COMPARISON BETWEEN PREFABRICATED AND CUSTOM MADE BAR USED FOR IMPLANT-RETAINED MANDIBULAR COMPLETE OVERDENTURE

Thesis

Submitted to the Faculty of Dental Medicine, Al-Azhar University

In Partial Fulfillment of the Requirements for the Doctor Degree in

Removable Prosthodontics

Presented by

SAYED ABD AL-HADY MAHMOUD MOGAHED

B. Ch. Mansoura University 1996
M.D.Sc. Al-Azhar University 2004

Faculty of Dental Medicine
Al-Azhar University

(CAIRO)

2007 G . 1428 H

SUPERVISORS

Dr./MOHAMED ESAM ELDIN SANAD

Professor of Removable Prosthodontics.

Faculty of Dental Medicine

Al- Azhar University

Cairo

Dr./AHMED SAYED ASSAD

Professor of Removable Prosthodontics.

Faculty of Dental Medicine

Al- Azhar University

Cairo

DEDICATION

“ TO THIS WHO MAKE ME VERY CLOSE

TO ALLAH AND ENLIGHTEN MY LIFE “

Youssof

ACKNOWLEDGEMENT

ACKNOWLEDGEMENT

First of all, I am most thankful to Allah for all his kindness and grace, for having granted me health, patience and perseverance to accomplish this work.

I would like to express my most sincere gratitude and appreciation to *Prof.* ***MOHAMED ESAM EL-DIN SANAD,*** Professor of Removable Prosthodontics, Faculty of Dental Medicine, Al-Azhar University, for his continuous encouragement and scientific advice. It was a great honor to work under his supervision. No words can express my thanks and gratitude for him.

I am greatly honored to express my deepest gratitude and thanks to *Prof.* ***MAGDY MOSTAFA BADAWY***, Professor and Head of Removable Prosthodontic Department, Faculty of Dental Medicine, Al-Azhar University, for his generous support and continuous encouragement.

I would like to express my deep appreciation and thanks to *Prof.* ***AHMED SAYED ASSAD,*** Professor of Removable Prosthodontics, Faculty of Dental Medicine, Al-Azhar University, for his supervision, endless encouragement, immeasurable support, devoted effort and valuable advice throughout this piece of work. I am really proud of being one of his teamwork.

I would like to express my deepest gratitude and thanks to *Prof.* ***HAMDY ABO EL-FOTOUH,*** Professor of Removable Prosthodontics, Faculty of Dental Medicine, Cairo University, for the devotion of his precious time to reading the study. I should like to extend my thanks to him for his kindness. A very warm welcome to him at Al-Azhar University.

I should not forget Dr**. Mohamed Abdel Hamed** for assistance in this study and Dr. **Said El-Iraqi** for his helpful role in the

statistical part. I can not forget Mr. **Guido HOUG** (The manager of Dyna Dental Engineering BV) for his support. I would like to express my deep appreciation and thanks to him.

I would like to express my deepest and heartfelt gratitude to my beloved mother and my great father who give everything and take nothing. I am greatly indebted to them

Many thanks to my wife and children – **Arwa**, **Rawda**, **Rowaida** and **Mustafa** for their patience and encouragement; words of thanks could not express what I feel towards them

Last but not least, I am grateful to my patients, my friends and all the staff colleagues of Removable Prosthodontic Department, Faculty of Dental Medicine, Al-Azhar University for their spiritual encouragement and support.

List of Contents

List of Tables

List of Figures

List of Figures (Continuous)

List of Figures (Continuous)

Abbreviation

Fig.	**Figure**
Dr.	**Doctor**
O.D.	**Overdenture**
F.F.P.	**Fixed Full Prosthesis**
I.R.O	**Implant Retained Overdenture**
C.D.	**Complete Denture.**
I.A.	**Instant Adjusting.**
G.I.	**Gingival Index**
B.O.P.	**Bleeding on Probing.**
P.I.	**Plaque Index.**
U.S.A.	**United States of America**

INTRODUCTION

INTRODUCTION

The ideal goal of modern dentistry is to restore the patient to normal contour, function, comfort, esthetics, speech, and health. (1) The major problem facing dentistry is that approximately 20% of the adult populations are edentulous. An excessive loss of the residual alveolar ridge makes it difficult to provide prosthesis that meets the needs of these dental patients. To help patients in their quest for a stable and comfortable complete denture, many remedies have been tried; that is, denture adhesives, cushions and soft-liners. These attempts have been met with limited success. Where the alveolar ridge is minimal, procedure offering functional, stable, and retentive complete denture is the implant retained overdenture.(2)

Dental implants have become a management strategy for replacing missing teeth.(3) Dental implants have become an increasingly common treatment option for missing dentition. (4-6) In recent years, more clinical studies have been published on the subject of dental implants than on any other topic in restorative dentistry.(7, 8)

To date, there is 100% survival of all implants and they all retain functioning prostheses.(9) For mandibular edentulism, an implant-retained overdenture should nowadays be considered a first choice for prosthodontic care, if not the standard of care. The needs of our patients specifically, and those of society generally, should be primarily drivers of innovation of the curriculum. (6)

Several attachments can be used with implant-assisted overdentures: ball and socket attachments, bar attachments, and magnetic attachments.(7)

In the mandible, prefabricated bars are preferred to milled or custom bars because they are far less expensive and more solid with an equal cross-section. Round bars allow greater distal vertical movement of the denture base (for instance, as consequence of mucosal resiliency and/or bone resorption) and produce less torque on the implants than the u-shaped bars. (8)

The bar used with overdentures may be cast or prefabricated one. Many researches studied the effect of cast bar on implant - retained mandibular complete overdentures; however the prefabricated bar is not deeply investigated. In this study, the prefabricated bar was evaluated and the results were compared with that of cast bar.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

DENTAL IMPLANT

Dental implant can be defined as “a prosthetic device made of alloplastic material(s) implanted into the oral tissues beneath the mucosal or/and periosteal layer, and on/or within the bone to provide retention and support for a fixed or removable dental prosthesis. [9]

CLASSIFICATION OF DENTAL IMPLANTS

Dental implant designs and insertion techniques can be classified as follows [10]

1-Mucosal Implants

Mucosal insert is a metal insert attached to the tissue surface of a removable prosthesis that mechanically engages undercuts in a surgically prepared mucosa. It is also called button implant-intramucosal insert or mucosal implant.

2-Subperioseal Implants

Subperiosteal dental implant is an eposteal dental implant that is placed beneath the periosteum and overlying the bony cortex.

3-Transosteal Dental Implant

Transosteal dental implant is a dental implant that penetrates both cortical plates and passes through the full thickness of the alveolar bone. It is also called staple bone implant, mandibular taple implant or transmandibular implant.

4-Endossteal Dental Implant

Endossteal dental implant is a device placed into the alveolar and/or basal bone of the mandible or maxilla and transecting only one cortical plate. Endossteal dental implants are the most common implants, which were subjected to progress in the design and the insertion techniques. This was due to the wide use of these implants.

Dental implants can be classified according to type as endosseous, subperiosteal, transosteal, intramucosal, endodontic, and bone substitutes. Endosseous dental implants are devices placed in alveolar and or basal bone and may further be categorized by their geometric design as root form, blade form, pin, and ramus form. Implants can be described by their site of insertion as ramus implants or alveolar ridge implants. Finally implants can be classified according to their material as non-metallic, metallic, and/ or coated metals. [11]

Dental implants may be classified according to their geometrical form into fin, screw, cylinder, blade, basket, root form, etc. Generally dental implants are classified according to their anchorage component as it relates to the bone that provides support and stability. Thus, there are three basic types of dental implants: eposteal dental implants, endosteal dental implants, and transosteal dental implants. Some dental implants possess both eposteal and endosteal components (by design or subsequent anchorage change); the decision as to what anchorage system provides the most support at initial placement determines which category is used to best describe the dental implant. The dental implant(s) provide bony support via the dental implant attachment while the dental implant abutment(s) connect the dental implant to the fixed or removable dental prosthesis.[9]

CRITERIA FOR SUCCESS OF DENTAL IMPLANTS

The criteria for success of osseo- integrated endosseous implants can be reviewed as follows:- [12]

I-Mobility less than 1mm in any direction.

II- Absence of radiographic radiolucency.

III-Bone loss no greater than one third of the vertical height of the bone.

IV-Gingival inflammation amenable to treatment, absence of symptoms and infection, absence of damage to adjacent teeth, absence of paresthesia, and anesthesia or violation of the mandibular canal, maxillary sinus or floor of the nasal passage.

V-Functional service for 5 years in 75% of patients.

The criteria for implant success can be summarized as follows [13]:-

I- Individual unattached implant that is immobile when tested clinically.

II- Radiograph that doesn't demonstrate evidence of peri-implant radiolucency.

III- Bone loss that is less than 0.2mm annually after the first year of service.

IV- Individual implant performance that is characterized by an absence of persistent and/or irreversible signs and symptoms of pain, infections, neuropathies, paresthesia, or violation of mandibular canal.

V- In context of criteria mentioned, success rate of 85% at the end of a 5-year observation is required period and 80% at the end of 10-year observation as minimum criterion for success of implant.

OVERDENTURE

Overdenture can be defined as any removable dental prosthesis that covers and rests on one or more remaining natural teeth, roots of natural teeth, and/or dental implants.[9]

Indications of Overdenture:-

Overdenture supported by implants was indicated in cases of:- Patients with sensitive mucosa easily irritated by the pressure of a denture, when bone is resorbed and thus exposes the alveolar nerve,when a knife-edge ridge or sharp mylohyoid projection is present, when the opposing arch has natural teeth and it is indicated for reasons of stress distribution. It is also indicated in patients with an extreme gag reflex. The overdenture is held in place during function and thus does not trigger the gag reflex.[14]

Implant-supported overdenture is indicated in the presence of moderate ridge resorption when an implant-supported bridge cannot be acceptably placed [15]

Combined implant- and tissue-supported removable restoration (overdenture) is indicated in the following cases [16,17]:-

1-Patients not able to receive a fixed implant-supported prosthesis.

2-Treatment considerations based on factors such as simplicity of this method and lower cost may lead to viable alternatives to bone grafting.

3- For medically compromised patients, overdenture treatment can widen the indications for implant treatment to include patients that could otherwise only receive dentures.

4- Fewer implants may be needed.

5- Medically debilitated patients may require treatment with implant prostheses to improve masticatory function and nutritional balance.

6- To reduce the risk associated with long surgical procedure or general anesthesia, the placement of fewer implants is propitious.

7- Economic factors may dictate the use of an overdenture supported by a few implants, notwithstanding possible additional maintenance costs associated with a removable design.

8- A prosthesis that would require excessive cantilevers to obtain necessary occlusal contact would likely be better designed as an overdenture that uses tissue support.

9- This may be helpful with unfavorable arch relationships with moderate to advanced resorption.

10- When opposed by a resorbed jaw, overdentures lend greater stability than a fixed detachable prosthesis.

CLASSIFICATION OF IMPLANT OVERDENTURE

In general one can differentiate between three treatment strategies [18]:

I- Mainly tissue borne.

II- An implant and tissue borne.

or III- Mainly implant borne overdenture.

There are several factors influencing the selection of either of these.

Implant-retained overdentures may be considered either implant-supported or implant-mucosa–supported, depending on the number of implants and type of superstructures used to retain the prostheses.[19]

Osseointegrated dental implants have been proven successful in the treatment of edentulism and the predictability of the implant-supported prosthesis has also been established. Several techniques have been described for the successful restoration of the edentulous mandible: fixed-detachable prostheses with either the original hybrid prosthesis design or conventional implant-supported fixed partial dentures, implant-retained overdentures and implant-supported over- dentures. However, in cases of advanced ridge resorption in which facial tissue support is needed from flanges of the prosthesis or when a removable type of prosthesis is preferred by the patient, an implant-supported prosthesis is indicated.[20]

ADVANTAGES OF IMPLANT- RETAINED OVERDENTURE

1-Preservation of Alveolar Bone

Complete dentures have always been a poor substitute for natural teeth. Mandibular complete dentures frequently cause pain and discomfort, accelerated residual bone resorption, while failing to restore effective chewing. The provision of two implants to stabilize the mandibular complete denture can result in significant improvements and preservation of alveolar bone.[21]

Excessive alveolar bone atrophy often confounds a conventional therapy with complete dentures. Implant therapy has found a way to solve the problem through enhanced stability and retention, thus preserve alveolar bone increasing its functionality, leading to improved patient satisfaction and a higher quality of life.[22]

2-Increase Retention and Stability

An implant-stabilized overdenture has been shown to be a predictable solution for problems with retention and stability of a lower denture in the majority of patients with a severely resorbed mandible. The stability of the overdentures retained by two implants was excellent, and the lingual dimensions of the denture could be reduced to the level of the mylohyoid line to provide more space for the tongue. [23 - 30]

The treatment in which two or four implants are placed in an edentulous patient to support an overdenture has been more effective and safe, and the retention and stability of overdenture have been improved by the use of attachments fabricated on implant abutments. [31]

The type of attachment that is used in oral rehabilitation by means of implant-retained mandibular overdentures may influence the retention and the stability of the denture. [32, 33]

A mandibular overdenture retained by 2 implants connected by a bar is an efficacious treatment that was shown to maintain stability of the prostheses in the long term.[34, 35]

The two-implant mandibular overdenture provides greater retention than does a conventional mandibular denture and, due to its cost and efficacy, can significantly improve an edentulous patient's quality of life. [36]

3- Increase Chewing Efficiency

Patients wearing mandibular implant-retained overdentures chewed the food at a higher rate than complete-denture wearers. [37, 38]

A study of chewing efficiency compared wearers of complete dentures with wearers of implant-supported overdentures. The complete denture group needed 1.5 to 3.6 times the number of chewing strokes compared with the overdenture group.[39]

The masticatory function was significantly improved after implant treatment with each of the 3 attachments (magnet, ball, and bar). The number of chewing cycles until swallowing hardly decreased after implant treatment. Better masticatory performance, combined with a slightly smaller number of chewing cycles after implant treatment, results in smaller food particles being swallowed. [40]

Patients with an extremely resorbed mandible and functional complaints of their lower denture reported significant improvement in masticatory function after implant-overdenture treatment. [41]

An implant-assisted overdenture group has significantly better perceptions than the mandibular conventional denture group for improvement in chewing, comfort, ability to eat hard foods, eating enjoyment, and denture security. [42]

4- Improve Esthetic

The esthetics and function of a tissue borne, implant retained overdenture are two of the most important factors that define a patient's acceptance of the prosthesis. [43]

Overdenture retained by a bar attached to implants and clips attached to the bar is favorite alternative for edentulous mandibles. The patient's facial form can be developed to any reasonable appearance the patient desires; dentures can be cleaned when taken out of the mouth; implants can be cleaned when the prosthesis is removed; the prosthesis can be easily repaired; and chewing efficiency is nearly the same as that with natural teeth. [44]

A removable implant-supported prosthesis offers several advantages over a fixed restoration where facial esthetics can be enhanced with labial flanges and denture teeth. The labial contours can replace lost bone width and height and support the labial soft tissues without hygienic compromise.[42]

An overdenture provides support for the lips and soft tissues of the face compared with a fixed prosthesis because the prosthesis contour does not have to accommodate daily care requirements. [1, 11]

5-Patient Satisfaction

With respect to patient satisfaction and psychosocial functioning, it is clear that patients regard implant-supported mandibular dentures as very beneficial. [41, 45, 46]

From the clinical and microbiological standpoint, as well as patient satisfaction, both an overdenture (OD) and a fixed full prosthesis (FFP) offer a favorable long-term outcome. [14]

Implant-retained mandibular overdenture (IRO) group was the most satisfied compared to conventional denture (CD) groups. Both on the short and long term denture satisfaction appears most favorable in IRO group when compared to a new set of CD groups. Implant-retained overdentures are, therefore, a favorable treatment modality for edentulous patients with lower denture problems. [47, 48]

A mandibular two-implant overdenture opposed by a maxillary conventional denture is a more satisfactory treatment than conventional dentures for edentulous middle-aged adults. [49]

Conventional overdenture is a more satisfactory treatment than conventional dentures for edentulous middle-aged adults. [50]

Placement of provisional implants fulfilled the requirements for initiating immediate prosthetic rehabilitation and showed that removable interim overdentures can be adequately stabilized and provide added patient comfort and satisfaction.[51]

6-High Rate of Success

Survival of implants supporting overdentures was very high and implants supporting overdentures in the maxilla had greater cervical bone loss than in the mandible.[52, 53]

From the clinical and microbiological standpoint, as well as patient satisfaction, both an overdentures (ODs) and fixed full prostheses (FFP) offer a favorable long-term outcome.[47]

Endosseous implants, serving as retention for a mandibular overdenture, has a high survival rate after ten years of follow-up (93%).[54]

The implant-retained overdenture supported by two implants in the mandible had a 100% success rate.[55]

The high success rate of dental implants has changed the quality of life for many patients.[56]

The success rates of maxillary overdentures do not appear to be as good as for mandibular overdentures; this may be attributable to the adverse loading conditions, short implant length, and poor quality of bone, number of implants used, flexible bar design, or poor treatment planning. [57]

7-Economic

The removable restoration costs less than half the price of the fixed when both technical time and implant component costs were evaluated. Maintenance for both groups was higher than expected, but patients required more appointments

in the removable group both in the first year and beyond. The overdenture offers an effective and initially a more economical alternative to the fixed prostheses, in the treatment of the edentulous mandible. However, long-term maintenance of such prosthesis can be significant. (58, 59)

Cost control was the most important reason to choose an overdenture above a fixed implant-supported prosthesis. (60)

An implant and tissue supported overdenture may give great benefit for long time denture wearers with a progressively worsening lower denture fit. An implant and tissue supported overdenture provides an economic alternative for the patient who only needs additional retention and stability for a lower denture.(61)

Initial treatment and maintenance costs over the observation period were significantly higher for fixed compared to overdenture prostheses.(53) Longer term (15 years) treatment costs for the initial two groups were significantly higher for the fixed group. The sensitivity analysis at an equal salary rate demonstrated the same trend. Time costs were significantly higher for the fixed groups.(41)

Overdenture therapy for edentulous patients is a more cost-effective treatment compared to fixed prosthodontic treatment.(8, 62)

General dentists can provide successful mandibular two-implant overdentures with minimal training.(15)

8-Improving Social Life

Edentulism has a negative impact on social and sexual life. Mandibular overdentures provide greater improvement in unease in intimate activities than new conventional mandibular dentures.[63]

A person's social life has been reported to become more active after conventional complete dentures have been replaced with implant-retained overdentures. [64- 66]

Implant-retained removable complete overdentures offer an effective rehabilitative treatment for edentulous mandibles.[67, 68]

Improved retention and function of denture may have favorable psychological effects.[22]

A significant improvement in the patient's quality of life was noticed. In comparison to conventional dentures, the implant-supported overdentures offer better function and comfort for many patients.[14]

9-High Bite Force

Objective oral function was significantly improved when the mandibular denture is supported by oral implants. The maximum bite force of subjects with a mandibular denture supported by implants is 60 to 200% higher than that of subjects with a conventional denture.[69]

Patients with complete dentures often report functional problems due to a lack of retention and stability of the mandibular denture. The maximum bite force

of these subjects is only 20 to 40% of that of dentate subjects.[32]

A better retention and stability of the denture improve the oral function. Eighteen edentulous subjects received two permucosal implants, a new denture successively. The maximum average bite force after treatment was still only two-thirds of the value obtained for dentate subjects.[32]

Maximum bite force is significantly increased as a result of implant treatment. The differences in maximum bite force obtained with magnet, bar-clip, and ball attachment are small. Thus, all 3 suprastructures greatly improve oral function.[70]

Higher bite forces have been documented for mandibular overdenture on implants. The maximum occlusal force of a patient with dentures may be improved 300% with an implant-supported prosthesis.[71]

10- Less Time Consuming

An overdenture supported by two implants is the least expensive and simplest alternative.[44]

The prosthodontic maintenance for mandibular implant overdentures required on average 72 to 98 minutes of professional time per patient during the first year of service, depending on the system used. [36]

The mean number of scheduled visits with the oral surgeon was four, and the mean time taken was 104 minutes. The mean time taken by the surgical assistant was 122 minutes. On average, the prosthodontist was required for two visits, with a total mean time of 36 minutes. In addition to the scheduled visits,

the average time taken for unscheduled visits was 32 minutes. Combining scheduled and unscheduled visits, the mean total time taken by the oral surgeon was 109 minutes. The surgical assistant was needed for a mean total of 125 minutes, and the prosthodontist spent, on average, 46 minutes in this phase of treatment.[72, 73]

ATTACHMENTS

An attachment can be defined as (a mechanical device for the fixation, retention, and stabilization of a prosthesis made up of two or more parts; a retainer consisting of a metal receptacle and a closely fitting part; the former (the female {matrix} component) is usually contained within the normal or expanded contours of the crown of the abutment tooth and the latter (the male {patrix} component), is attached to a pontic or the denture framework.[9]

Advantages of Attachments

The number of chewing cycles until swallowing was hardly decreased after implant treatment. It was concluded that significantly better masticatory performance, combined with a slightly smaller number of chewing cycles after implant treatment, results in smaller food particles being swallowed .[40]

The patient is more secure in the use of overdenture with attachment and there is splinting of the abutment.[74]

Implant-supported magnet-retained overdenture is a predictable and reliable method, especially for old patients with edentulous jaws. [75]

Ball and bar attachments are the main retainer systems for implant-bearing overdentures to achieve a successful treatment in the partial or full edentulism.[76]

Mandibular implant supported overdenture treatment reduced various denture complaints. Patients strongly preferred bar-clip and ball-socket attachments over magnet attachments. [77]

Removable and fixed prostheses were associated with complications at different frequencies and of different types. In the removable group, adjustments and foreseeable complications were numerous, recurrent, and usually easy to manage. Bar-retained prostheses had fewer complications than ball-retained ones. [78, 79]

Bar-and-clip attachments for dental implants are a common and versatile device for improving the retention and stability of a removable prosthesis.[79]

The first search on bar attachment systems produced evidence of low failure rates of interabutment bars.[80]

The type of attachment that is used in implant-supported mandibular overdentures may influence the retention and stability of the prosthesis and, thus, masticatory function. The masticatory function is significantly improved after implant treatment with each of the 3 attachments (magnet, ball and bar). Small differences in masticatory function were observed among the 3 attachment types. Slightly better masticatory performance was recorded with ball and bar-clip than with magnet attachments. The number of chewing cycles

until swallowing was hardly decreased after implant treatment. It was concluded that significantly better masticatory performance, combined with a slightly smaller number of chewing cycles after implant treatment, results in smaller food particles being swallowed. [40]

Implants used for overdenture retention are either splinted together with a cast metal bar or they remain freestanding and are not connected to one another. When a bar is used to connect the implants, clips that are attached to the bar provide retention of the overdenture.[81]

Disadvantages of Attachments

Although the attachments have many advantages, they have the following disadvantages [82]:-

1- Higher loads are transmitted to the abutment teeth during mastication and when the overdenture is inserted and removed.

