months	85

List of Figures *(Cont...)*

Fig. No.	Title	Page No.
Fig (43):	Biting forces of group B at baseline & after 1 month & after 3 months.	87
Fig (44):	Comparison between group A & B regarding biting forces at baseline, after 1 month & after 3 months.	89
Fig (45):	Biting forces changes between different intervals in Group A.....	91
Fig (46):	Biting forces changes between different intervals in Group B.....	93
Fig (47):	Comparison between group A (2 implants) and group B (4 implants) regarding biting forces.....	95

List of Tables

Table No.	Title	Page No.
Table (1):	Normality exploration of both groups:	83
Table (2):	Mean & standard deviation of biting forces of group A	85
Table (3):	Mean & standard deviation of biting forces of group B	87
Table (4):	Comparison between group A & B regarding biting forces at baseline, after 1 month & after 3 months in right side, left side & overall:	88
Table (5):	Mean difference & standard deviation of biting forces between baseline & after 1 month, after 1 month & after 3 months and baseline & after 3 months in right side, left side & overall in group A (2 implants):.....	91
Table (6):	Mean difference & standard deviation of biting forces difference between baseline & after 1 month, after 1 month & after 3 months and baseline & after 3 months in right side, left side & overall in group B (4 implants):	93
Table (7):	Comparison between group A (2 implants) and group B (4 implants) regarding biting forces difference between baseline & after 1 month, after 1 month & after 3 months and baseline & after 3 months in right side, left side & overall	94

List of Abbreviations

Abb.	Full term
<i>2D</i>	<i>Two-dimensional</i>
<i>3D</i>	<i>Three dimensional</i>
<i>APT</i>	<i>Alkaline phosphate test</i>
<i>CBCT</i>	<i>Cone beam computed tomography</i>
<i>CT</i>	<i>Computed tomography</i>
<i>ERA</i>	<i>Extra-coronal Resilient Attachment</i>
<i>MBL</i>	<i>Marginal bone loss</i>
<i>MPR</i>	<i>Multi-planar reformation</i>
<i>MRI</i>	<i>Magnetic resonance imaging</i>
<i>OD</i>	<i>Overdenture</i>
<i>PM</i>	<i>Prosthesis movement</i>
<i>SD</i>	<i>Standard deviation</i>
<i>TMDs</i>	<i>Temporomandibular joint disorders</i>
<i>TMJ</i>	<i>Tempromandibular joint</i>

INTRODUCTION

Denture wearers mostly reported problems with masticatory function, mainly caused by retention and stability problems of the mandibular prosthesis. Masticatory function of those patients is quite poor in comparison with that of healthy dentition subjects. Oral function significantly improves after rehabilitation with mandibular implant over denture. ^(1, 2)

It was noticed that overdenture wearers have masticatory conditions more similar to that of dentate individuals than complete denture wearers. This advantage is quite important to provide ideal nutritional condition and better quality of life to edentulous subjects. ^(3, 4)

Bite force is one indicator of the functional state of the masticatory system that result from action of jaw elevator muscles modified by Cranio-mandibular biomechanics. ⁽⁵⁾

The influence of bite force on the masticatory system is very profound. The magnitude of bite force has shown to be correlated to the patients' satisfaction with their complete dentures, type of patients' food intake as well as the amount of bone resorption under prostheses. ^(6, 7)

Various treatment modalities with implant supported prosthesis have been described for mandibular edentulous ridges⁽⁸⁾. Two to four dental implants placed in bimental region has shown high success rate.⁽⁹⁾ It was reported that peri-implant health between two implants and four implants had no significant differences ⁽¹⁰⁾. In addition, the prosthetic maintenance, complications, and patient satisfaction of two and four implant groups do not

appear to be significantly different.⁽¹¹⁾ However, it was reported in both in-vivo and in-vitro studies that retention and stability of the dentures improves with increasing implant number and distribution.^(12, 13)

Implants splinted together with bars may decrease the risk of overload to each implant as a result of greater surface area, load sharing between implants and improve biomechanical distribution.⁽¹⁴⁾

T-Scan is a computerized occlusal force analysis device which is an essential part of clinical functional analysis in prosthetic insertions. The T-Scan computerized system can rapidly determine prematurity, high points, region of excessive force and non-uniform force concentration it can also analyze dis occlusion time accurately.⁽¹⁵⁾