Effect of splinting of hybrid implants retaining mandibular overdentures

A thesis

Submitted to Faculty of Dentistry Ain Shams University For the partial fulfillment of the requirements of Master Degree in Oral and Maxillofacial Prosthodontics

By

Ahmed Salah Abd El Haleem Saad

B. D. S. (2009)

Tanta University

Faculty of Dentistry
Ain Shams University
2016

Supervisors

Prof. DR. Marwa Ezzat Sabet

Professor and Chairman of Prosthodontics Department Faculty of Dentistry Ain Shams University

Dr. Mohamed Shady Nabhan

Lecturer of Removable Prosthodontics Faculty of Dentistry Ain Shams University

Acknowledgment

First of all, I thanks Allah for his great support in accomplishing this work.

I would like to express my deepest gratitude, sincere thanks and appreciation to **Prof Dr. Marwa Ezzat Sabet**, professor and Chairman of prosthodontics Department, Faculty of Dentistry, Ain Shams University, for her helpful supervision and guidance, as well as her beneficial advice and encouragement throughout the whole study.

Words do fail to express my sincere gratitude and appreciation to **Prof Dr. Magdy Eid Mohamed**, Professor of prosthodontics Department, Faculty of Dentistry, Ain Shams University, for his valuable instructions, co-operation, and support during the progress of the study.

No words can express my deepest gratitude and appreciation to **Dr. Mohamed Shady Nabhan**, Lecturer of Prosthodontics department, Faculty of Dentistry, Ain Shams University, for his excellent guidance, extraordinary support and great help that facilitated all the difficulties that faced me.

I would like to thank my patients, my mother, my father, and my wife for their patience and support.

Last but not least, I would like to thank all staff members of prosthodontics Department, Faculty of Dentistry, Ain shams University, for their support and encouragement.

Ahmed Salah Abd El Haleem



List of Contents

Title Pa	age
INTRODUCTION	1
REVIEW OF LITERATURE	4
Edentulism	4
Consequences of edentulism	4
A) Bony consequences:	4
B) Soft tissue consequences:	6
C) Masticatory consequences:	7
D) Esthetic Consequences:	7
E) Psychiatric consequences:	8
Management of edentulism	9
I) Conventional complete dentures:	9
☐ Problems of the conventional complete dentures:	9
A) Problems related to support:	9
1) Problems with the supporting resorbed alveolar bone:	9
2) Problems with the supporting soft tissues:	10
B) Problems related to retention and stability:	11
☐Surgical enhancement for the supporting structures:	12
A) Bone augmentation:	12
B) Soft tissue surgery:	13
II) Overdenture modality:	14
☐Tooth supported overdentures:	14
☐Dental implants:	14
Classification of the dental implants:	16
- Eposteal dental implant:	16
-Transosteal dental implant:	17



-Endosteal dental implant:17
-Ramus frame implant:17
•Implant diameters:18
☐Implant overdentures:19
•Classification of the implant supported overdentures:19
A) Totally implant supported overdentures:19
B) Combined implant and tissue supported overdentures:20
C) Mucosally supported implant overdenture:20
•Advantages of the implant overdentures:20
A) Advantages in comparison to the conventional complete
dentures:20
B) Advantages in comparison to the fixed prostheses:21
☐Hybrid implants:22
•Advantages of the hybrid implants:23
Advantages of the hybrid implants compared to mini-implants:28
☐Number and position of the implants:30
☐Attachments used with the implant overdentures:32
A) Bar attachment:33
B) Stud attachments:36
- O-ring or ball attachments:36
-Locator attachments:38
C) Telescopic attachments:
D) Magnetic attachments:39
☐Methods of evaluation:40
•The radiographic evaluation:40
1) Intraoral radiography:41
2) Panoramic radiographs:42
3) Cone Beam Computed Tomography (CBCT):43
AIM OF THE STUDY47
MATERIALS AND METHODS49