2- The increased bulk of attachment will weaken the overlying denture base, and may lead to fracture of the base; also, it causes esthetic and occlusal space problems.

3- Plaque control may be more difficult to achieve especially with the bar attachment.

4- Subsequent maintenance is likely to be more complicated.

5- Using of attachments with overdenture is more difficult to fabricate.

6- More expensive than conventional telescopic overdenture.

Factors Affecting Selection of Attachment

Varieties of attachments are available for use with implant overdenture .The selection of a specific attachment depends on various factors [83]**:-**

1-The type of overdenture to be fabricated.

2-The relative importance of stability and retention.

3-The condition of residual alveolar ridges.

4-The length of the implant used.

5-The aesthetic requirements.

6-The dexterity of the patient in being able to insert and remove the prosthesis **.**

7-The psychosocial needs of the patient

8-The position of implant in the ridge .

Determinants for Attachment Selection Include .[84] :-

1- Type of prosthesis.

2- The length of the bar.

3- The number of implants.

4- Inclination of implants

5- Dexterity, expectation, and financial capabilities of the patients.

Types of Attachments

There are three types of attachments used in implant retained overdentures (magnet, ball and socket and bar-clip attachments).The type of attachments may influence the retention and stability of the prosthesis and ,thus, masticatory function. The patient is more secure in the use of overdenture with attachment and there is splinting of the abutments.[63, 64]

CLASSIFICATION OF OVERDENTURE ATTCHEMENTS

Stud Attachments [78- 85]

Ball and socket type of stud attachment consists of two halves and it has the advantage of allowing the overdenture to be retained on the abutment root face. It provides increased retention to the overdenture. The matrix can either be reactivated if it is a split metal-based cap, or replaced if it is made of a synthetic product.

Types of Stud Attachments

1- Rothermann Attachment

It has two types :

A- The non-resilient type:

The non-resilient Rotherman attachment consists of a female portion that is attached to the overdenture base and a male portion that is soldered to the abutment coping

B- The resilient type

The resilient attachment differs from the non-resilient type in that the height of the male part is 1.7 mm. This allows the C - clip to move vertically up and down. Another difference between the two types is the presence of a spacer that's placed between the abutment coping and the overdenture. The advantages of the Rotherman attachments are that the non- resilient type is very space saving and that the free hand soldering reduces laboratory time and

cost. The disadvantage is that the acrylic base may surround the C - clip and prevents it from proper opening to engage the undercut of the stud.

2- Ceka Attachment

It is indicated for overdentures with sufficient interocclusal distance. Ceka attachment was classified into 2 Types:-

A- Rigid type: of 3. 65-mm height

B- Resilient type: of 4. 1-mm height.It allows vertical and rotational movement

3- Dalbo Attachments

The ball and socket mechanism provides the direct retention of the units, which is adjusted by gently bending the finger springs around the open end of the socket.

4- Zest Anchor Attachments

A modification of the ball and socket attachment was developed but unlike many similar attachments, the socket is seated within the root face and the stud attached to the denture base. It is indicated when a transial aid is needed to provide increased retention while the patient is adapted to a new prosthesis and in permanent attachment system if a correct case selection is made.

5- Gerber Attachment

Gerber attachments has two types :-

(A) Non resilient.

(B) Resilient:- This provides vertical movement spacer between two units during processing. Both types are available in two sizes; the larger one is 5.2-mm height and the smaller one is 4.7mm, so they need enough intermaxillary distance.

6- Ancrofix Attachments

It is a resilient pressure button system that consists of four parts soldered base, replaceable retention head that has a hemispherical knob on its top, a female housing with four lamellae that can be activated to increase retention and teflon ring to allow the lamellae to function after the female housing is embedded in the resin.

BAR ATTACHMENT

Classification of Bar Attachments

Bar attachments are classified into two groups: bar joint and bar unit. [76]

A- Bar Joint:

Bar joint permits some degree of movement around the bar during mastication. It can be used for splinting abutments and improvement of retention, support, and stability. There are two types of the bar joint which are single sleeve bar joint and multiple sleeve bar joint.

I- Single Sleeve Bar Joint

II- Dolder Bar Joint

Dolder bar joint is the oldest bar system used to connect and splint the

abutment teeth. It consists of a pear shaped gold bar; the narrow side of the pear shape is towards the ridge and a rider sleeve with an integral retention flange. The single sleeve bar runs straight. The Dolder bar is fabricated in 50 mm length and 3 mm on its major diameter.

The open-sided sleeve is made from a sheet of gold alloy (0.2 mm in thickness), having the same length of the bar. A second smaller sleeve with holes on both sides is used to attach the first sleeve to the acrylic resin of the fitting surface of the denture. There is a spacer to allow vertical and rotational movements of the denture. Straight bar is contraindicated when the arch is markedly curved and when insufficient interarch space exists. [85- 88]

III- Multiple Sleeves Bar Joint

Hader bar Joint : A prefabrication of Hader bar joint as a plastic bar that is adapted on the master cast and attached to the coping wax-up and is cast with the coping. A short plastic retentive clip is embedded in the overdenture base and grasps the bar when the overdenture is inserted in place.

If more retention is desired, the plastic clip can be transferred into metal clip. [89]

Overdenture retained by bar attachment (Hader bar system) exhibits apical force on the abutment teeth and less torque. [90]

Ackermann Bar Joint

The Ackermann system is a bar and rider attachment, the bar is supplied in three types which are a rounded bar, oval bar and a pear shaped bar.

The rider is clip has acrylic wings in a labio-lingual orientation. The clip measures 3-6 mm in length and it is common for the three types of bars. [91]

B- Bar Unit:

Bar unit provides rigid fixation of the overdenture. It has parallel walls that prevent rotation or vertical movements of the prosthesis. [92]

1- Dolder Bar Unit:

The Dolder bar unit system has a parallel side bar providing rigid fixation. The retention between the sleeve and the bar is entirely frictional. [91]

2- CEKA Bar Unit:

Ceka bar unit consists of one or more basic Ceka studs incorporated in a rectangular bar. It has special design to be directly retained in acrylic.[93]

3- CM Bar Unit:

CM bar unit is a precious metal bar which can be cut to the correct shape to fit the ridge and adapted on master cast. The rider can be cast to fit the bar.[94]

Advantages of Bar-clip Attachment:

When overdenture retained by two implants splinted by a bar was compared to conventional denture and implant supported fixed prosthesis,it was found that bone resorption was absent in the maxilla against mandibular overdenture retained with two implants splinted with a bar.[95]

The bar retained overdenture provides more advantageous than both magnet

and ball attachments as it provides more retention and patient satisfaction related to prosthesis stability and chewing comfort which was the lowest in the magnet group. Also, magnet and ball attachments presented the highest incidence of prosthetic complications. For example, magnets needed renewal because of wear and corrosion. The ball group needed frequent tightening of the abutment screws and renewal of the rubber rings. Ulcer was observed more often in the magnet and ball groups. [96]

Ball and bar attachments are the main retainer systems for implant-bearing overdentures to achieve a successful treatment in the partial or full edentulism.[76]

The milled bar implant-supported prosthesis offers the benefits of both fixed and removable restorations. It was also added that Its infrastructure provides the same rigidity as the fixed restoration, owing to the precise fit to the superstructure, which is removable, to promote adequate access for hygiene, yet it still provides lip support and maintains close contact with the soft tissues. These advantages enhance phonetics, esthetics, correct lip support, maintenance, and patient comfort.[57]

A variety of bar designs has been advocated. The Hader bar developed by Helmut Hader in the 1960s has become one of the most popular bar and-clip concepts because of its simplicity, versatility, low profile, and 20-degree clip rotation. Plastic clips are advantageous over metal clips because they are easier to replace and are usually less expensive.[97]

When vertically and obliquely directed dislodging forces were applied, the bar

and clip attachment system had the highest value of retention followed by ball and then magnets were the last one.[98]

Implants used for overdenture retention are either splinted together with a cast metal bar, or they remain freestanding and are not connected to one another. When a bar is used to connect the implants, clips that attach to the bar provide retention of the overdenture.[81]

There was slightly better masticatory performance with ball and bar-clip than with magnet attachments. It was concluded t that the number of chewing cycles until swallowing was hardly decreased after implant treatment.[40]

The first search on bar attachment systems produced evidence of low failure rates of interabutment bars.[88]

Removable and fixed prostheses were associated with complications at different frequencies and of different types. In the removable group, adjustments and foreseeable complications were numerous, recurrent, and usually easy to manage. Bar-retained prostheses had fewer complications than ball-retained ones. [78, 79]

Bar and clip attachments provide greater retention and stability, permit splinting of implants, and can mask excessive residual ridge atrophy.[79]

Mandibular implant supported overdenture treatment reduced various denture complaints. Patients strongly preferred bar-clip (10 subjects) and ball-socket attachments (7 subjects) over magnet attachments (1 subject). Patients' preference could not be predicted on the basis of baseline observations.[77]

PREFABRECATED BAR

New design of bars called Dyna Instant Adjusting Bar (I.A.Bar) was developed by Dyna industries which has several advantages and indications that overcome that of cast bar as follows [99]

Advantages:

1- 100% stress free construction

2- High precision

3- Fully prefabricated in titanium

4- Time saving

5- Simple procedure

6- Reduction of costs.

Indications of I. A. Bar

Dyna Instant Adjusting Bar is indicated for restoring edentulous patients with bar retained overdentures supported by two implants. Though, it is possible to produce an overdenture supported by e.g. two separate bars in the upper or lower jaw.

Contra-Indications

All contraindications associated with elective prosthetic rehabilitation on implants should be noticed. The use of Dyna Instant Adjusting Bar is additionally contraindicated for:

1- Implants placed less than 16 mm from each other (If less the I.A. Bar joints must be adjusted).

2-Implants placed more than 26 mm from each other.

3- Implants with an angulation of more than 9º non parallel position.

4-When hygienic requirements can not be met.

5- In situations when occlusal forces transferred to the bar are not favourable.

6- Unfavourable buco/lingual supporting implants inclination.

7- In all situations where it is not indicated.

METHODS OF EVALUATION OF DENTAL IMPLANTS

Implants are evaluated by certain parameters such as bone density, marginal bone loss, gingival index, plaque index, and mobility index.

BONE DENSITY

Available bone is particularly important in implant dentistry and describes the external architecture or volume of the edentulous area considered for implants. In addition, bone has an internal structure described in terms of quality or density, which reflects the strength of the bone.[100, 101]

For osseointegration of endosteal implants to occur, not only is adequate bone quantity (height, width, and shape) required, but adequate density is also needed.[102]

Bone structure is the most important factor in selecting the most favorable treatment outcome in implant dentistry. Bone quality is a significant factor in determining implant selection, primary stability, and loading time. [15, 103]

The excellent success rates obtained depend on the bone quality and volume. For implants placed in type IV bone and in bone grafts, the reported failure rates are higher as they have the weakest biomechanical strength and the lowest contact area to dissipate the load at the implant/bone interface. [1, 15]

Bone density was classified by (Linkow)[104] into three categories:-

Class 1 bone structure: This ideal bone type consists of evenly spaced trabeculae with small cancellated spaces.

Class 2 bone structure: The bone has slightly larger cancellated spaces with less uniformity of the osseous pattern.

Class 3 bone structure: Larger marrow filled spaces exist between bone trabeculae.

Another classification for bone density was stated by (Misch)[1] as follows:-

Class I: bone has a very satisfactory foundation for implant prostheses.

Class II: bone is satisfactory for implants.

Class III: bone results in a loose-fitting implant.

Many bone density classifications were raised as follows [1]:

I- Dense and porous cortical bone is found on the outer surfaces of bone and includes the crest of an edentulous ridge.

II- Coarse and fine trabecular bone is found within the outer shell of cortical bone and occasionally on the crestal surface of an edentulous residual ridge.

I-According to The macroscopic description bone density was classified into [90]

D1 bone is dense cortical bone.

D2 bone has dense to thick porous cortical bone on the crest and within coarse trabecular bone.

D3 has a thinner porous cortical crest and fine trabecular bone.

D4 bone has almost no crestal cortical bone.

D5 is very soft bone with incomplete mineralization (immature bone).

II- According to tactile sense of the operator bone was classified into [1]

Drilling into D1 bone is similar to drilling into oak or marple wood.

Drilling into D2 bone is similar to drilling into white pine or spruce.

Drilling into D3 bone is similar to drilling into balsa wood.

Drilling into D4 bone is similar to drilling into styrofoam.

III- According to bone location bone was classified into [1] :-

D1 bone is almost never observed in the maxilla but in the mandible, D1 bone is observed

about 8% of the time. D1 bone is observed twice as often in the anterior mandible compared with the posterior mandible.

D2 Bone density is the most common bone density observed in the mandible. The anterior mandible consists of D2 bone two thirds of the time. The maxilla presents D2 bone less often than the mandible.

The anterior maxilla has D3 bone about 65% of the time.

The softest bone, D4, is found more often in the posterior maxilla.

Bone quantity and quality are classified as follows [(1)] ***:-***

Bone quantity (height, width, and shape) was assessed as follows :

Class A: Most of the alveolar ridge is present.

Class B: Moderate resident ridge resorption has occurred and only basal bone remains.

Class C: Advanced resident ridge resorption has occurred and only basal bone remains.

Class D: Some resorption of basal bone has begun.

Class E: Extreme resorption of the basal bone has taken place in the mandible.

Class F: Extreme resorption of the basal bone has taken place in the maxilla bone.

Bone quality (types of bone structure) found in the anterior regions of the jawbone was assessed as follows :-

Quality 1: was composed of homogenous compact bone.

Quality 2: had a thick layer of compact bone surrounding a core of dense trabecular bone.

Quality 3: had a thin layer of cortical bone surrounding dense trabecular bone of favorable strength.

Quality 4: had a thin layer of cortical bone surrounding a core of low-density trabecular bone.

Periapical or panoramic radiographs are not beneficial to determine bone density because the lateral cortical plats often obscure the trabecular bone density. In addition, the more subtle changes of D2 to D3 cannot be quantified by these radiographs. [105]

One may determine bone density more precisely by tomographic radiographs, especially computerized tomograms. [92]

MOBILITY

Assessment of implant mobility in routine evaluations and clinical monitoring of implants must always be performed in conjunction with the evaluation of the other parameters, as the increase in clinical mobility represents a highly specific, but not at all a sensitive parameter for monitoring clinical stability [106]

During implant placement, primary stability is often defined by the surgeon as the

lack of clinically detectable motion when using two opposing instruments in a lateral direction. (92)

A health implant moves less than 73 µm; hence, it appears as zero clinical mobility. (107)

Lack of implant mobility does not always coincide with a direct bone-implant interface.(108)

However, when observed clinically, rigid fixation usually means that at least a portion of the implant is in direct contact with bone, although the percentage of bone contact cannot be specified.(96)

The primary criteria for assessing implant quality are pain and mobility. The presence of either factor greatly compromises the implant, and removal is usually indicated.(107)

Implant mobility can be assessed using the handles of two dental mirrors. (108)

Radiographic examination of marginal bone height changes together with fixture mobility tests seems to be the preferable parameters in the assessment of prognosis for osseointegrated fixtures. (109)

Also in assessing clinical parameters, there should be no mobility associated with dental implants. The presence of mobility is a good indication of future implant failure. (110).

The supragingival portion of each implant was subjected to alternative pressure in a buccolingual and mesiodistal direction between the handles of two mirrors.(111)

PERCUSSION

Percussion is often used on teeth to determine which tooth is sensitive to function or is beginning to abscess. In the past, percussion was used to evaluate the presence of rigid fixation. However, percussion is neither an indicator of clinical health nor rigid fixation. The ringing sound that occurs on percussion only corresponds to the presence of some bone at the interface because 2 mm of bone and 16 mm of bone-implant interface sound almost identical. Percussion may be used to diagnose pain or tenderness with an implant but is misleading if used to determine the status of rigid fixation.[1]

MARGINAL BONE LOSS

It was concluded that changes in the crestal bone level occur mostly in the first postsurgical year. Prosthetic complications were rare, mostly encountered in the first year after loading and often limited to re-tightening of the occlusal screw.[112]

The peri-implant clinical parameters differed only slightly between bar and ball and magnet implants. No correlation was found between bleeding on probing and marginal bone loss. [113]

It is generally accepted that bone loss around implants does not occur at stage-II surgery because implants do not receive mechanical loading. However, early marginal bone loss around implants occasionally does occur during the healing period. [114]

Micromovement of an endosteal dental implant and excessive stress at the implant-bone interface have been suggested as potential causes for peri-implant bone loss and failure of osseointegration.[5] In a 3-year longitudinal study of successful dental implants, reported an average loss of marginal bone of 0.4 mm during the first year following implant placement and 0.03mmper year during the second and third years were recoded. [115]

GINGIVAL INDEX (G. I.)

The modified Gingival Index (GI) may be used with success to assess the status of health or inflammation in peri-implant mucosal tissues to indicate mucositis in clinical research, it may be preferable to use bleeding on probing (BOP) for routine clinical documentation. Calibration exercises to determine accuracy and repeatability of examiners using BOP should be performed prior to initiating studies in the same manner as for the GI. [116]

PLAQUE INDEX (P.I.)

The Mombelli index was used to quantify the amount of plaque retained on the surface of the supramucosal part of the implant The mombelli index was used to quantify the amount of plaque retained on the surface of the supramucosal part of the implant (mombelli et al 1988)[117]

Score 0: No detection of plaque

Score 1: Plaque can be detected by running probe across

the smooth marginal surface of the implant

Score 2 Plaque can be seen by the naked eye

Score 3 Abundance of plaque material

MATERIALS AND METHODS

MATERIALS AND METHODS

Materials used in this study

The materials used in this study were implant system and prosthetic dental materials.

I- IMPLANT SYSTEM*:

1- The implants

Two stages push in (press fit) Titanium implants with ϕ 3.6 mm diameter and 13 mm length were used. The implant is cylinder with reversed screw and hydroxyapetite coat (Fig. 1).

2- The healing abutments

Titanium healing abutments with ϕ 3.6 mm diameter and 6 mm length were used in the second surgical phase to heal and form the gingiva. (Fig. 2).

3- Bar Attachements Consisted of:-

- Bar abutments (Fig. 3).
- Laboratory implant analoge (Fig. 4).
- Long –headed Laboratory Screw (Fig. 5).
- Plastic clip (Fig. 6).
- Metal housing (Fig. 7).
- Castable plastic bar (Fig. 8).
- Castable plastic sleeve (Fig. 9).

Prefabricated Dyna Instant Adjusting Bar (I.A.Bar) consisted of:-

Instant Adjusting Bar (I.A. Bar) consists of (Fig. 10):-

- I.A. Bar Joint (arm Ø 1.9 mm)
- I.A. Bar Round
- I.A. Bar Octa extension abutments
- I.A. Bar Fixation screw
- I.A. Bar Laboratory analogue.

***Dyna Dental Engineering, Bergen op zoom, Netherlands**

- I.A. Bar Impression coping
- I.A. Bar Closing screw
- I.A. Bar Riders

4- Implant laboratory analoge.

II-PROSTHETIC DENTAL MATERIALS

The prosthetic dental materials used in this study are listed in table (1)

Table (1): Prosthetic dental materials used in the present study

Material	Trade name	Manufacturer	Made in
Base plate wax	(regular) Modelling Wax	Cavex	**Netherlands**
Heat cured acrylic resin	Heat cured resin	Acrostone Dental Factory	**Egypt**
Self cured acrylic resin	Self cured acrylic resin	Acrostone Dental Factory	**Egypt**
Alginate impression material	Cavex CA 37	Cavex	**Netherlands**
Rubber base impression material light body	Coltène AG	Feldwiesenstrasse	**Switzerland**
Rubber base impression material mediums body	Impregum F,	ESPE Dental AG,	**Germany**
Dental stone	Super- cal IV,	COE Laboratories Inc	**USA**
Chrome-Cobalt alloy	Cobalt-Chroe- Leglerung / Typ federhart /CrMo/ extra	BioSil, Degussa, hard.	**Germany**
Investment material	Multi-Vest	Dentsply	**USA**
Green seal compound	Kerr	Kerr U.K.Limited	**Netherlands**

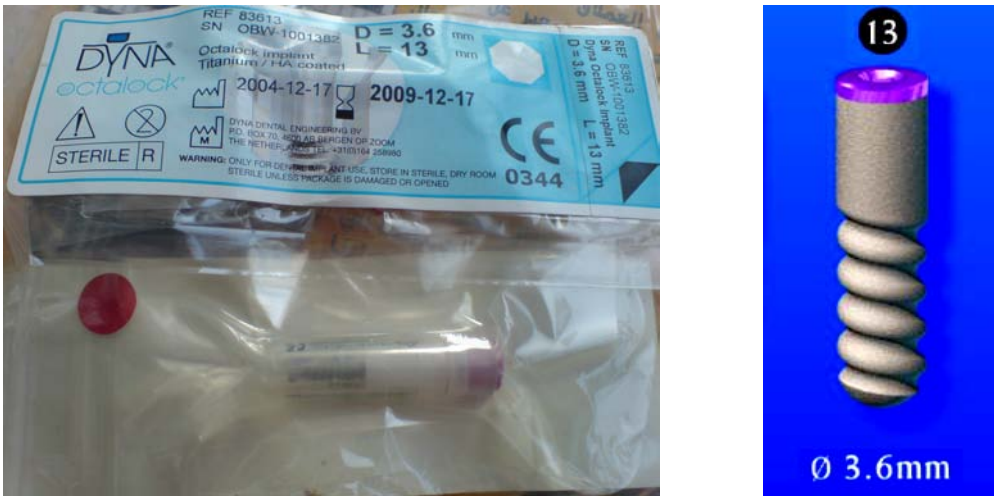


Fig. (1): Dyna dental implant.

Fig. (2): Dyna titanium healing abutments.

Fig. (3): Bar abutments.

Fig. (4): Laboratory implant analogues.

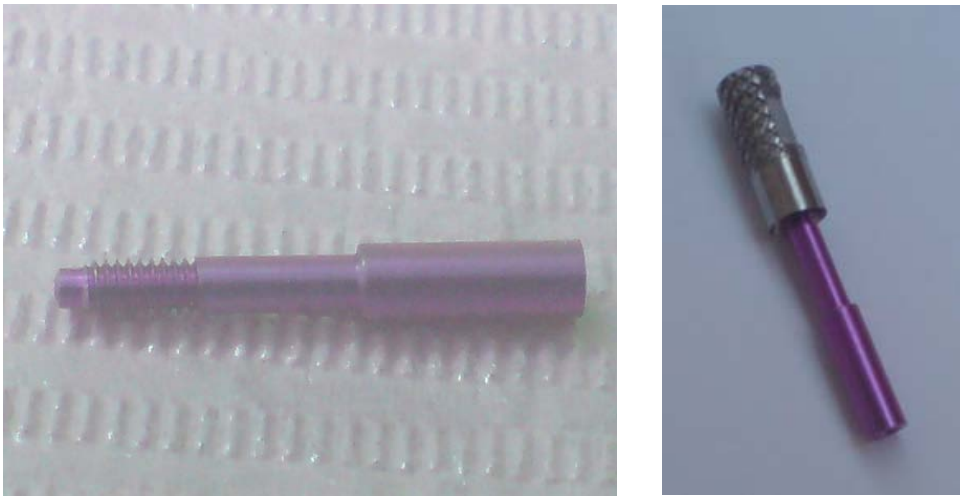


Fig. (5): Long–headed laboratory screw

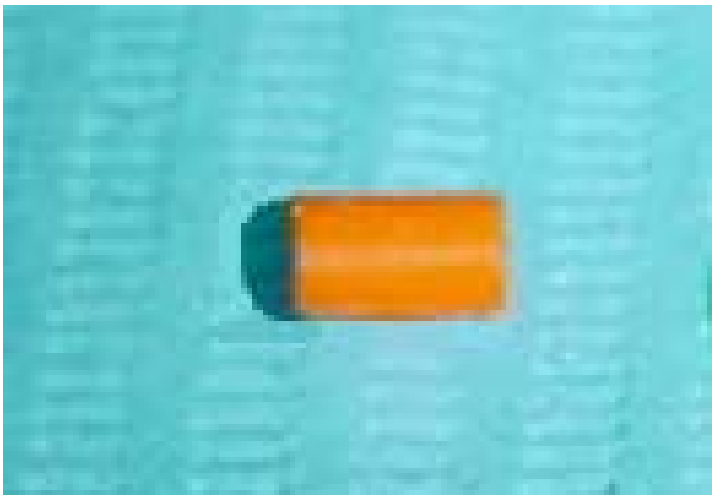


Fig. (6): Plastic clip

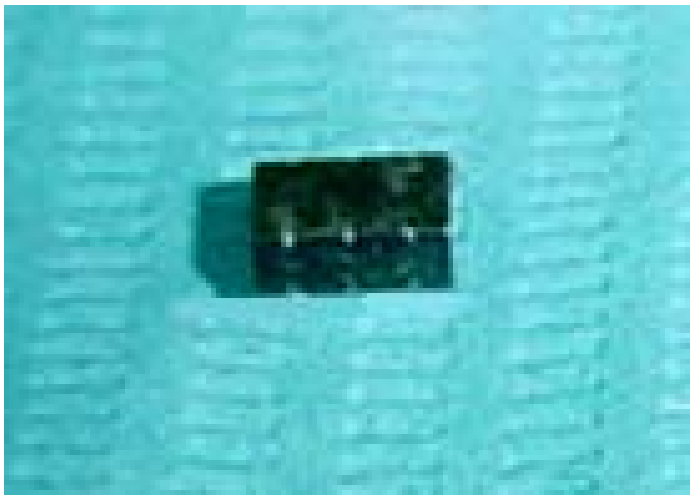


Fig. (7): Metal housing.

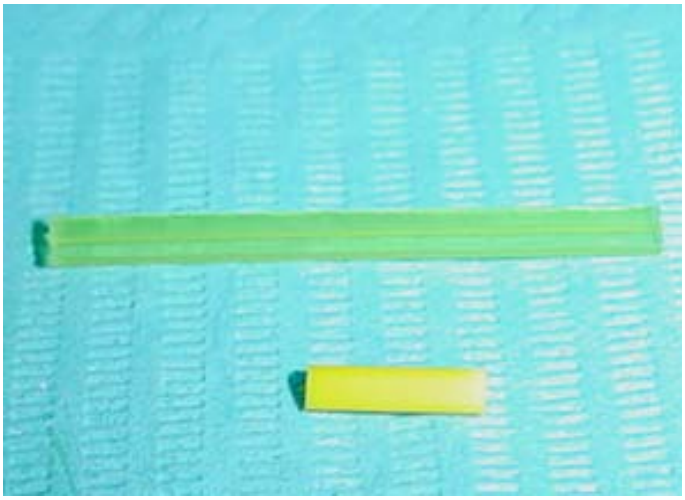


Fig. (8): Castable plastic bar

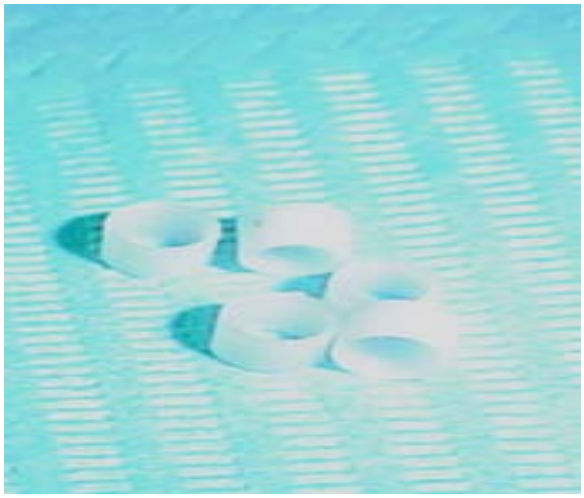


Fig. (9): Castable plastic sleeve

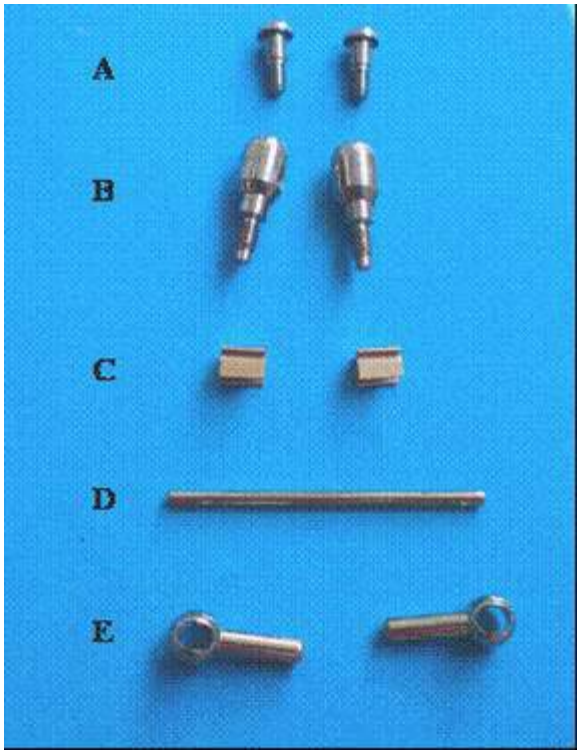


Fig. (10): (A) I.A. Bar fixation screw, (B) I.A. Bar Octa extension abutments, (C) I.A. Bar riders, (D) I.A. Bar round and (E) I.A. Bar joint.

Implant Armamentarium

The surgical kit of Dyna implant system (Fig. 11) consisted of:

- Pilot drill (externally irrigated)

- Spade drill 3 and 3.6 mm (internally irrigated)

Special drills:-

- Crestotome drill (internally irrigated)

- Bone cutter drill rose shape (internally irrigated)

- Lindemann Fraise Direct ϕ2.3 (externally irrigated)

- Spiral drill 2 mm (internally irrigated)

- Parallel/Depth instruments 2, 3, and 3.6 mm

- Implant puller

The prosthetic instruments:-

Torque wrench with 32 Ncm.

Single slot driver.

Octa slot driver

An electric motor/irrigation system with adequate flow of irrigation (30/60 ml/min) and a reduction hand piece whose drilling speed ranged from 125-1700 R.P.M. were used (Fig. 12).

PATIENTS' SELECTION AND EXAMINATION

Ten patients 5 males and 5 females with age ranged from 51-67 years old were selected from clinic of removable prosthodontics, Faculty of Oral and Dental Medicine, Al-Azhar University and from my dental clinic in Mansoura, Egypt.

PATIENTS' EXAMINATION

1-Assessment of the general condition

The medical and mental history, clinical and radiographic inspection and laboratory investigations (Complete blood picture with glucose level) were performed for each patient by a physician).

2-Assessment of the oral condition

Visual and digital examinations were done to detect any inflammation or hypertrophic tissues that may require removal. The size of the tongue and the tightness of the lower lip were also evaluated. Maxillary-mandibular relationship was also evaluated. The labiolingual width of the bone at the prospective implant site was measured using a caliper with pointed end after giving local anesthesia.

3-Examination of tempromandibular joint

Tempromandibular joint examination was done to detect any joint disorders and to determine the degree of maximum opening of the mouth to detect the accessibility during surgery.

PATIENTS' SELECTION

The patients were selected according to the following criteria:

1- Completely edentulous patients for at least 6 months before beginning of the study.

2- Class I jaw relationship.

3- Free from any systemic diseases (cardiac disease, uncontrolled diabetus mellitus, and debilitating diseases) that may affect the prognosis of implant-overdenture.

4- Healthy firm mucosa covering the edentulous ridge which was free from any remaining roots, cysts, residual infection or impacted teeth.

5- Each subject was required to have a minimum interarch distance of 20 mm and a fairly equally divided intermaxillary spacing (this was necessary to ensure room for the attachment within the mandibular overdenture)

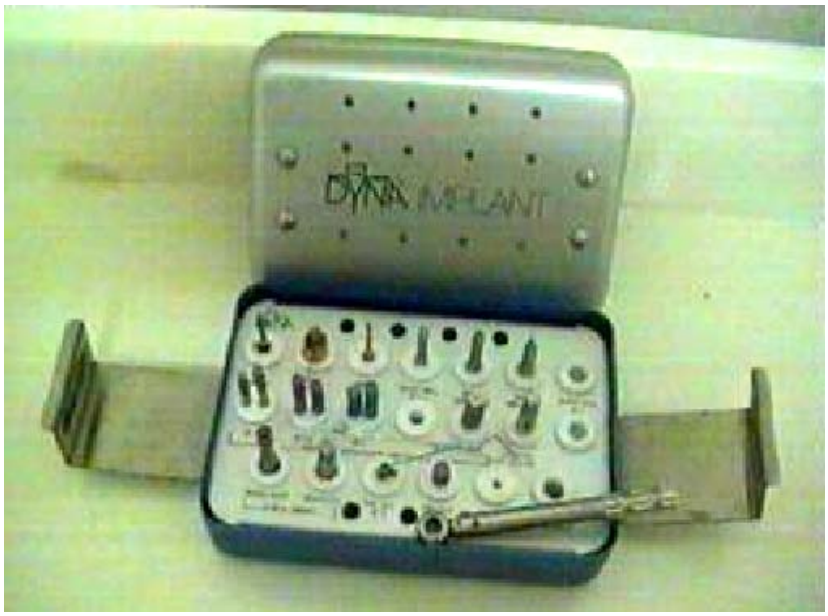


Fig. (11): The surgical kit of Dyna implant system

Fig. (12): An electric motor/irrigation system with adequate flow of irrigation

6- Co-operative patients.

7- Patients could be motivated for good oral hygiene.

The following patients were excluded from the study:

1- Patients with history of previous radiation or osteoporosis.

2- Patients with history of buruxism or clenching.

3- Patients with bone width less than 7 mm at the prospective implant site.

4- Cases with severe bony undercuts (especially lingual bony undercut), sharp bony edges and wiry ridges.

5- Heavy smokers (more than twenty cigarettes per day) .

6- High frenal or muscle attachments that may require surgical correction.

7- Presence of any attached or keratinized mucosa at the prospective implant site.

8- Cases of either extremely large or small jaws.

9- Patients with TMJ disorders or limited mouth opening.

PREPARATIONS OF THE PATIENTS TO RECEIVE IMPLANT RETAINED #OVERDENTURE

1-Construction of interim denture

Primary alginate impressions in stock trays were made for the upper and lower arches, and poured into plaster. Self-cure acrylic special trays were made for each cast. Border molding with green compound was performed and the secondary impression of both the maxillary and mandibular arches were made using rubber base impression material then stone casts were poured. The recording blocks were made and the centric relation was registered in the mouth at the proper vertical dimension. The casts were mounted on the articulator and setting was done using 20 degrees cusp angle acrylic teeth. The waxed denture was tried in the mouth to obtain the patient approval then returned to the articulator. The lower cast was duplicated and the denture was finished. Two weeks after the first stage surgery, relief was done on the fitting surface opposite to the canine area and the prosthesis was used as interim denture.

2-Construction of the radiographic guide

The prospective implant sites (under the artificial canine) were marked on the duplicated lower cast. One sheet of base plate wax was adapted onto the lower cast similar to denture base. The wax was transferred to clear acrylic resin in the usual manner. Two metal balls 5mm in diameter were attached to the acrylic guide at the prospective implant sites using self-cure acrylic resin. Then the radiographic guide was finished, polished and checked in the patient's mouth (Fig. 13). Panoramic x- ray film was made for each patient with the radiographic guide in place in the patient's mouth to evaluate bone quantity and quality and to detect the location of the prospective implant sites in relation to the mental foramen (Fig. 14).
The radiographic guide was modified to be used as surgical guide by removal of the two metal balls and making two holes at their sites
Measurement of the diameter of metal spheres was made on the x ray film to correct the distortions of the panoramic radiograph and the true amount of vertical bone height at the proposed implant sites.
The actual amount of clinically available vertical bone height at the proposed implant sites can be calculated from the known diameter of metal spheres as follows:

$$\mathbf{S \times RM = RS \times RX}$$

Where:

S is the actual metal sphere measurement.

RS is the x-ray metal sphere measurement.

RM is the x-ray bone measurement.

RX is the bone measurement thought.

SURGICAL PHASES

Surgical procedures were done in two stages under local anesthesia on the dental chair with strict measures of sterilization.

Surgical Approach Stage I (implant insertion)***:-***

The patients were asked to rinse their mouths with Betadine for 3 minutes prior to surgery and the circumoral skin was rubbed with 70% alcohol to remove cosmetics, grease dirt or layers of dead cells and wiped with Betadine. Bilateral lingual and labial infiltration anesthesia was given to each patient using Mepivacaine Hydrochloride 2% with Adrenaline 1:100,000*.

The surgical guide was removed from the Betadine and washed with saline, then inserted into the mouth and the position of the fixture sites were determined and marked on the mucosa by dental probe (Fig. 15). The guide was removed and by using a lancet with surgical blade number 15 a long flap incision through the mucosa just lingual to the crest of the lower ridge was made.The incision was extended 15-20 mm distal to the site of implant in both sides. The oblique incision (about 1 cm) was made in distal and vestibular directions at each end of the long incision (Fig. 16).

The flap was then reflected using muco-periosteal elevator (Fig. 17). The alveolar crest was flattened and any irregularities were removed using the bone file and crestotome with internal and external irrigation leaving ivory clean bone surface (Fig. 18).

The surgical guide was inserted into the mouth and the position of the fixture sites were finally determined by the holes of the surgical guide. The definitive location of implantation for initial drilling was marked with rose- shape bone cutter drill at low speed with internal and external irrigation. The drills were attached to a contra-angle hand-piece which was, in turn, connected to a physiodispenser. The procedure of drilling was performed

***Scandonist 2%Spécial Septodont, France.**

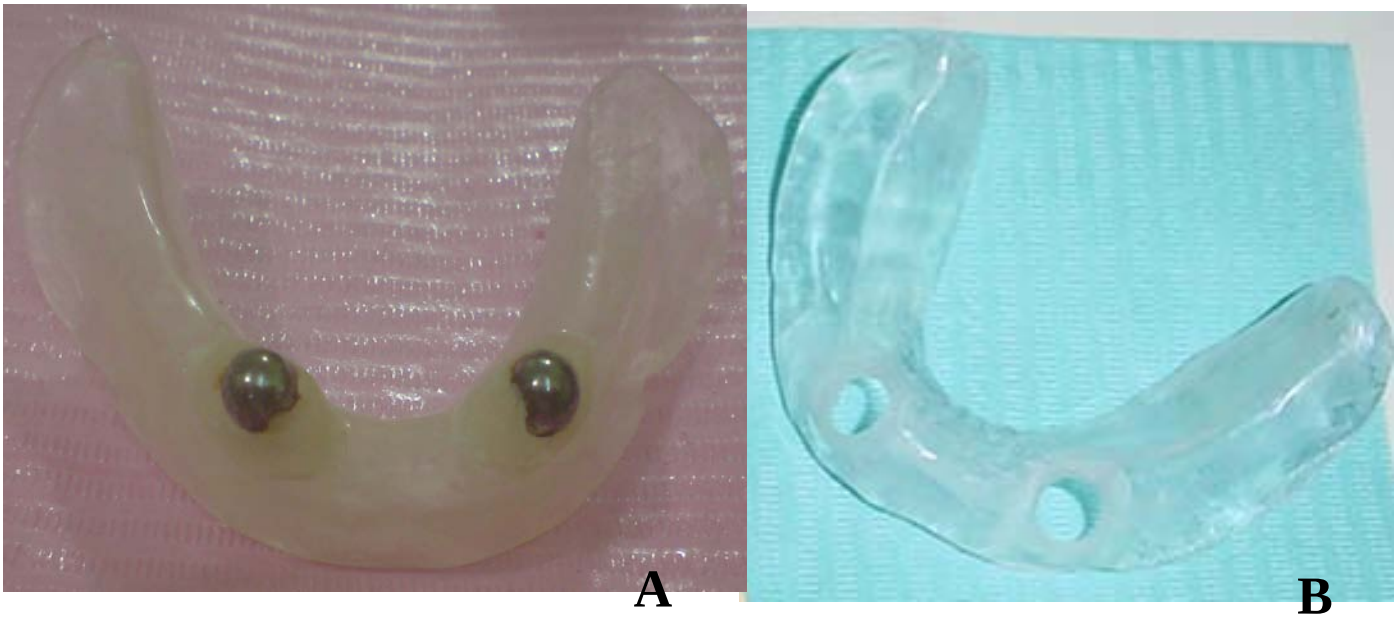


Fig. (13): (A) Acrylic guide with two metal spheres before making panoramic x ray.
(B) Surgical acrylic guide with two holes.