RESULTS	119
DISCUSSIONS	132
SUMMARY	151
CONCLUSION	155
REFERENCES	157
الملخص العربي	١١

Table of figures

FIG.	Description	Page
FIG. 1	Mounting the casts with provisional occlusion blocks on a mean value articulator to determine the available space for the lower denture.	53
FIG. 2	Examining the maxillo-mandibular relationship.	53
FIG. 3	A radiographic stent.	55
FIG. 4	The Radiographic stent with gutta percha markers.	55
FIG. 5	Radiographic examination by CBCT with radio- opaque markers in lateral incisor, canine, and premolar right and left regions.	56
FIG. 6	The radiographic stent transferred into a surgical stent by drilling holes in the planned implant positions.	<i>57</i>
FIG. 7	Upper and lower alginate primary impressions.	59
FIG. 8	Upper and lower zinc oxide eugenol secondary impressions.	59
FIG. 9	Jaw relation with face bow transfer. (a) Maxillary face bow record in the patient mouth. (b) Face bow transfer to a semi-adjustable articulator to mount the maxillary cast.(c) Centric occlusion relation record in the correct vertical dimension following the inter-occlusal wax wafer technique to mount the mandibular cast.(d) Both maxillary and mandibular casts mounted on the articulator.	61
FIG. 10	Setting of the acrylic teeth.	62
FIG. 11	Try – in of the waxed-up trial dentures.	62
FIG. 12	Finished upper and lower complete dentures.	62
FIG. 13	Lower ridge before surgery.	64
FIG. 14	A crestal incision in the canine-premolar region.	64

_		_
FIG. 15	A periosteal elevator for reflecting the flap.	65
FIG. 16	Initial penetration through the cortex of the bone	65
	using a Point Drill through the hole of the stent	
	which represented the planned position of the	
	implant.	
FIG. 17	The surgical kit of Mini-Plus implant system.	67
110127	The sangisar me or mining has implante system.	0,2
FIG. 18	Twist Drill of 1.3 diameter (Initial Drill).	68
	,	
FIG. 19	Initial Drill as a paralleling pin to confirm a proper	68
	angulation.	
FIG. 20	Twist Drill of 1.8 diameter.	69
FIG. 21	Twist Drill of 2.3 diameter (The Final Drill).	69
	,	
FIG. 22	The Packages of both ball and cement (square head)	71
	types.	
FIG. 23	Cement (square head) and ball type Mini-Plus	71
	dental implants.	
FIG. 24	The sterile vial of the ball type implant.	72
FIG. 25	The ball type implant held in place by its ratchet	72
	driver.	
FIG. 26	The wrench torque connected to the ratchet driver.	73
FIG. 27	The paralleling pin (The Initial Drill) used in the	73
	opposite side to obtain a parallelism with the first	
	implant.	
FIG. 28	2 Ball type implants in the canine regions.	74
	,, ,	
FIG. 29	Suturing of the flaps and the ball type implants in	74
	place.	
FIG. 30	The sterile vial for the square head (cement) type	76
	implant.	
FIG. 31	The ratchet driver connected to the square head	76
	(cement) type implant.	
FIG. 32	The square head (cement) type implant held in	77
	place by the ratchet driver.	-
	product of the received of the re-	