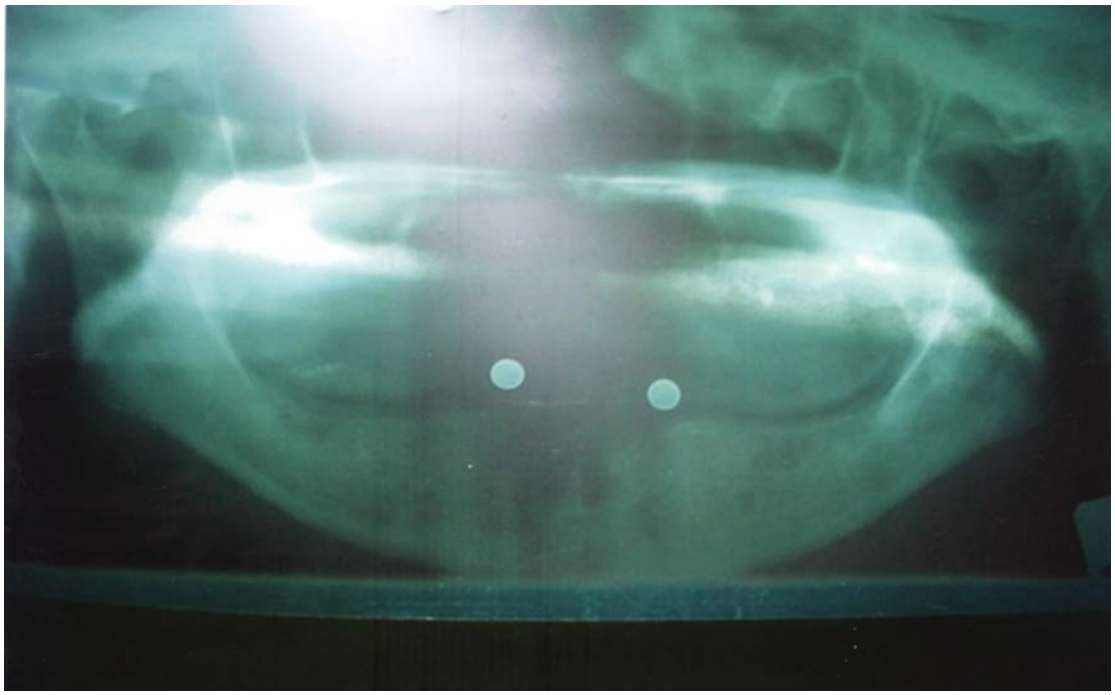


Fig. (14): Panoramic X- ray film.

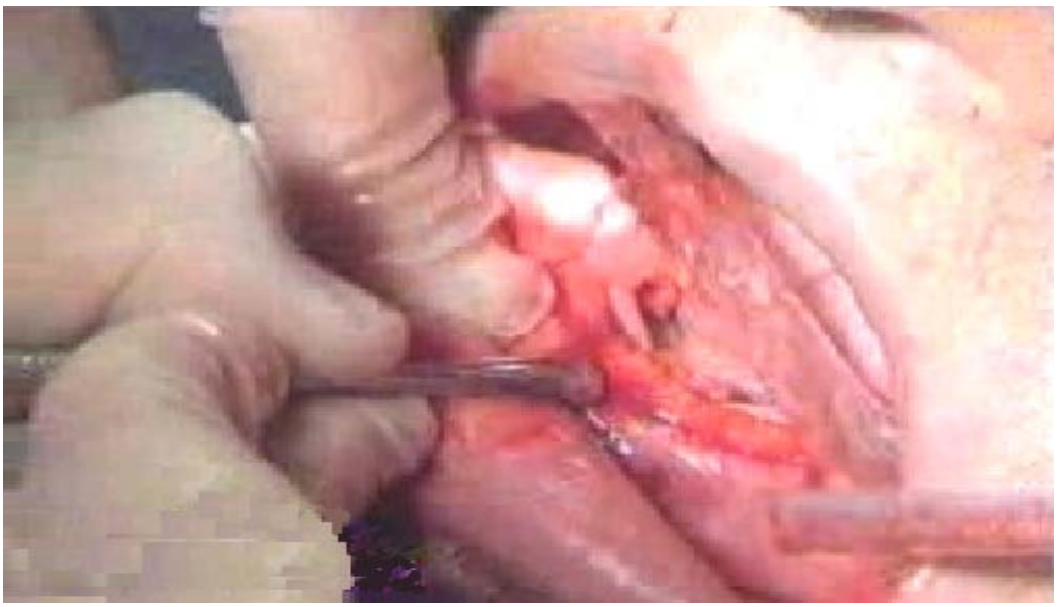


Fig. (15): Surgical guide inserted into the mouth to determine the position of the fixture sites

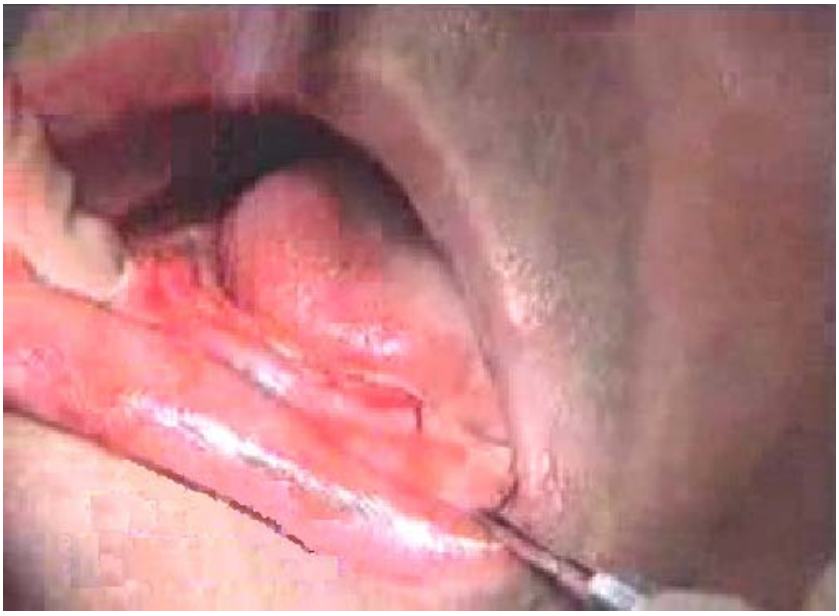


Fig. (16): Oblique incision in distal and vestibular directions at each end of the long incision

Fig. (17): Reflection of the flap using muco-periosteal elevator

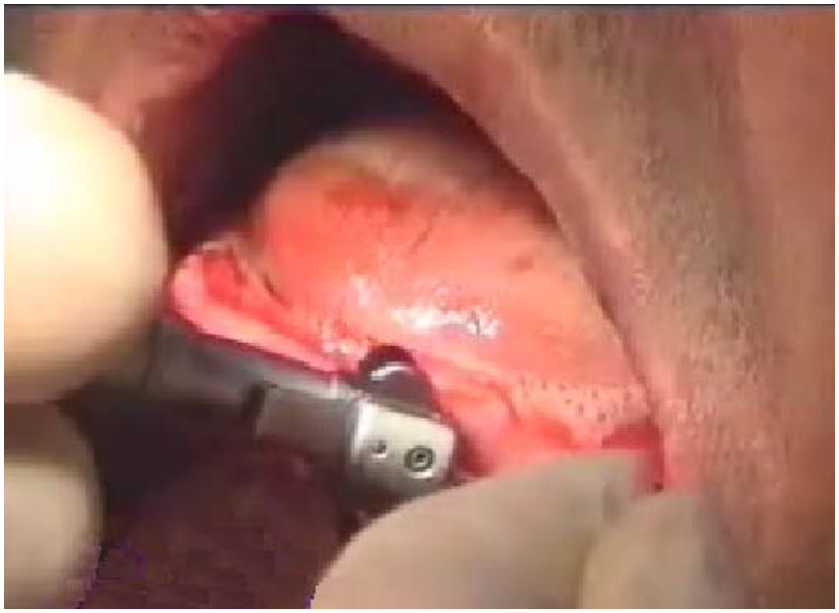


Fig. (18): Alveolar crest was flattened using the bone file and crestotome

at a maximum rotation speed of 2500 rpm under profuse internal and external irrigation with room temperature saline. Initial bone drilling started using the pilot drill under light intermittent pressure to the determined depth. Lindemann Frees was used to make the preparation wider and to slightly change the angulations if required .Then by spade drills of successively increasing diameter, the implant sites in bone were gradually widened and adjusted to fit the implants (Fig. 19).

Parallel depth instruments were successively installed into the prepared sites to establish parallism between the preparation sites of implants and to measure the depth of the prepared sites (Fig. 20) where the implant was inserted at or above the bone crest (Fig. 21 and 22).

Before suturing, good irrigation of the wound was done and excess soft tissue was removed then the flap was secured by interrupted sutures.

Post Operative Instructions:

The patients were asked to bite on gauze rolls during the first hours to reduce the risk of hematoma formation under the flap. The patients were instructed to use liquid or soft diet during the first week. Antibiotic (Velosef, 500 mg cap. 3 times daily),anti-inflammatory(Ibuprofen, 400mg cap.3 times daily) and (Clinitol mouth wash containing 0.2% Chlorohexidine) were prescribed for a week after surgery.

Seven days after operation, sutures were removed and all patients were being under observation during the four months (osseointegration period).

The implants were checked for successful osseointegration by X-ray photo and clinical evaluation before proceeding with the second phase (Fig. 23).

Two weeks after surgery the interim denture was checked in the mouth and the lower denture was relieved especially at the operation site and relined with chair-side soft liner. The interim denture was used during the osseointegration period until the definitive overdenture was made.

Surgical Approach Stage II:

After four months from the first surgery, the area of implant site was locally anaesthetized with infiltration anesthesia. Implants were located using surgical guide and dental probe, then uncovered with small incision using no 15surgical blade (Fig. 24).

The Titanium covering screw was unscrewed from the implants and replaced with the healing abutment (Fig. 25 and 26). In some situations, layer of bone covering the implant was removed to screw the healing abutment tightly to the implant.

To check the osseointegration, mobility test was made for each patient. Mobility test was recorded clinically by placing the healing abutment between two sterilized metal handles of dental mirrors and exerting firm pressure in all directions (labio-lingual and mesio-distal).

Any degree of implant movement is considered failure of osseointegration. Another test for osseointegration was done by percussion test using a handle of dental mirror, where dull percussion sound indicates failure of osseointegration.

The healing abutments were left in place for two weeks to allow healing of gingival tissue and the patients were advised to apply gel containing Chlorhexidine (EZ- CARE oral gel)* three times a day for 3 days after placing the healing abutments. The fitting surface of the mandible interim denture was heavily relieved opposite to the healing abutment until complete seating of the denture occurred.

GROUPING OF THE PATIENTS

Selected patients in this study were randomly divided into two groups, five patients in each group to receive either sequence:-

Group I: - This group was provided with cast bar-retained overdentures.

Group II:- Patients in this group were provided with prefabricated bar- retained overdentures.

CONSTRUCTION OF *OVERDENTURES RETAINED BY CAST BAR*

(GROUP I)

The Dyna bar abutment is an attachment designed to be used with the Dyna implants.

1- Full arch alginate impressions of the edentulous arch with healing abutments were made (Fig. 27) and impressions were poured into dental stone (Fig. 28).

***Vita Pharm for EZ-Pac Alexandria-Egypt**

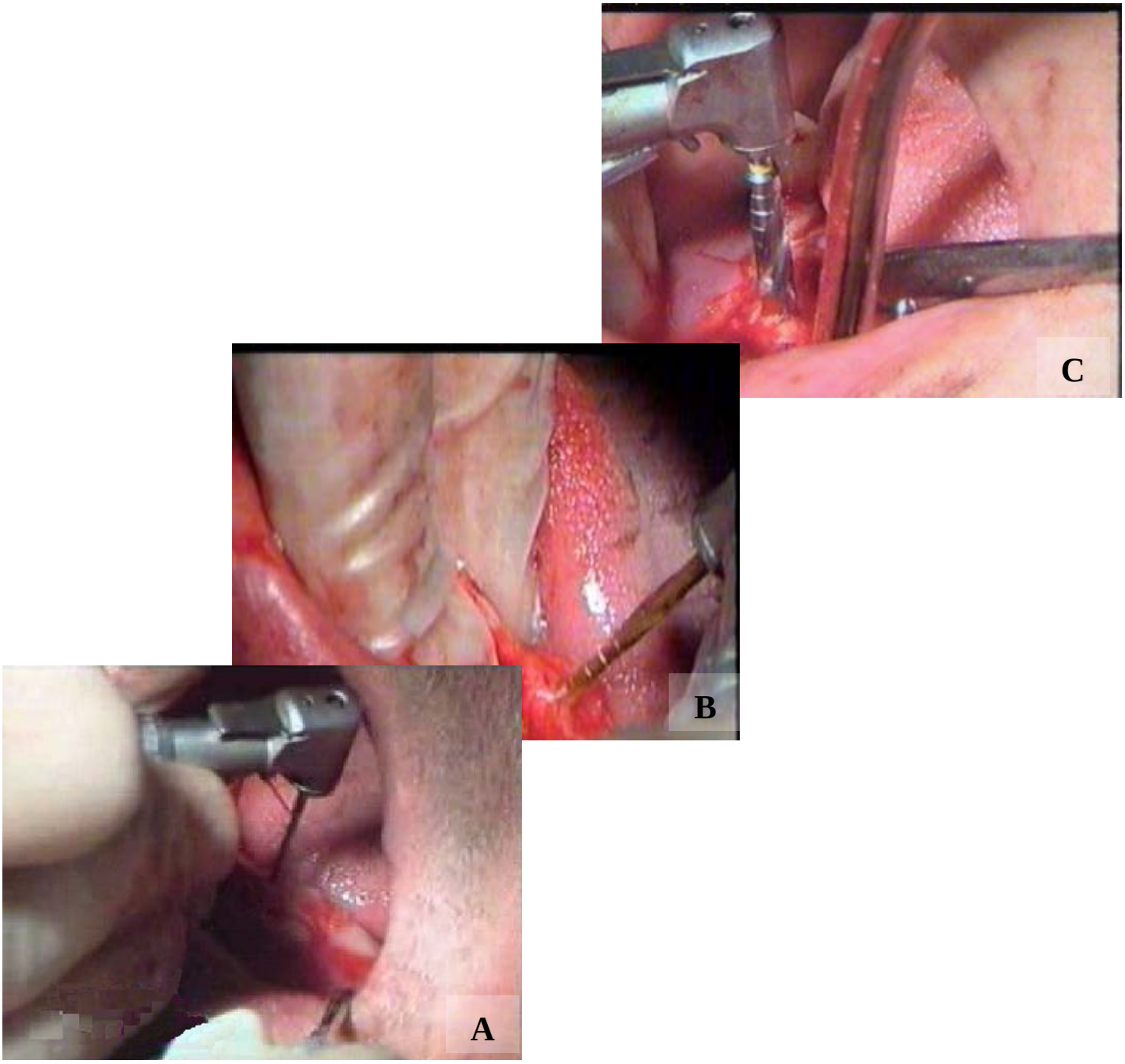


Fig. (19):

A: Initial bone drilling with pilot drill

B: Preparations widening by Lindemann frees.

C: A successively increasing diameter with spade drills

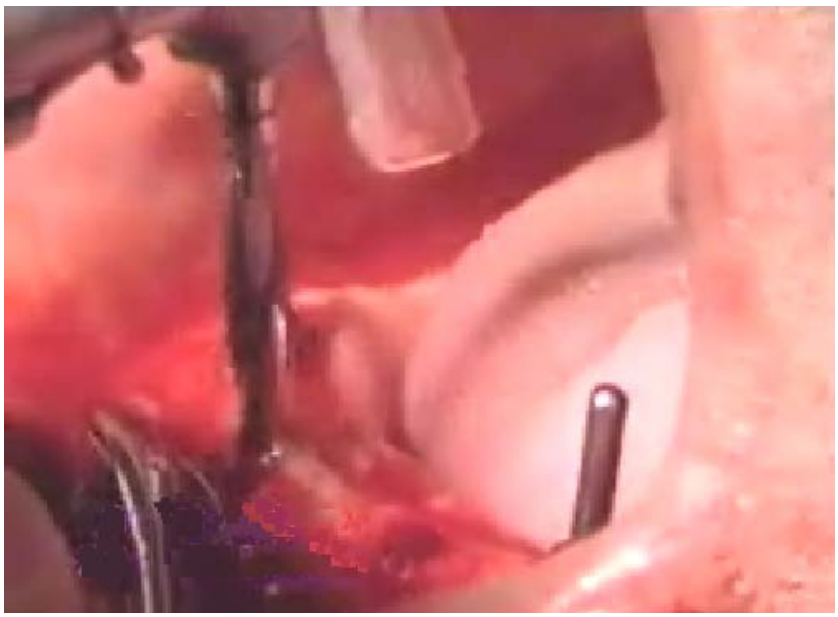


Fig. (20): Parallel depth instruments.

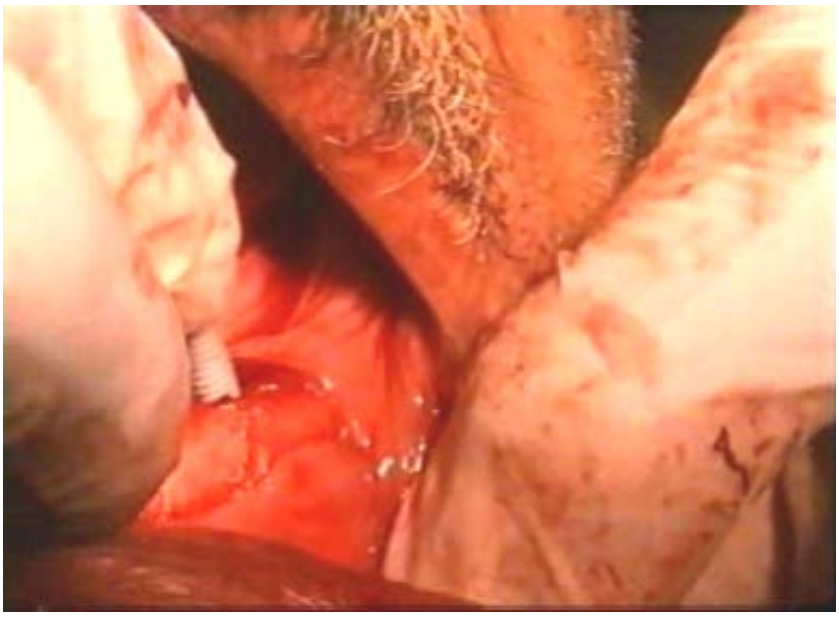


Fig. (21): The sterile implant was picked up into its prepared site

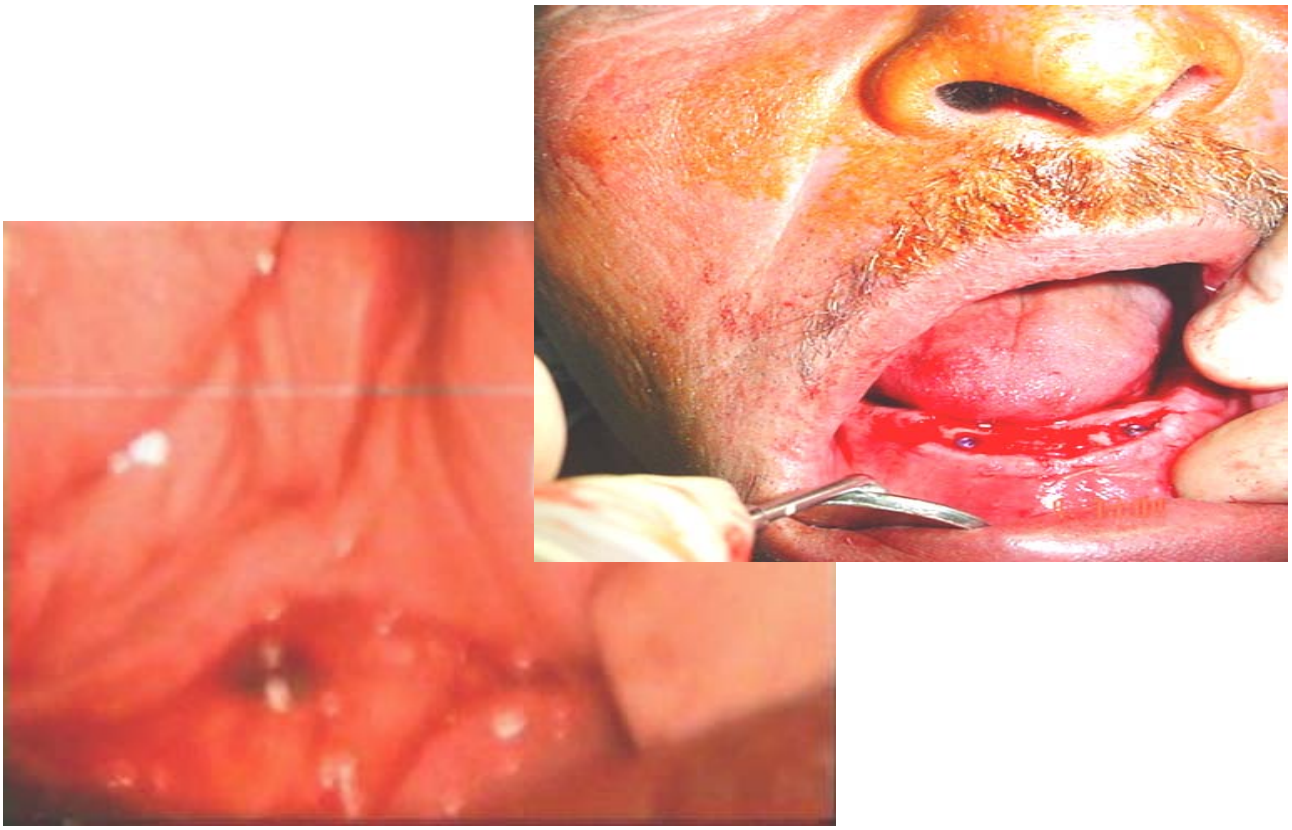
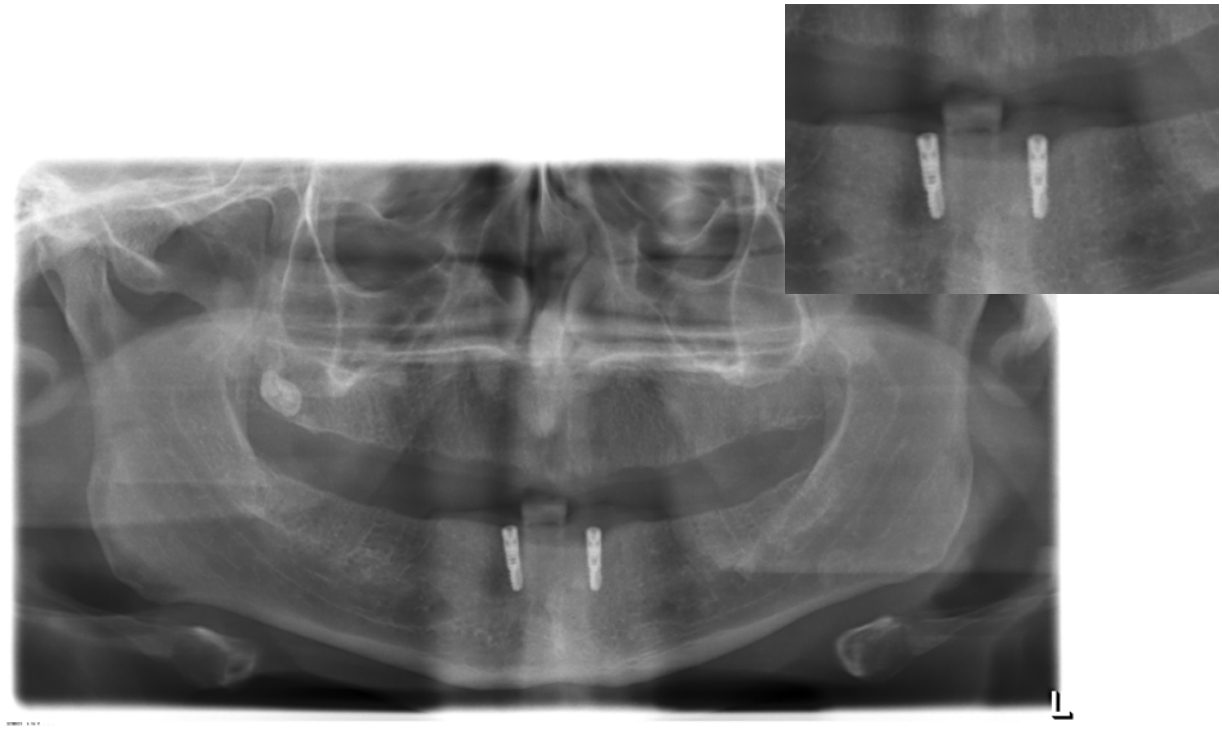


Fig. (22): The sterile implant reached the crestal bone level.



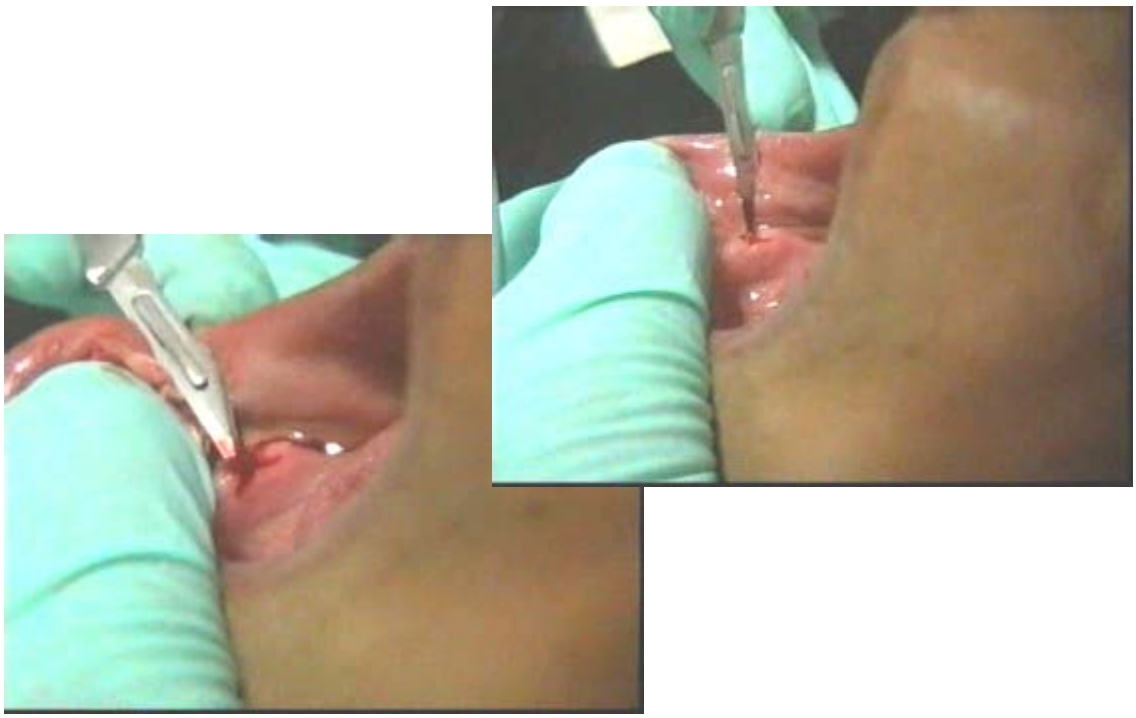


Fig. (24): Implants were located and uncovered with small incision

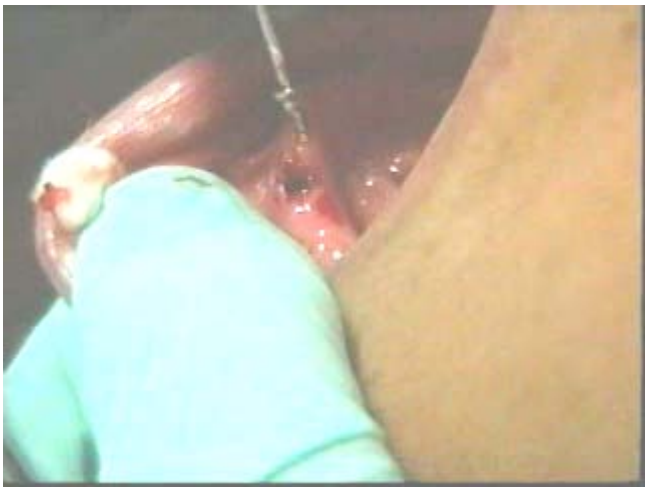


Fig. (25): The Titanium covering screw was unscrewed from the implants

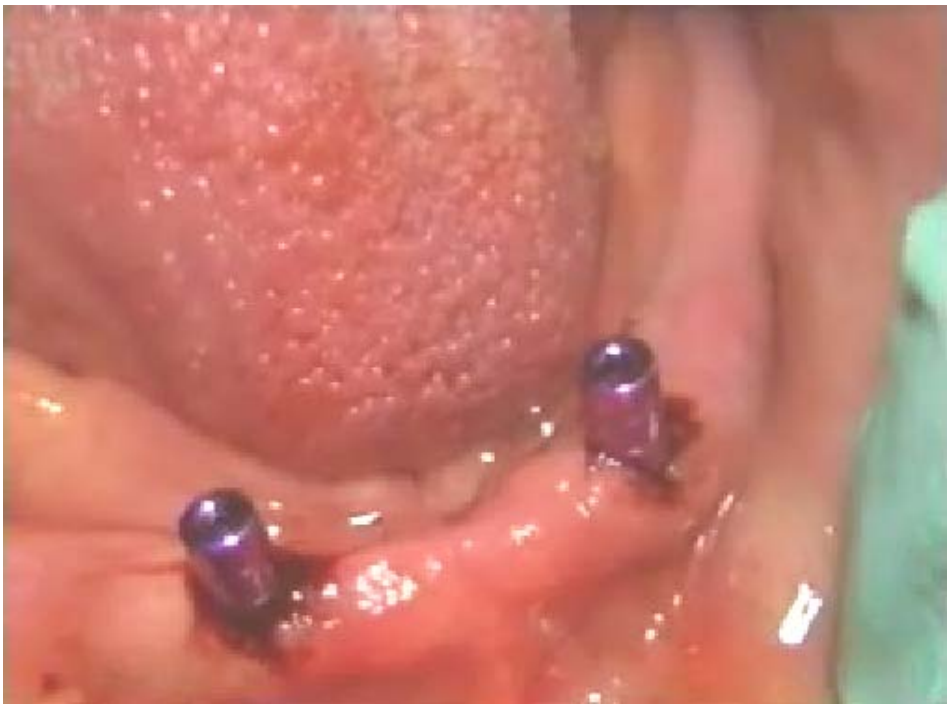


Fig. (26): The Titanium covering screw was replaced with the healing abutment

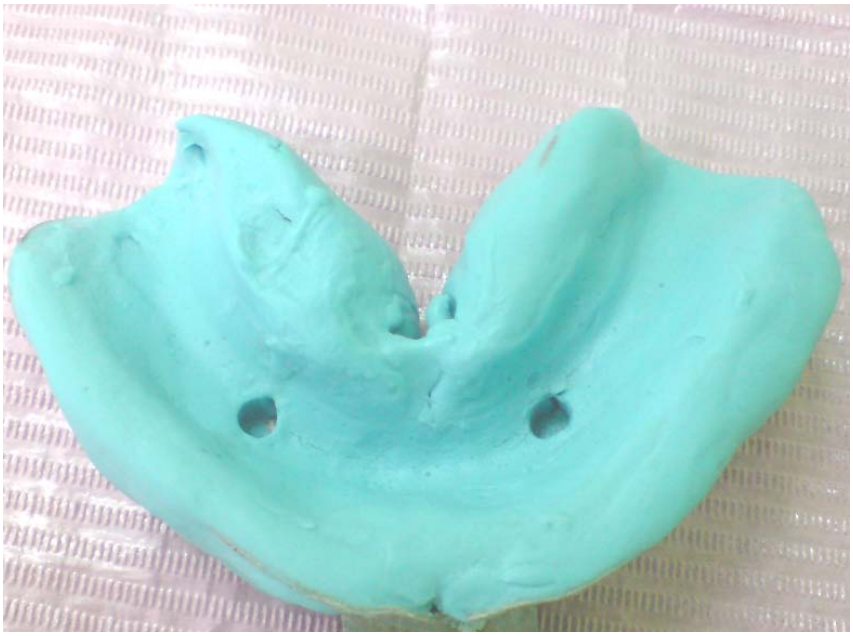


Fig. (27): Full arch alginate impressions of the edentulous arch with healing abutments

Fig. (28): Alginate impressions were poured into dental stone

2- The surface area around and above the healing abutments was enlarged with wax to simulate the position of impression copings that would be used (Fig. 29).

3- Impression copings replaced the healing abutment and fixed to the implants (Fig. 30).

4- The tray was checked, impression copings were visible through the holes and stick out slightly above the tray.

5- The openings of the copings were covered with wax and the impression was taken using rubber base impression material. Once the material had set the wax was removed and the long fixation screws were unscrewed and the impression was pulled out. The same laboratory screw implant analogue was connected to the impression copings.

6- The final impressions were poured into dental stone .The screws were unlocked. Then the cast was separated from the impression. The record block was fabricated.

7- Centric relation was recorded with interocclusal wax record.

8- The relationship of the maxilla to the hinge axis was recorded using maxillary face bow and transfer.

9- The upper cast was mounted to the upper member of a semi-adjustable articulator using the maxillary face bow.

10- The lower cast was attached to the lower member of the articulator by means of inter occlusal record .

11- Acrylic resin teeth with 20 degree cusp angle for posterior teeth were selected.

12- Setting up of teeth and waxing up the denture were performed as usual, and tried in the patient mouth

13- Sleeves were placed in its position over the bar abutment on the cast, burned out wax bar was attached to the sleeve parallel to the ridge and 2mm away from the ridge.

14- Impression copings replaced the healing abutment and fixed to the implants.

15- Waxed bar with sleeves was tried-in in the patient mouth, and then invested, burned out then cast in chrome cobalt alloy metal (Fig. 31).

16- Metal bar was tried-in in its position onto the bar abutment in the patient mouth, then removed from the mouth (Fig. 32).

17- The bar abutments were screwed onto the model and the metal bar was fixed to the abutments.

18- The metal housing with the plastic clip was fixed in the center of the bar.

19- All bar construction undercuts were blocked out with wax except the retention parts of the clips were left exposed.

20- Process of overdenture construction was performed as usual, after polymerization, metal housing with clip was secured to the fitting surface of the denture at the area between the two bar abutments.

21- The bar abutment and the bar were removed from the cast and the abutments were screwed into the implants in the patient's mouth.

22- The bar was cemented into the abutments and excess cement was removed.

23- The overdenture was delivered to the patient and the patient was instructed for oral hygiene and regular check-up.

Fig. (29): The surface area around and above the healing abutments was enlarged with wax

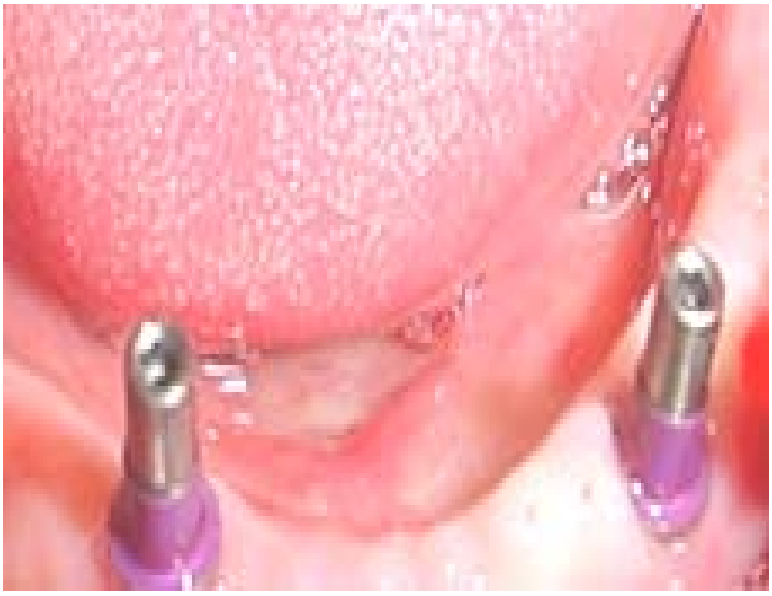


Fig. (30): Bar abutment replacing the healing abutment in the patient's mouth.

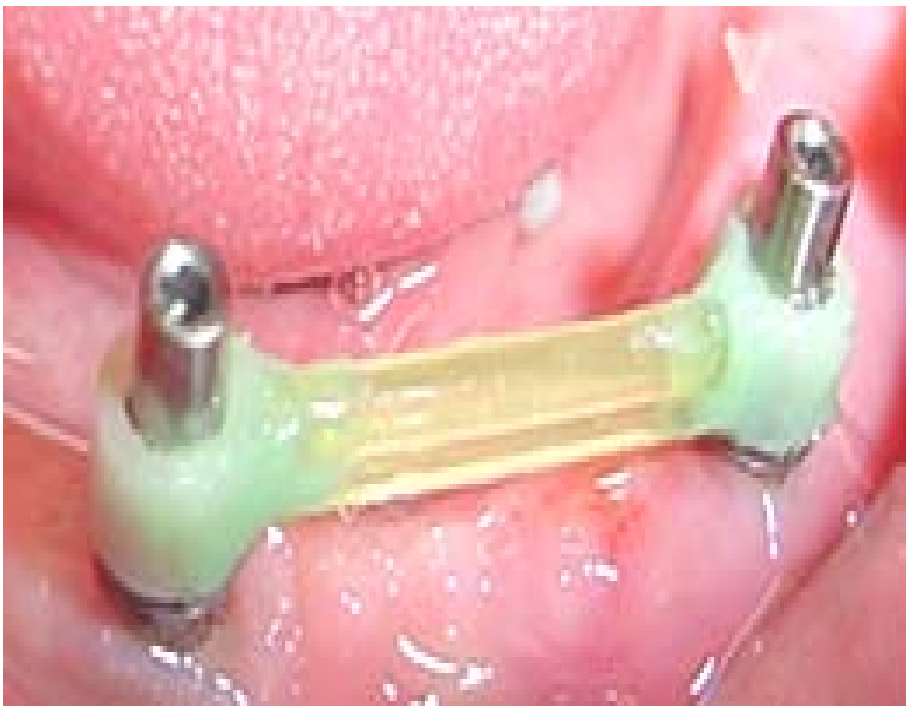


Fig. (31): Try-in plastic sleeve and bar in the patient mouth.

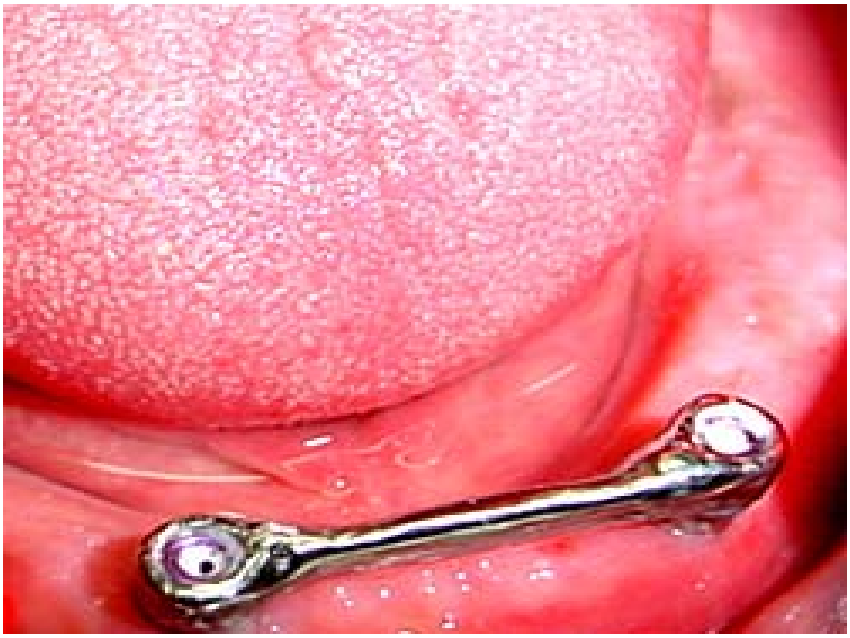


Fig. (32): Try-in metal sleeve and bar in the patient mouth.

CONSTRUCTION OF *OVERDENTURES RETAINED BY PREFABRECATED BAR*

(GROUP II)

Impression at I.A. Bar extension level (open tray technique)

1- Full arch alginate impressions of the edentulous arches with healing abutments were made (Fig. 27) and impressions were poured into dental stone (Fig. 28).

2- The surface area around and above the healing abutments was enlarged with wax to simulate the position of impression copings that would be used (Fig. 29).

3- Acrylic individual tray was fabricated (Fig. 33).

4- The mucosa thickness was verified by means of the healing abutment.

5- The proper height (0 to 6 mm) of the hygiene and occlusal aspects was chosen.

6- The healing abutments were removed from the mouth (Fig. 34) and the I.A. Bar Extension abutments were tightened with torque wrench to 32 Name with the Dyna Single slot screwdriver (Fig. 35).

7- The connection between the implant fixture and the I.A. Bar Extension abutments was verified with X-ray photo.

8- The I.A. Bar abutments were tightened to the implant analogues by hand. (Fig. 36).

9- The tray was verified intra-orally.

10- Functional impression was taken.

11- The impression copings were unthreaded

12- The extension abutments were covered with the Dyna I.A. Bar Cover screw.

13- The special I.A. Bar Implant analogues were tightened to the impression copings and were replaced in the impression (Fig. 37).

14- The connection of the I.A. Bar impression copings and the I.A. Bar Implant analogues was checked.