FIG. 33	The wrench torque connected to the ratchet drive.	77
FIG. 34	The left square head (cement) type implant inserted to its full length.	78
FIG. 35	Both right and left square head (cement) type implants in place.	78
FIG. 36	Suturing of the flap around the square head (cement) type implants.	79
FIG. 37	Trimming the abutments of the square head (cement) type implants to the first mark that allowed a fixed abutment heights which were suitable for the available interarch spaces for all patients.	79
FIG. 38	The impression posts and the implant analogues for the square head (cement) type implants.	81
FIG. 39	The impression posts placed over the implant abutments.	81
FIG. 40	A putty rubber base impression with the impression posts and analogues secured in their places.	82
FIG. 41	The stone cast from the impression with the apparent portions of the implant analogues that represented the implant abutments trimmed to the same level as the abutments in the patient mouth.	82
FIG. 42	Wax pattern copings fabricated on the abutment of the implant analogues.	83
FIG. 43	Bredent vario soft resin bar pattern .	84
FIG. 44	Bredent medium friction clips for the vario soft bar.	84
FIG. 45	Bredent clips attached to the bar pattern.	84
FIG. 46	The resin bar pattern connected the two wax copings.	85
FIG. 47	The wax coping – bar pattern sprued.	85
FIG. 48	The sprued pattern placed in the casting ring.	86
FIG. 49	The casted bar after finishing and polishing and ready for the cementation.	86
FIG. 50	The positions of the implant abutments marked by a rubber base impression material in the fitting surface of the lower denture.	88

FIG. 51	(a) The ball attachment socket (the attachment enclosed in the metal housings). (b) The elastomeric shim (silicone tube) for blocking out the undercuts below the attachment sockets. (c) The ball attachment sockets connected to the ball abutments and the elastomeric shims blocked out the undercuts below the attachment sockets.	89
FIG. 52	Relieving the fitting surface of the lower denture to accommodate the ball abutments with the connected ball attachment sockets and the surrounding elastomeric shims.	90
FIG. 53	Self-cured acrylic resin used as a hard pick-up material which placed in the relieved areas in the fitting surface of the lower denture and the patient instructed to bite in centric maximum intercuspation.	90
FIG. 54	The ball attachment sockets picked-up in the fitting surface of the lower denture.	91
FIG. 55	The bar tried and cemented in the patient mouth.	93
FIG. 56	The clips were attached to the cemented bar.	93
FIG. 57	The undercuts blocked out using a rubber base impression material.	94
FIG. 58	The fitting surface of the lower denture relieved to accommodate the bar with its clips and the surrounding rubber base impression material which blocked out the undercuts.	94
FIG. 59	The clips picked-up in the fitting surface of the lower denture using self-cured acrylic resin.	95
FIG. 60	Small hall between lower second premolar and lower first molar of the lower denture.	98
FIG. 61	Two small pieces of gutta percha used as radio- opaque markers.	98
FIG. 62	Gutta percha placed in the hole and the hole blocked by self-cured acrylic resin.	98
FIG. 63	The patient position on the CBCT machine.	100
FIG. 64	The exposure parameters.	100

FIG. 65	InVivoDental viewer.	102
FIG. 66	The axial plane with two radio opaque points representing the implants.	103
FIG. 67	The axial plane adjusted with a slice thickness of 0.0 mm.	103
FIG. 68	The intersection between the coronal and sagittal reference lines imposed on the center of the radio-opaque point.	103
FIG. 69	The implants appeared clearly in both coronal and sagittal planes.	104
FIG. 70	The slice thickness adjusted to be 4 mm in the coronal and sagittal planes.	106
FIG. 71	The reorientation icon in the tool bar of the viewer.	106
FIG. 72	The inclination of the implant adjusted to be parallel to the sagittal and coronal reference lines in the coronal and sagittal planes respectively	107
FIG. 73	In the coronal plane, the axial reference line (the orange line) was adjusted to be 6mm above the apex of the implant.	108
FIG. 74	The axial plane adjusted so that the coronal reference line (the blue line) was parallel to the labial cortex in front of the evaluated implant.	108
FIG. 75	The toggle cursor visibility icon.	110
FIG. 76	The Linear measurements in the coronal plane for both groups.	110
FIG. 77	The linear measurements in the sagittal plane for both groups.	111
FIG. 78	Adjusting the intersection between the sagittal and coronal reference lines to be imposed on the radio-opaque markers at the posterior residual ridge.	113
FIG. 79	Adjusting the orientation of the sections under the radio-opaque markers so that the long axes of the sections were parallel to both sagittal and coronal reference lines in the coronal and sagittal planes respectively.	114
FIG. 80	Linear measurements for the bone at the posterior residual ridge.	116