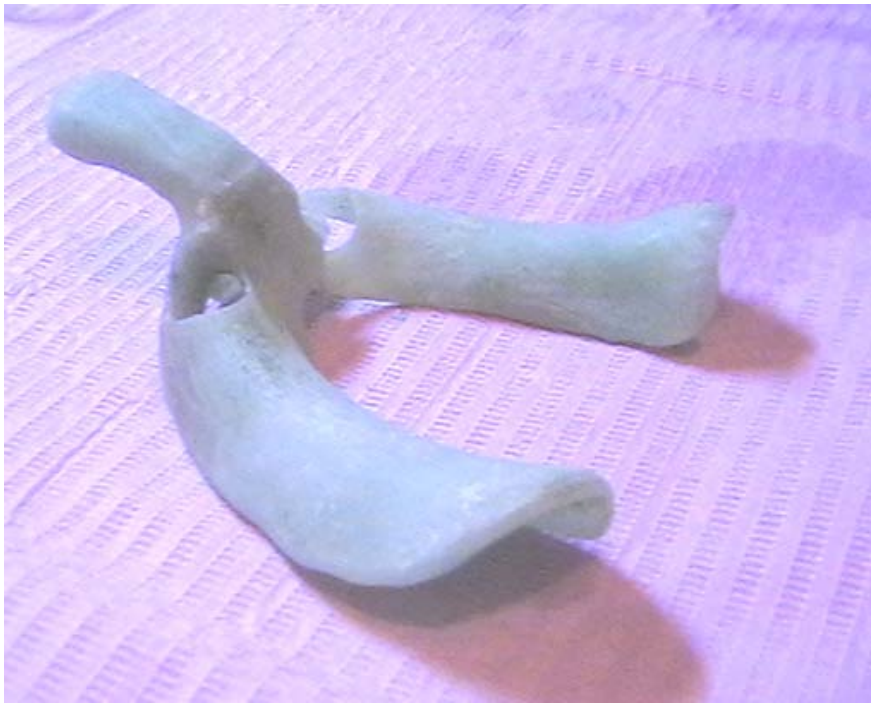


Fig. (33): Fabrication of acrylic individual tray

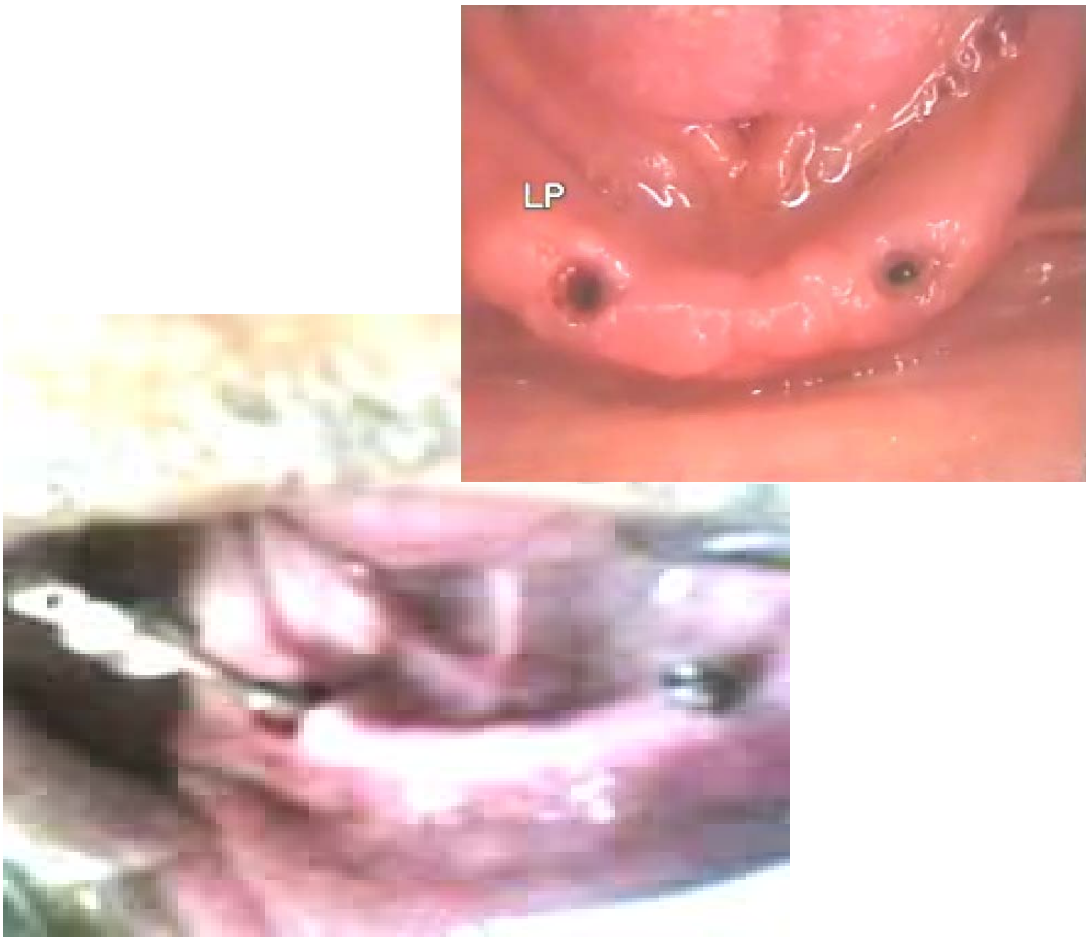


Fig. (34): The healing abutments were removed from the mouth.

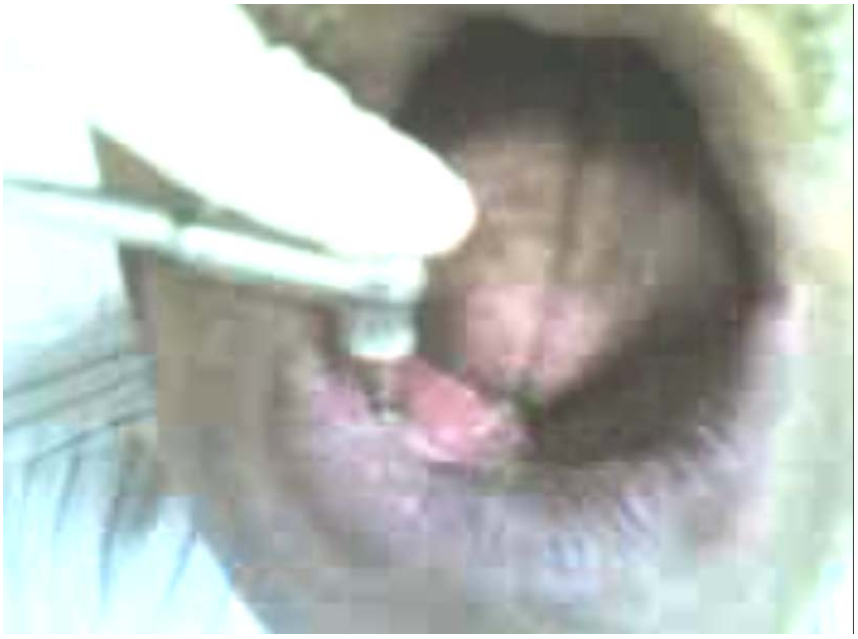


Fig. (35): The I.A. Bar extension abutments were tightened with torque wrench.

Fig. (36): The I.A. Bar abutments were tightened to the implant analogs.

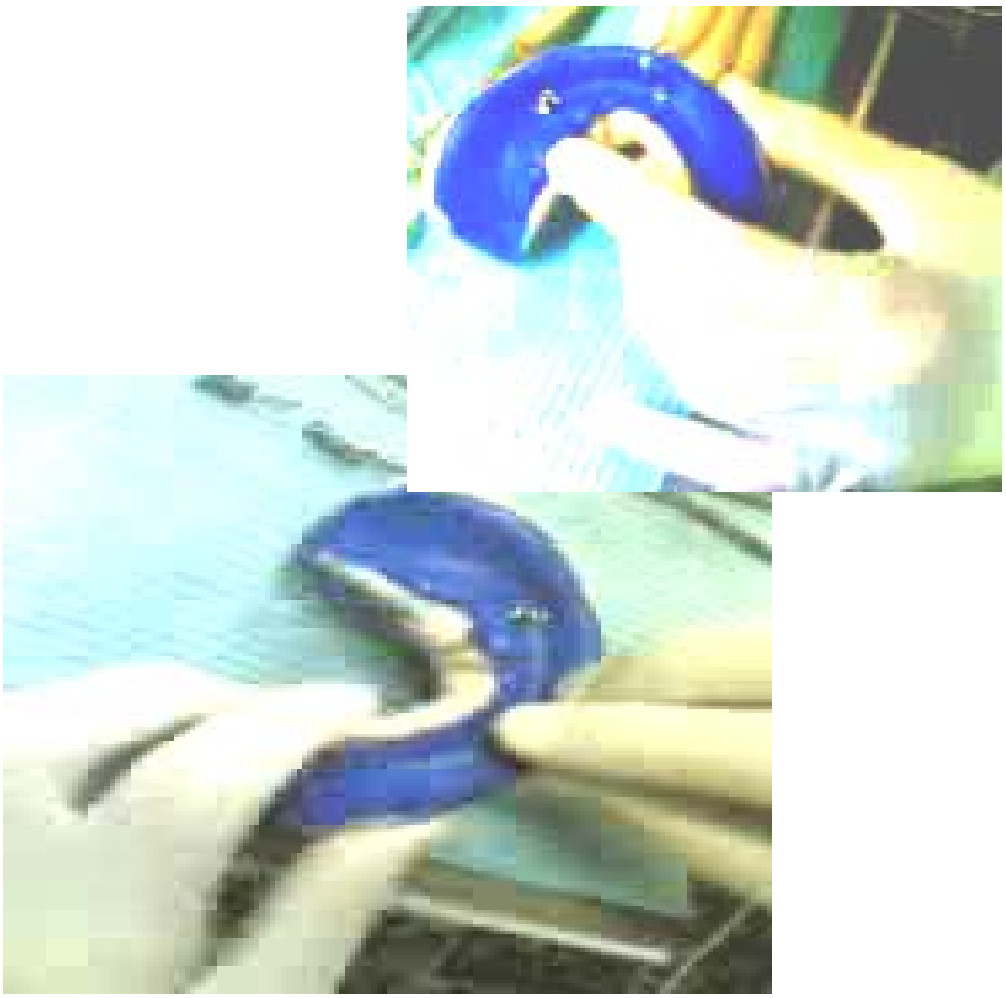


Fig. (37): I.A. Bar implant analogues were tightened to the impression copings

15- The impression was verified and the working cast was poured.

16- After the dental stone set, the tray was removed from the model gently.

17- The I.A. Bar impression copings were removed.

18- Base plates were made for bite registration.

Defining the proper length and height of the Instant Adjusting Bar:

The proper length of the I.A. Bar was calculated by measuring the distance between the centers of the implant. It was measured then 4, 5 mm were subtracted and Bar into this length was cut. The trimmed end was debarred, polished and checked if it fits stress-free on the model. Eventual necessary adjustments in length were done to make it fit without any stress. The I.A. Bar was attached to the bar abutments on the cast (Fig. 38, 39).

Realization of the denture

Individual impression trays were made.

A bite registration at the vertical dimension of occlusion was made. The teeth were selected then the wax try-in was fabricated .

The working cast was mounted together with the opposing model on an articulator. The Dyna Instant Adjusting Bar was placed and Wax try-in was produced.

The try-in denture was verified and necessary adjustments were done (Fig. 40). The retention clips were placed in the centre of the bar (Fig. 41).

All bar construction undercuts were blocked out with wax except the retention parts of the clips which were left exposed (Fig. 42).

The denture was processed with acrylic resin and polished. The healing abutments were removed from the mouth and the extension abutments were tightened onto the implants with 32 Ncm.

The connected I.A. Bar joints were threaded with the I.A. Bar Fixation screws to the I.A. Extension abutments with approximately 30 Ncm.

The finished denture was inserted into the patient’s mouth and it was snapped onto the bar (Fig. 43-47).

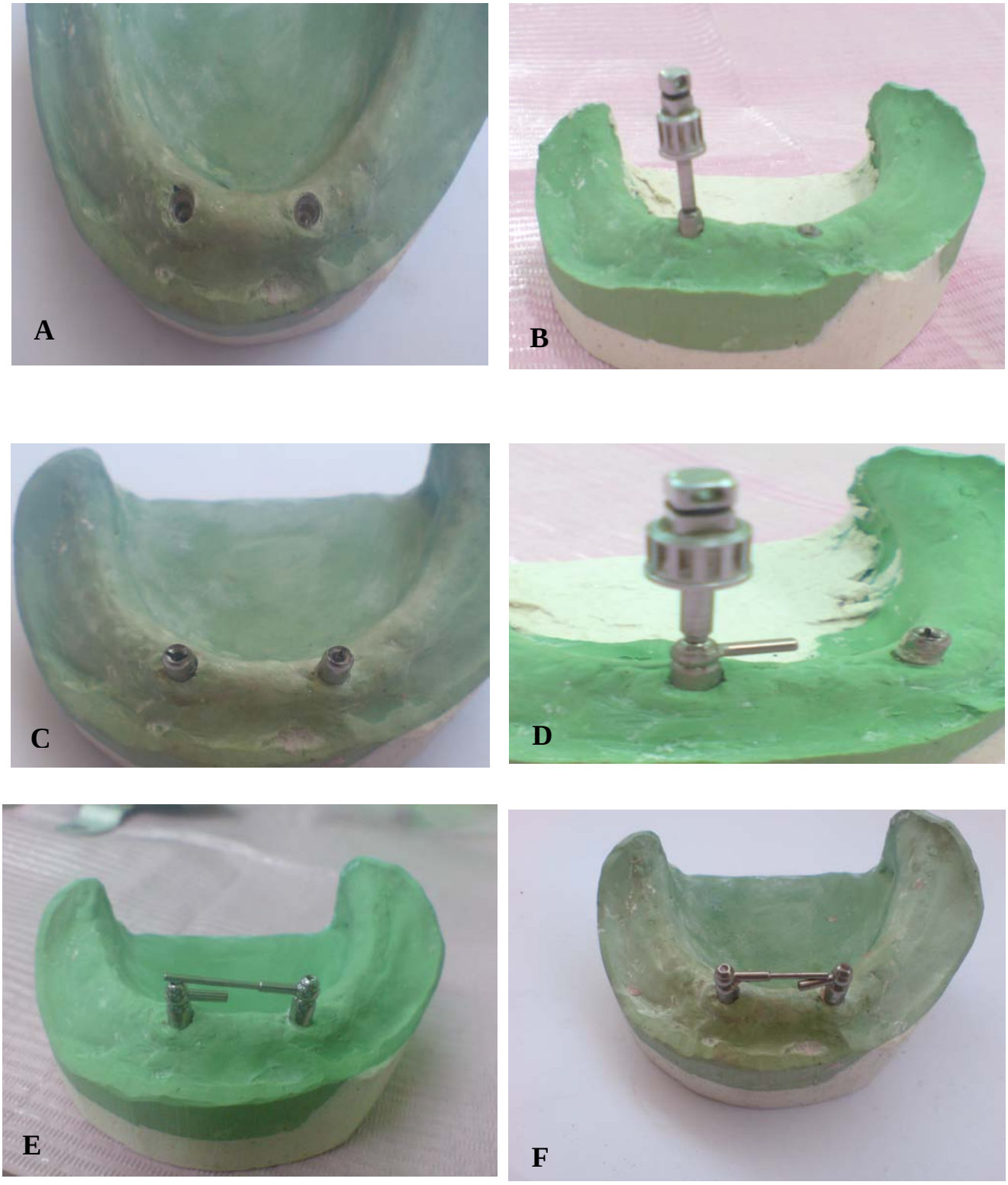


Fig. (38): (A) Working cast with implant analogue, (B) Tightinening I.A. Bar Octa extension abutment with single slot driver, (C) I.A. Bar Octa extension abutments, (D) Tightinening I.A. Bar Joint with single slot driver, (E) I.A. Bar before trimming.

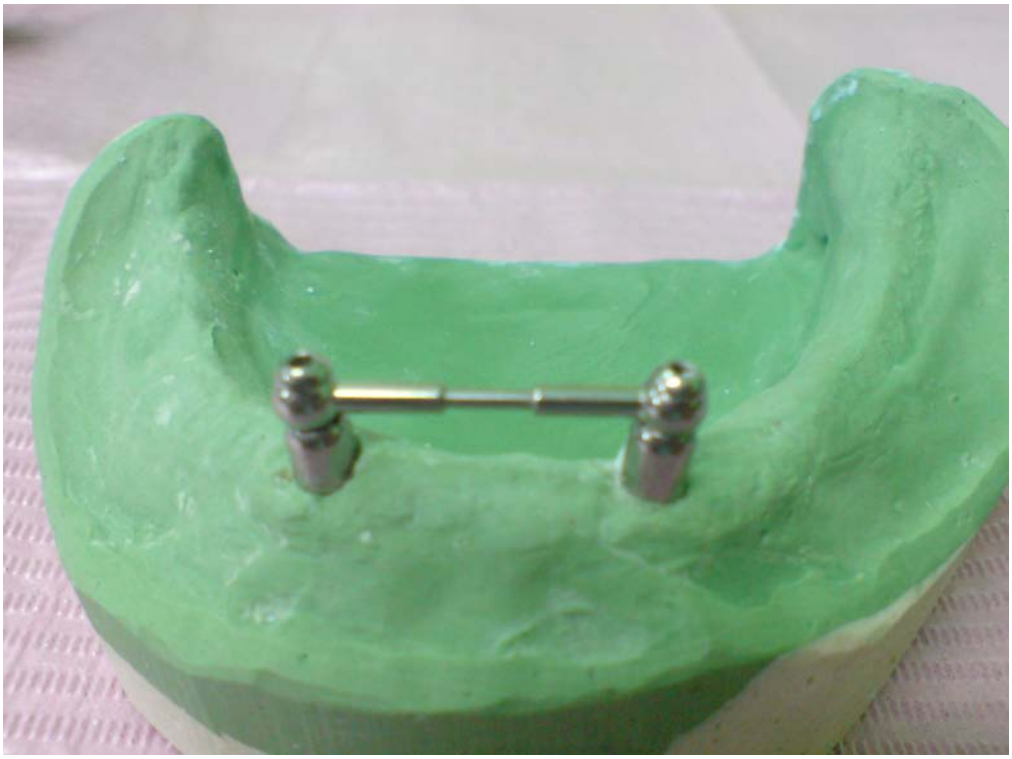


Fig. (39): I.A. Bar after trimming, debarrrig and polishing

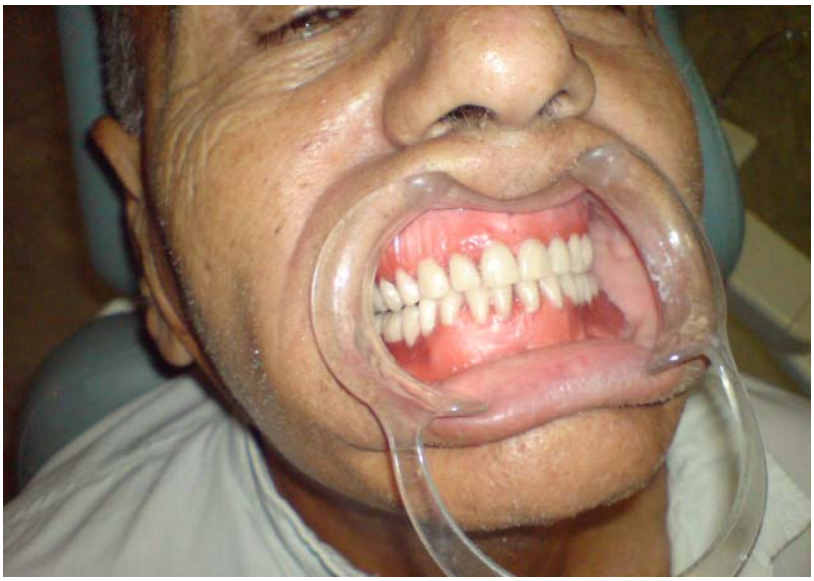


Fig. (40): The try-in denture was verified

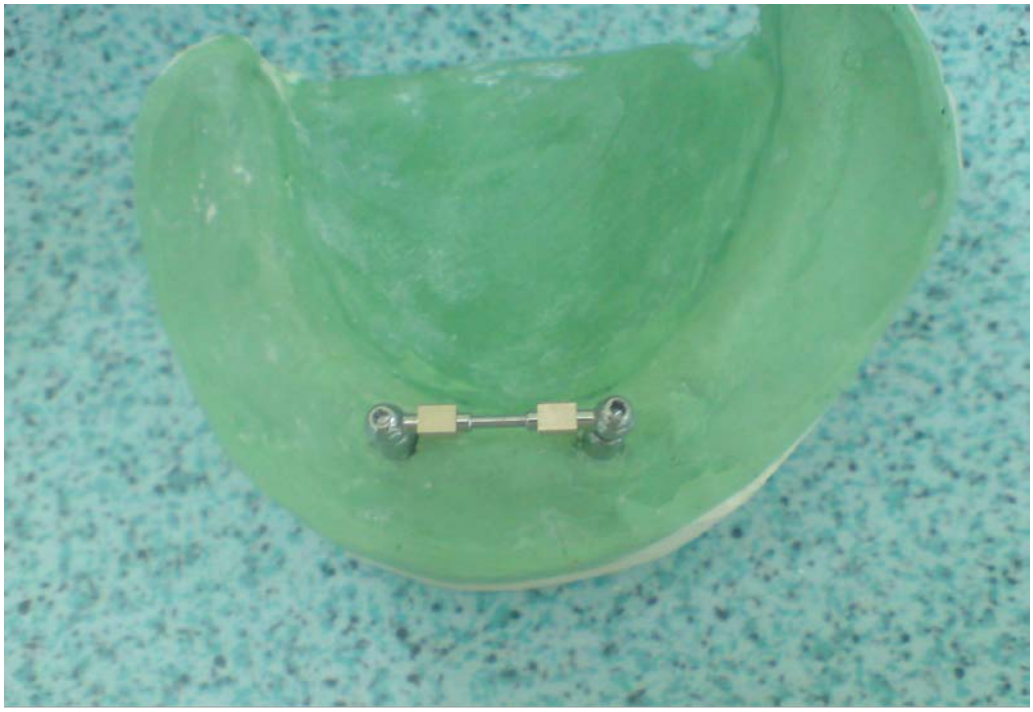


Fig. (41): The retention clips were placed in the centre of the bar.

Fig. (42): All bar constructions undercuts were blocked out with wax except the retention parts of clips

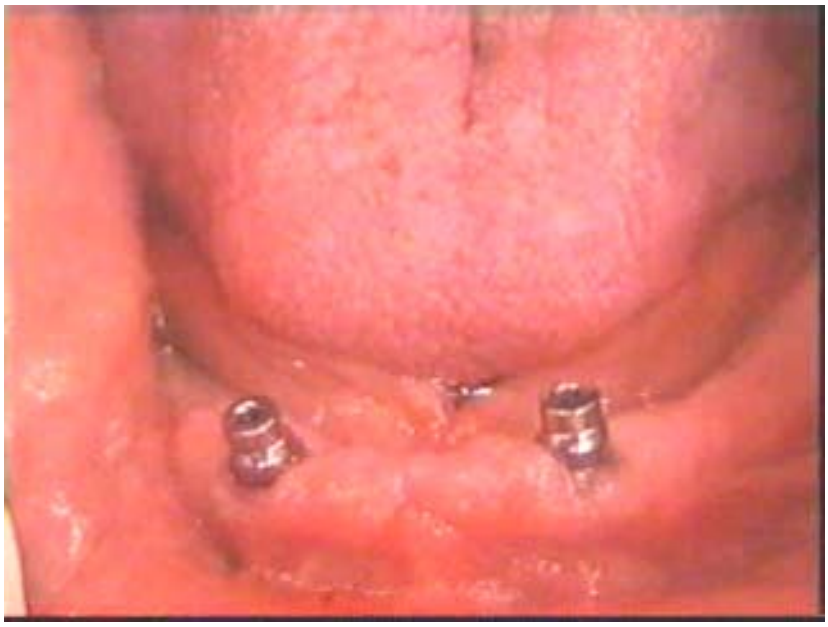


Fig. (43): I.A. Bar Octa extension abutment into the patient's mouth

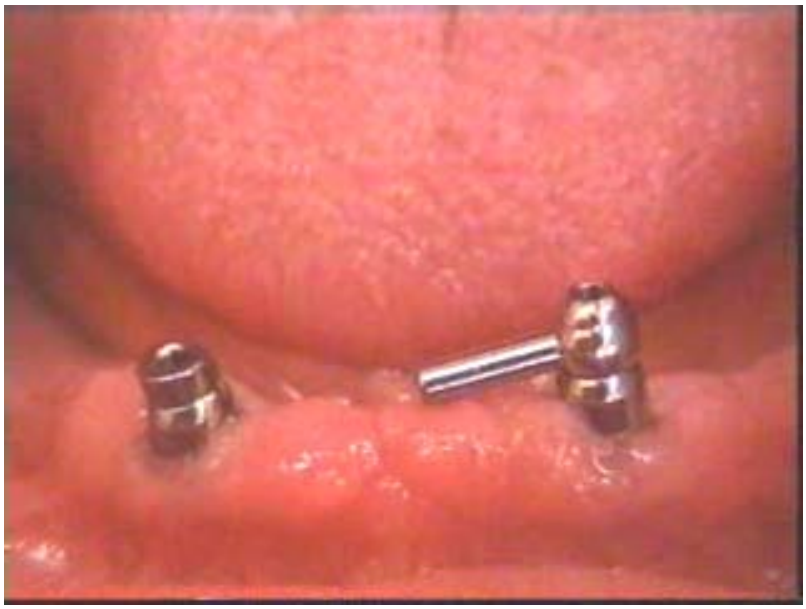


Fig. (44): I.A. Bar Joint into the patient's mouth

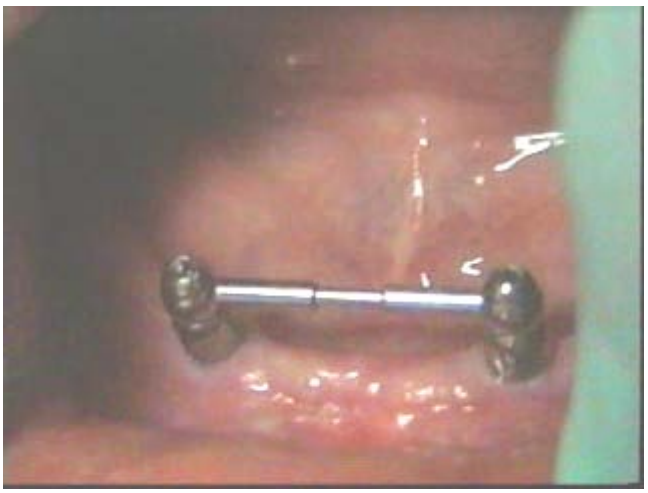


Fig. (45): I.A. Bar into the patient's mouth

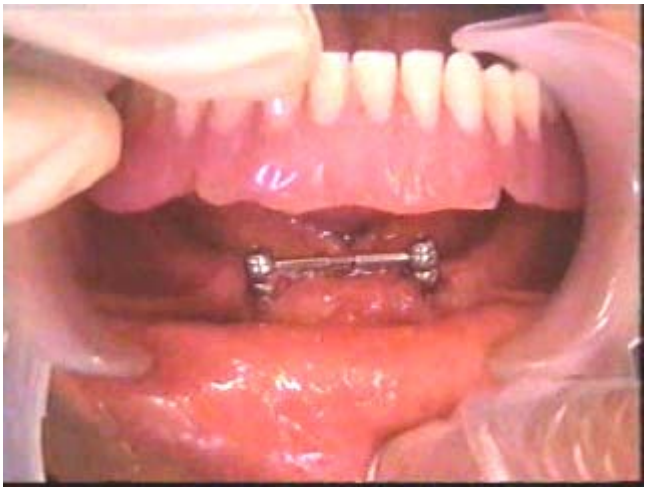


Fig. (46): The finished denture was inserted into the patient's mouth

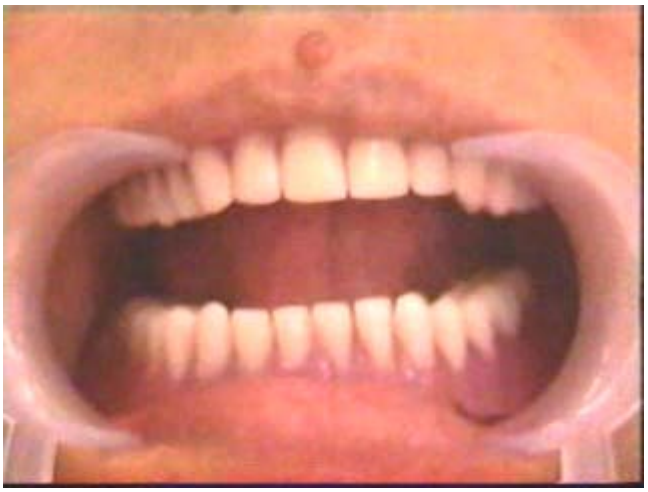


Fig. (47): The finished denture was snapped onto the bar

Final adjustments were made to the occlusion.

All patients were instructed in the use and care of the prosthesis, and provided with adequate hygiene information and training.

MAINTENANCE INSTRUCTIONS

All patients in both groups were instructed for good oral hygiene; these instructions included:

1- Carefully cleaning the mouth and brushing the abutments using (EZ- CARE oral gel).
2- After each meal, the denture was washed and brushed under tap water by soft denture brush.
3- Keeping the denture out of mouth during sleeping hours (rinsing in EZ-FRESH Solution)*.
4- Soaking the denture in water when not in use.
5- The patients were asked to return every month or if any complain appeared.

Patients' Follow-up:

Follow-Up of the patients were done monthly after final adjustment of the prosthesis. Clinical and radiographic evaluation were done and recorded immediately after insertion, after 6 months, 12 months and 18 months for all cases.

CLINICAL EVALUATION OF THE PROSTHESES AND PATIENT SATISFACTION

Patients were asked if there were any problems associated with retention, stability or occlusion of the prostheses.The patient satisfaction was also recorded.

I-MOBILITY TEST

Mobility was recorded only clinically where supragingival portion of the implants were subjected to firm pressure in all directions (labio-lingual and mesio-distal) by using sterilized two metal handle of dental instruments, as any degree of implant

***Vita Pharm for EZ-Pac Alexandria-Egypt**

movement is considered failure of osseointegration (Gher, 1994)[118] (Adell monem 1998)[10] .

II-PERCUSSION

The abutments were subjected to percussion by handles of dental mirrors and the sound was recorded According to Bateenburg et al (1998)[29] index as follows:-

Score 0: high percussion sound

Score 1: dull percussion sound, indicating mobility of the implant

III-GINGIVAL INDEX (GI)

At first the gingiva around each implant was smoothly dried with sterilized gauze and air; then all surfaces (Mesial, Distal, Buccal, and Lingual) were scored individually according to Loe and Silness index (1963)[119] where they divided the condition of gingival health into 4 categories as follow**s:**

Score 0: (Represents normal mucosa)

Score 1: Represents mild inflammation, slight change in color, slight edema and/or bleeding on probing

Score 2: Represents moderate inflammation, redness, edema, glazing and bleeding on probing.

Score 3: Represents severe inflammation, marked redness, marked edema, ulceration and tendency to spontaneous bleeding

The mean of the 4 surfaces (Mesial, Distal, Buccal, and Lingual) collectively was considered the mean G.I score for each abutment.

The mean values of the right and left implants were added and their mean was calculated.

IV -PLAQUE –SCORE

The Mombelli index was used to quantify the amount of plaque retained on the surface of the supramucosal part of the implant (Mombelli et al 1988)[117]

Score 0: No detection of plaque

Score 1: Plaque can be detected by running probe across the smooth marginal surface of the implant

Score 2: Plaque can be seen by the naked eye

Score 3: Abundance of plaque material

V-MARGINAL BONE HEIGHT

Radiographic Evaluation

Panoramic radiographs were used for the assessment of crestal bone level, peri-implant bone quality and bone surrounding implant apices. The radiographs were compared with baseline radiographs .

The marginal bone level was assessed at mesial and distal side of fixture on the radiographs. The bone height was measured to the nearest 0.01 mm using a caliper. For each implant the bone height were detected in the same manner. The difference in the

bone height between the follow up periods were calculated.

VI- BONE DENSITY

Measuring bone density was done also with the help of extraoral panorama .

For determining the values of bone density five points were drawn on different location in close proximity to the implant threads 2 mesial, 2 distal and one apical to inferior border of the implant.

The processed radiographs were digitized and analyzed using special computer software program* to trace the bone density and detect changes in the gray level according to [Wenzel (1991)[120], Karin et al (1992)[121], El-Guindy et al (1996)[122].

The degree of blackening and whitening (radioluceney and radiopacity) was expressed in numbers from 0 - 256 pixels where the normal human bone reading approximately ranges from 40 (least detectable bone e.g., the reading of an empty socket with only shadows of the surrounding cortices) and 120 (a relatively very dense area like that of the lamina dura).

The degree of lightness and darkness of the selected points on the panorama indicate the degree of bone density which will vary with time indicating osteoid tissue deposition or bone resorption around the implant.

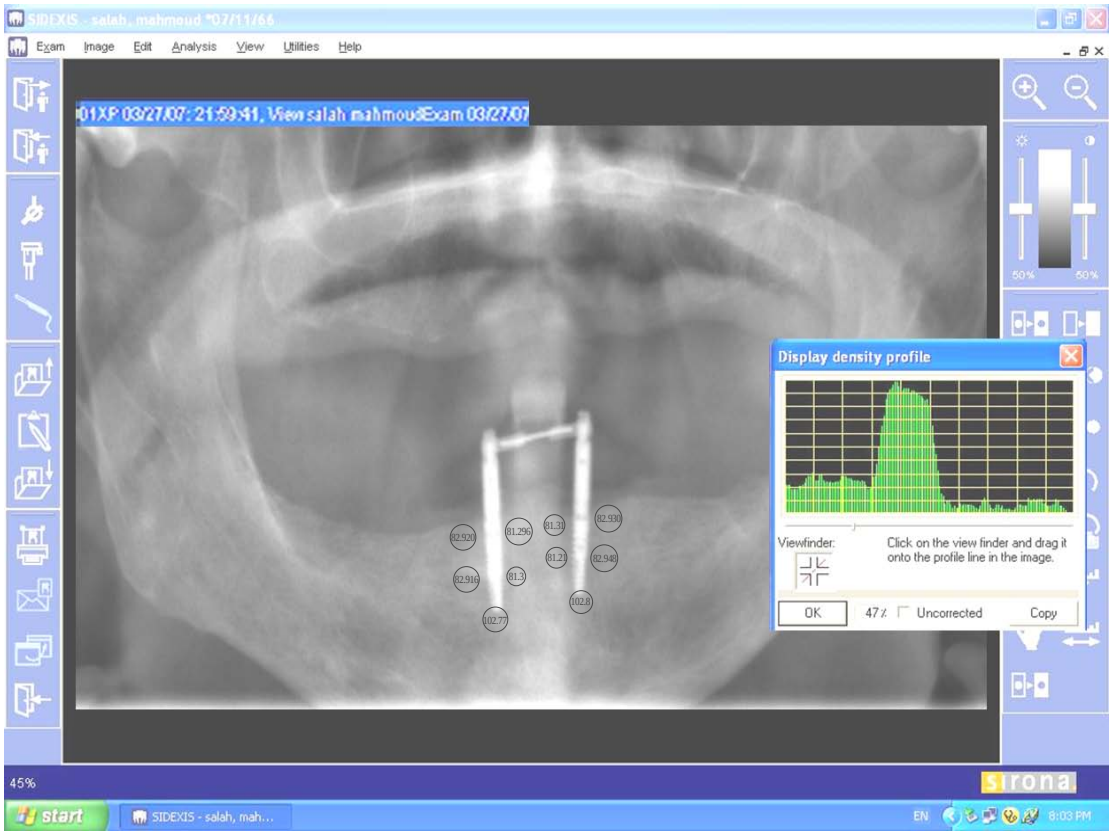


Fig.(48) : Computer program showing the 5 selected points to assess the bone density

by using image tool (**SIDEXIS - Version V1.45**) * . The X-ray films were analyzed to get their Mean and SD estimated from histogram in the Mesial, Distal ,Apical aspects (Fig. 48).

The mean of the two (mesial or distal) points of each implant was considered the mean for (mesial or distal) bone density.

All patients in the two studied groups attended the follow-up period till the end of the study (18 months) and all implants showed successful osseointegration in both groups. The obtained data were tabulated and graphically illustrated. Statistical analysis of the obtained data was done using SPSS** for Windows statistical package Descriptive statistics were presented as means, standard deviations and mean percentage changes.

Analytical tests used for all parameters except gingival index scores and plaque index scores were included (dependent t-test) to assess significant changes within each group over time and (independent t-test) to compare the two groups. Testing for significance with respect to gingival index score and plaque index score included McNemar' s test to analyze time effect within each group throughout the different time intervals of the study and Fischer's test for groups comparison .

-Significance levels of 0.05 were used through all statistical tests.

***SIDEXIS - Version V1.45**

****Significance package for Social Sciences (SPSS) for Windows .Release 10 SPSS Inc.Chicago USA.**

RESULTS

RESULTS

1- Evaluations of the prostheses and patient's satisfaction:

During the follow-up periods, all patients in both groups were satisfied with their prostheses, regarding denture stability, retention esthetics and occlusion.

2- Results of Sensitivity of Lip and Chin

The normal sensation of lip and Chin was not affected with implantation in all patients.

3- Results of Percussion

Percussion on implants revealed Score 0 = high percussion sound in both groups.

4-Results of Implant mobility:

No movement was found in the implants of both groups as detected clinically.

1- Gingival Index (G.I)

The mean values and standard deviations of the measured G.I scores were summarized in tables (2, 3) and illustrated in figures (49, 50). It appeared that the mean values of gingival index scores of group (I) who received overdenture attached to cast bar were 0.238 at the time of denture insertion, 0.522 at 6 months, 0.779 at twelve months and 1.523 at eighteen months following denture insertion .

In group (I); the percentage change in the mean values of the gingival inflammation was 7.09 % from 1st day of denture insertion till six months, 13.54 % from 1st day till 12 months and 32.115 % from 1st day till eighteen months.

The mean values of the measured G.I scores of group (II) treated by prefabricated bar were 0.236 at the time of denture insertion, 0.459 at six months, 0.521 at twelve months and 0.9 at eighteen months following denture insertion .

The percentage change in the mean values of the measured G.I in group (II) was 5.59 % from 1st day till six months, 7.14% from 1st day till twelve months and 16.6% from 1st day till eighteen months.

It was revealed that there were no statistically significant difference between both groups at the first day of denture delivery and after 6 months and significant difference after 12 &18 months.

2-*Results of Plaque index (P.*I.)

The results of plaque index in both groups at the different follow-up periods are summarized in table (4,5) and figure (51, 52).

Table (4) shows comparison of mean value of the measured P.1. Scores between cast bar group (I) and prefabricated bar group (II) at the time of denture insertion, after six, twelve and eighteen months of loading with mandibular overdenture. It was revealed that there was no statistically significant difference between cast bar group (I) and prefabricated bar group (II) at the time of denture insertion and after six months. On the other hand , there was a statistically highly significant difference between both groups after twelve months and eighteen months following denture insertion.

The percentage change in the mean values of the measured P.I. scores of group (I) treated by cast bar was 7.09 % from 1st day till six months, 15.66 % from 1st day till twelve months and 20.7% from 1st day till eighteen months.

Table (2) Gingival Index in Group (I) and Group (II) at Different Follow up Periods.

Period	Group (I)				Group (II)				F	t	Sign.
	Mean	SD	% Change	Std. Error Mean	Mean	SD	% Change	Std. Error Mean			
1st Day	0.238	0.02387	5.95	.01068	0.236	0305	5.9	0.0136	.104	0.115	N.S
6 Months	0.522	0.05113	13.0	.02287	0.459	.0371	11.48	0.0166	1.240	2.202	N.S
12 Months	0.779	0.22546	19.48	.10083	0.521	.0867	13	0.0388	4.671	2.390	S
18 Months	1.523	0.42486	38	.19000	0.900	.0965	22.5	0.0432	9.265	3.194	S

SD = Standard deviation t-value: t-test F=Fisher-test

Sign. = Significance (**S. • 0.05)** N.S = Not Significant

H.S = Highly significant (**H.S. • 0.001)**

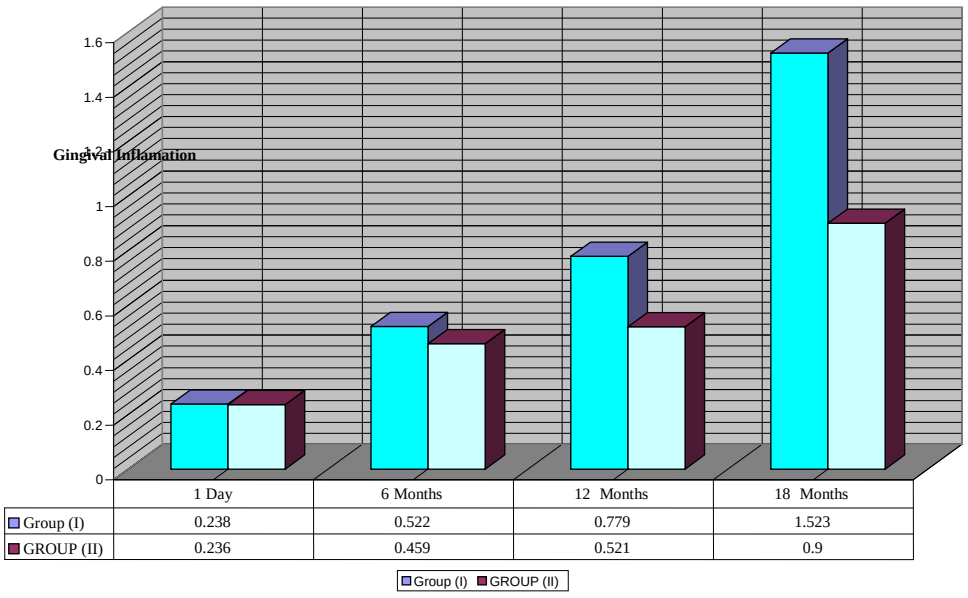


Figure (49): Mean Value of Gingival Index in Group (I) & Group (II)

Table (3) : Mean Value & % Change of Gingival Index in Group (I)& Group (II)

Period	Group (I)		Group (II)	
	Mean	%Change	Mean	%Change
1st Day - 6 Months	0.2838	7.09	0.2236	5.59
1st Day - 12 Months	0.5416	13.54	0.2854	7.14
1st Day - 18 Months	1.2846	32.115	0.6642	16.6

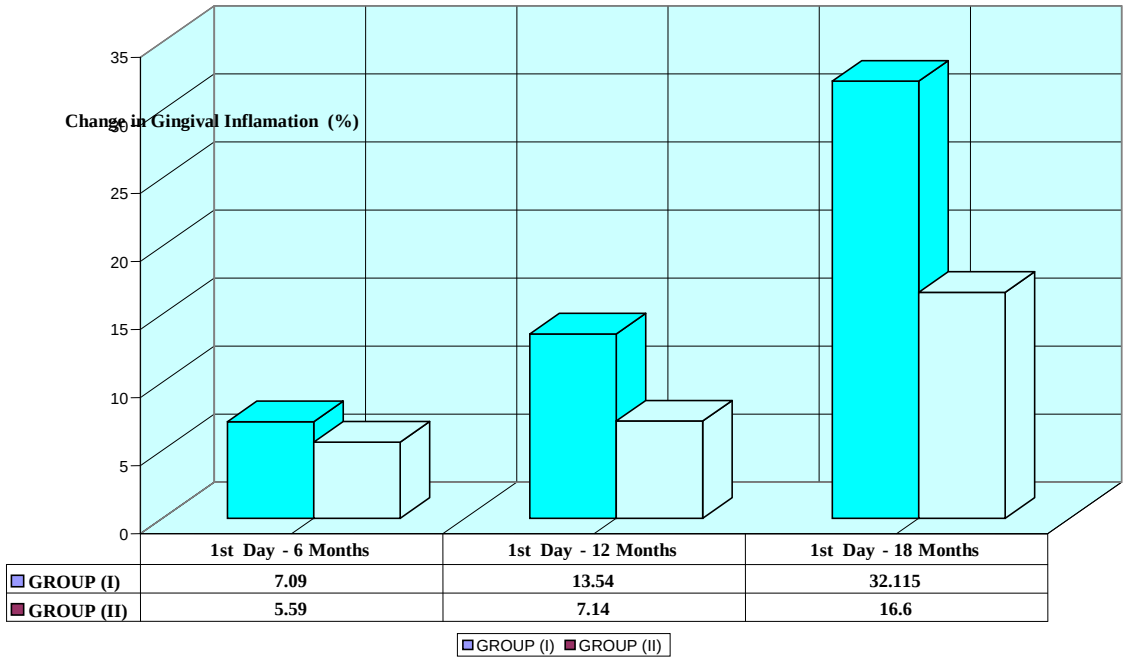


Figure (50): Percentage Change of Gingival Index in Group (I) & Group (II)

Table (4) Plaque Index in Group (I) and Group (II) at Different Follow up Periods.