FIG. 81	Shows a significant difference in the peri-implant and posterior bone heights in group I (with unsplinted implants) during the different follow-up periods.	122
FIG. 82	Shows a significant difference in the peri-implant and posterior bone heights in group II (with splinted implants) during the different follow-up periods.	122
FIG. 83	Shows a significant difference in the peri-implant and posterior bone height changes for group I (with un-splinted implants) during the two follow-up intervals except distally and lingually around the implants; the difference is not significant.	125
FIG. 84	Shows insignificant difference in the peri-implant and posterior bone height changes for group II (with splinted implants) during the two follow-up intervals.	125
FIG. 85	Shows a significant difference in the peri-implant bone height change for the two groups during the first follow-up interval (base line to 6 months) labially, lingually, and the average of all aspects, while, mesially, distally around the implants, and at the posterior residual ridge; the difference is insignificant.	129
FIG. 86	Shows a significant difference in the peri-implant bone height change for the two groups during the second follow-up interval (6 months to 12 months) labially, lingually, and the average of all aspects, while, mesially, distally around the implants, and at the posterior residual ridge; the difference is insignificant.	129
FIG. 87	Shows a significant difference in the peri-implant bone height change for the two groups after the whole year (base line to 12 months) labially, lingually, and the average of all aspects, while, mesially, distally around the implants, and at the posterior residual ridge; the difference is insignificant.	130

List of tables

Table	Description	Page
Table I	Means, Standard deviations, and P values related to ANOVA test for repeated measures for the perimplant and posterior bone heights of group I (with un-splinted implants) at different follow-up periods.	120
Table II	Means, Standard deviations, and P values related to ANOVA test for repeated measures for the periimplant and posterior bone heights of group II (with splinted implants) at different follow-up periods.	121
Table III	Means, Standard deviations, and P values related to Paired samples T test for the peri-implant and posterior bone height changes of group I (with Unsplinted implants) during the two follow-up intervals.	123
Table IV	Means, Standard deviations, and P values related to Paired samples T test for the peri-implant and posterior bone height changes of group II (with splinted implants) during the two follow-up intervals.	124
Table V	Means, Standard deviations, and P values related to Independent samples T test for the peri-implant and posterior bone height changes for the two groups during the first follow-up interval (base line to 6 months).	126
Table VI	Means, Standard deviations, and P values related to Independent samples T test for the peri-implant and posterior bone height changes for the two groups during the second follow-up interval (6 months to 12 months).	127
Table VII	Means, Standard deviations, and P values related to Independent samples T test for the peri-implant and posterior bone height changes for the two groups after the whole year (Base line to 12 months).	128





INTRODUCTION

Edentulism is defined as the loss of all permanent teeth. It affects millions of people, and considered to be unresolved issue of sustained significance in the old age, it is considered to have several negative effects on the patient; It is associated with a residual ridge resorption, altered facial form, diminished masticatory function, and subsequently a reduced general health and quality of life, the ultimate goal is to restore a satisfactory level of function for the patient.

The classical treatment option for the edentulous patients is the conventional complete dentures. Although, this treatment option is inexpensive and restore most functions, it has several drawbacks in regard to the supporting structures, retention, and stability.

Although, the problems of the conventional complete dentures can be managed using fixed prostheses supported by five or six endosseous implants, many patients are satisfied with implant supported overdenture that is simple, less invasive, and less expensive.

The main limitations of using implant overdentures are that implants are expensive, also, the bone volume may be insufficient for conventional diameter implants without some interventions like bone augmentation which will increase the cost and time of the treatment.

Narrow diameter implants have diameters between mini and conventional implants, and can take the advantage of both, so, they can be called Hybrid implants; they are less expensive than conventional implants, they can be inserted in the narrow ridges without the need for additional bone augmentation, they can achieve a suitable primary stability and can be immediately or early loaded to