Period	Group (I)				Group (II)				F	t	Sign.
	Mean	SD	% Change	Std. Error Mean	Mean	SD	% Change	Std. Error Mean			
1st Day	0.5864	0.00611	0.1466	0.00273	0.5770	.02080	0.1443	0.00930	15.313	0.970	N.S
6 Months	0.8698	0.00349	0.2174	0.00156	0.7264	.12238	0.1816	0.05473	9.409	2.619	N.S
12 Months	1.2130	0.02992	0.3032	0.01338	0.9100	.04402	0.2275	0.01969	1.375	12.730	H.S
18 Months	1.4146	0.14660	0.3536	0.06556	1.1514	.11185	0.288	0.05002	0.210	3.192	H.S

SD = Standard deviation t-value: t-test F=Fisher-test
Sign. = Significance (**S. • 0.05)** N.S = Not Significant
H.S = Highly significant (**H.S. • 0.001)**

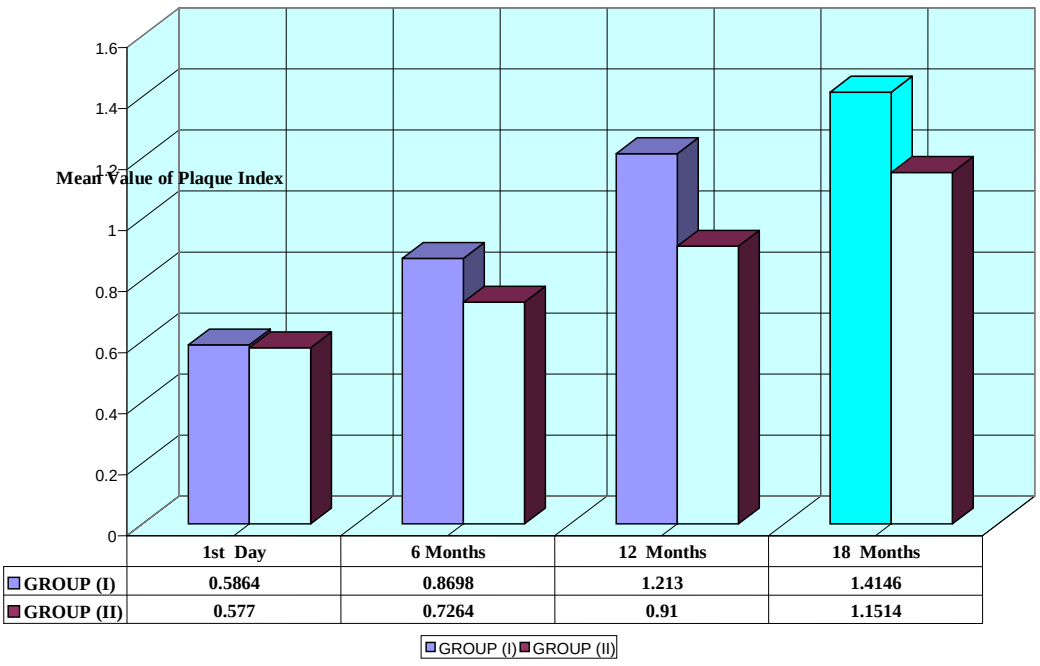


Figure (51): Mean Value of Plaque Index in Group (I) & Group (II)

Table (5): Mean Value & % Change of Plaque Index in Group (I) & Group (II)

Period	Mean			
	Group (I)	%Change	Group (II)	%Change
1st Day - 6 Months	0.2834	7.09	0.1494	3.735
1st Day - 12 Months	0.6266	15.66	0.3330	8.325
1st Day - 18 Months	0.8282	20.70	0.5744	14.360

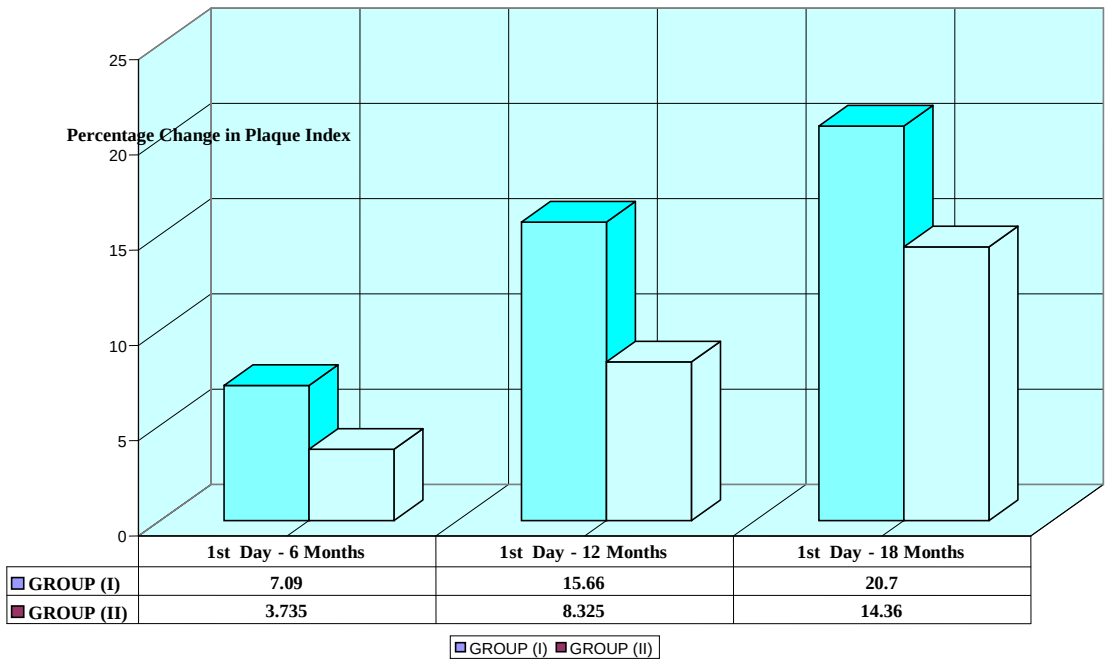


Figure (52): Percentage Change of Plaque Index in Group (I) & Group (II)

The percentage change in the mean values of the measured P.I. scores of group (II) treated by cast bar were 3.735% from 1st day till six months, 8.325% from 1st day till twelve months and 14.36% from 1st day till eighteen months .

1- Results of Marginal Bone Height:-

The results of the mesial and the distal marginal bone height for both groups at the different follow-up periods are summerized in tables (6, 7, 8, 9, 10 and 11) and figures (53, 54, 55, 56, 57 and 58).

Mesial aspect

Group (I):

The results of bone height were summarized in tables (6,7) and figures (53, 54).

The mean values of the mesial marginal bone height of group (I) were 12.948 mm. at the first day of denture delivery, 12.25 mm. after six months, 11.7640 mm. after twelve months and 11.664 mm. after eighteen months.

It was revealed that there were a statistically non significant difference at the first day of denture delivery between the two groups, a significant difference after 6 months between both groups and highly significant difference after 12 &18 months.

A decrease in bone height at the mesial aspect of the implant was -.598 mm from the beginning of study till six months, -1.184 mm from beginning of study till 12 months and -1.184 mm from the beginning of study 18 months.

Group (II)

The mean value of the mesial marginal bone height of group (II) were 12.91 mm. at the first day of denture delivery, 12.31 mm. after six months, 12.258 mm. after twelve months and 12.04 mm. after eighteen months.

A decrease in bone height at the mesial aspect of the implant was -.6 mm from the beginning of study till six months, -.652 mm from beginning of study till 12 months and -.87mm from the beginning of study till 18 months.

It was revealed that there were a statistically non significant difference between mesial aspect in group (I) and group (II) at the first day of denture delivery, significant difference after 6 months and significant difference after 12 &18 months.

Distal aspect

Group (I):

The results of bone height were summarized in tab. (8,9) and figures(55, 56).

The mean values of the distal marginal bone height of the group (I) were 12.884 mm. at the first day of denture delivery, 12.4 mm. after six months, 12.1 mm. after twelve months and 11.340 mm. after eighteen months.

It was revealed that there were a statistically non significant difference at the first day of denture delivery, significant difference after 6 months and significant difference after 12 &18 months.

A decrease in bone height distal to the implant was -.484 mm from the beginning of study till six months, -.784 mm from beginning of study till 12 months and -1.544 mm from the beginning of study till 18 months.

Group (II)

The mean values of the distal marginal bone height of the group (I) were 12.85 mm. at the first day of denture delivery, 12.7420 mm. after six months, 12.396 mm. after twelve months and 12.1 mm. after eighteen months.

Table (6) Mesial Marginal Bone Height (mm) in Groups (I) and Group (II).

Period	Group (I)			Group (II)			F	t	Sign.
	Mean	SD	Std. Error Mean	Mean	SD	Std. Error Mean			
1st Day	12.9480	05263	.02354	12.9100	.07416	.03317	.174	.934	N.S
6 Months	12.2500	.11180	.05000	12.3100	.21622	.09670	2.425	.367	S
12 Months	11.7640	.05177	.02315	12.2580	.21335	.09541	10.373	5.031	H.S
18 Months	11.6640	.05177	.02315	12.0400	.20736	.09274	9.653	2.888	H.S

SD = Standard deviation t-value: t-test F=Fisher-test

Sign. = Significance (**S. • 0.05)** N.S = Not Significant

H.S = Highly significant (**H.S. • 0.001)**

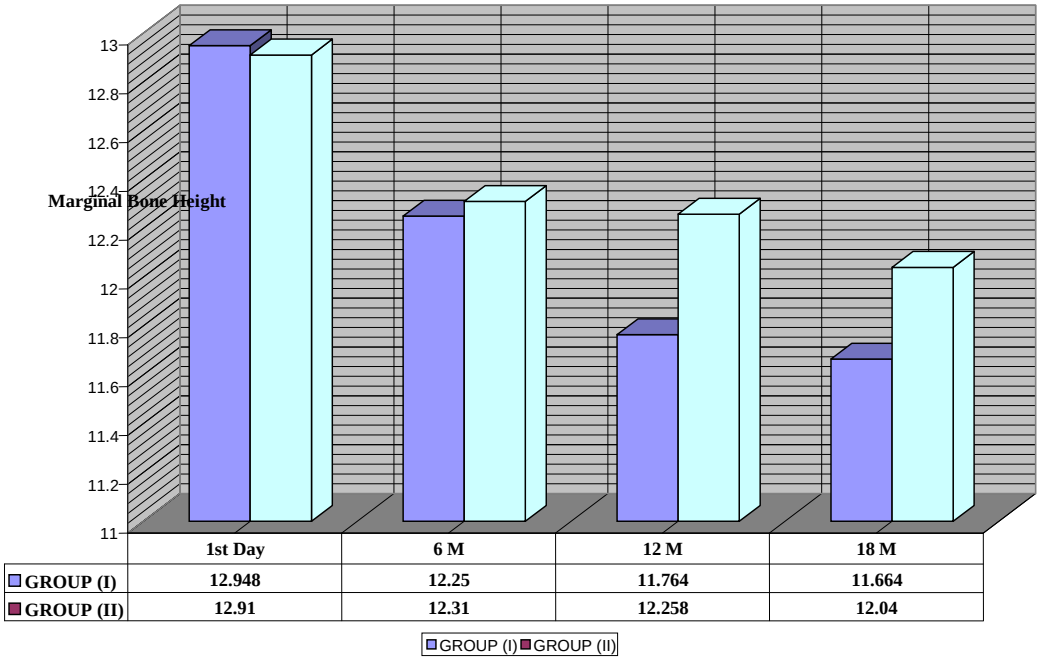


Figure (53): Mesial Marginal Bone Height (mm) in Groups (I) and Group (II).

Table (7) Mesial Marginal Bone Loss at Different Interval for Group (I) and Group (II).

Period	Mean	
	Group (I)	Group (II)
1 Day - 6 Months	- 0.598	- 0.6
1 Day - 12 Months	-1.184	- 0.652
1 Day - 18 Months	-1.284	- 0.87

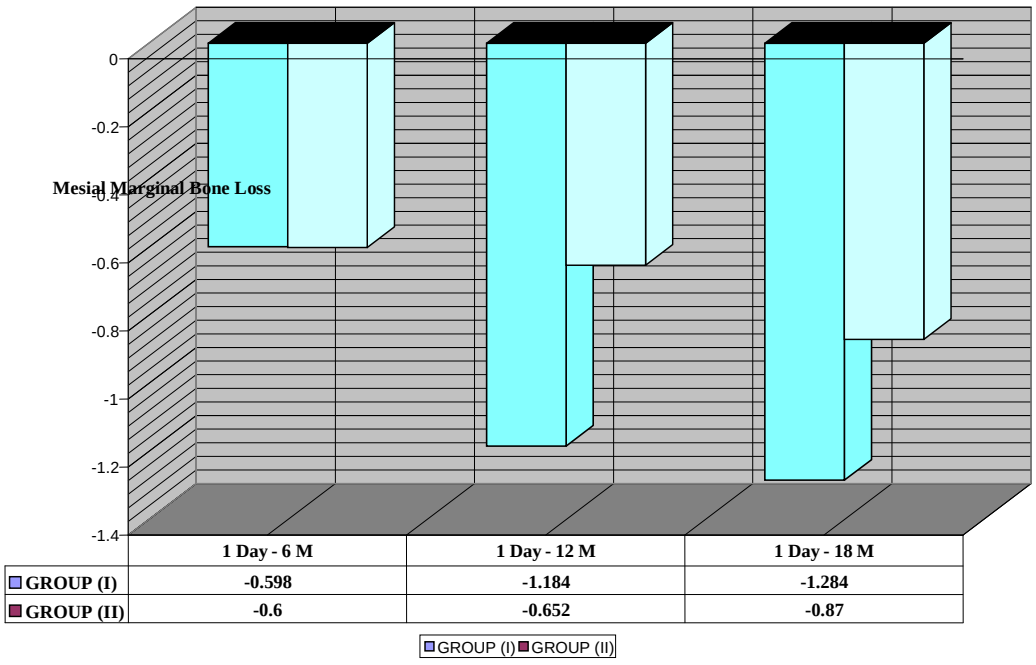


Figure (54): Mesial Marginal Bone Loss at Different Intervals in Group (I) & Group (II)

Table (8) Distal Marginal Bone Height (mm) in Groups (I) and Group (II).

Period	Group (I)			Group (II)			F	t	Sign.
	Mean	SD	Std. Error Mean	Mean	SD	Std. Error Mean			
1st Day	12.8840	0.12759	0.05706	12.8500	.10000	0.04472	0.308	0.469	N.S
6 Months	12.4000	0.14577	0.06519	12.7420	.05630	0.02518	1.588	4.894	N.S
12 Months	12.1000	0.15811	0.07071	12.3960	.19373	0.08664	0.168	2.647	S
18 Months	11.3400	0.39115	0.17493	12.1000	.15811	0.07071	8.476	4.028	H.S

SD = Standard deviation t-value: t-test F=Fisher-test
Sign. = Significance (**S. • 0.05)** N.S = Not Significant
H.S = Highly significant (**H.S. • 0.001)**

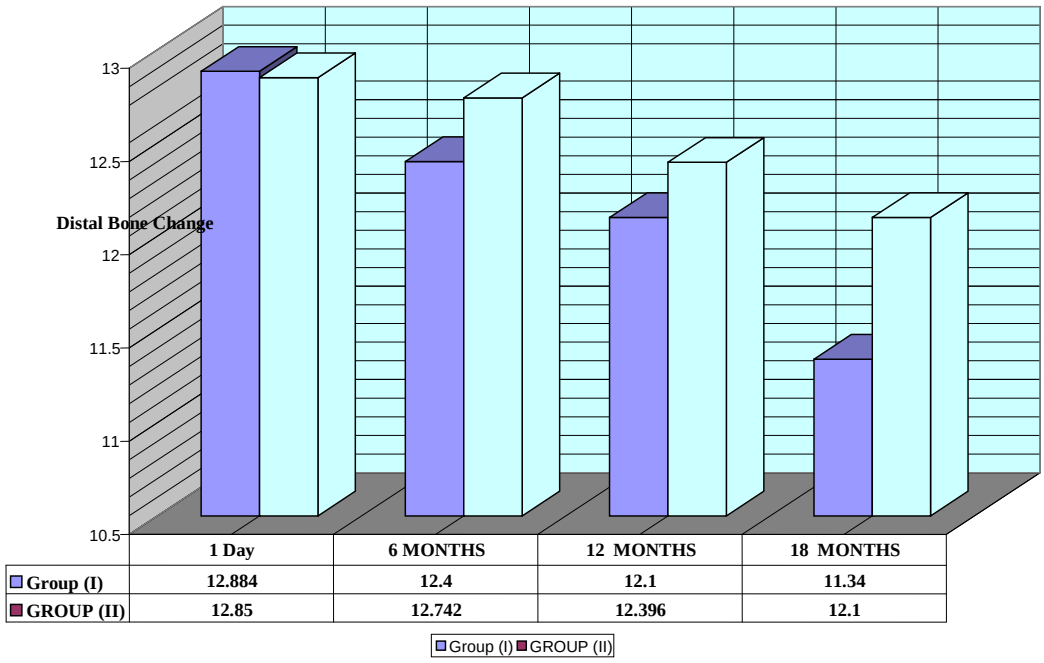


Figure (55) :Distal Marginal Bone Height (mm) in Groups (I) and Group (II).

Table (9) Distal Marginal Bone Loss at Different Interval for Group (I) and Group (II).

Period	Mean	
	Group (I)	Group (II)
1 Day - 6 Months	- 0.484	- 0.108
1 Day - 12 Months	- 0.784	- 0.454
1 Day - 18 Months	-1.544	- 0.75

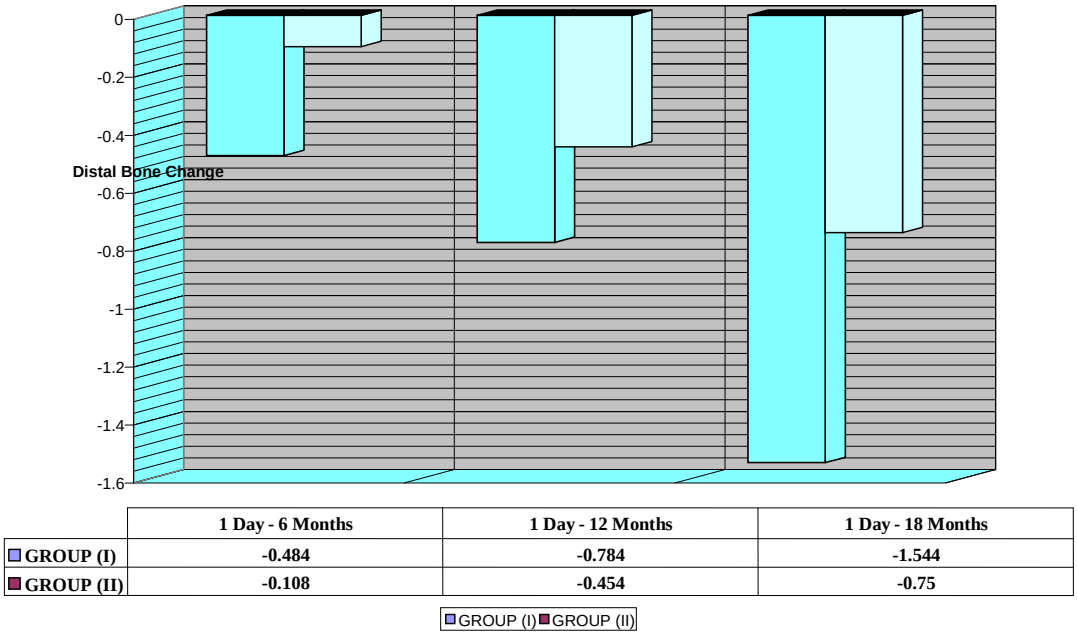


Figure (56) Distal Marginal Bone Loss at Different Interval for Group (I) and Group (II).

Table (10): Comparison Between Mean Value of Mesial and Distal Bone in Group (II) at Different Interval.

Period	Mean	
	Mesial	Distal
1st Day - 6 Months	- 0.108	- 0.6
1st Day - 12 Months	- 0.454	- 0.652
1st Day - 18 Months	- 0.75	- 0.87

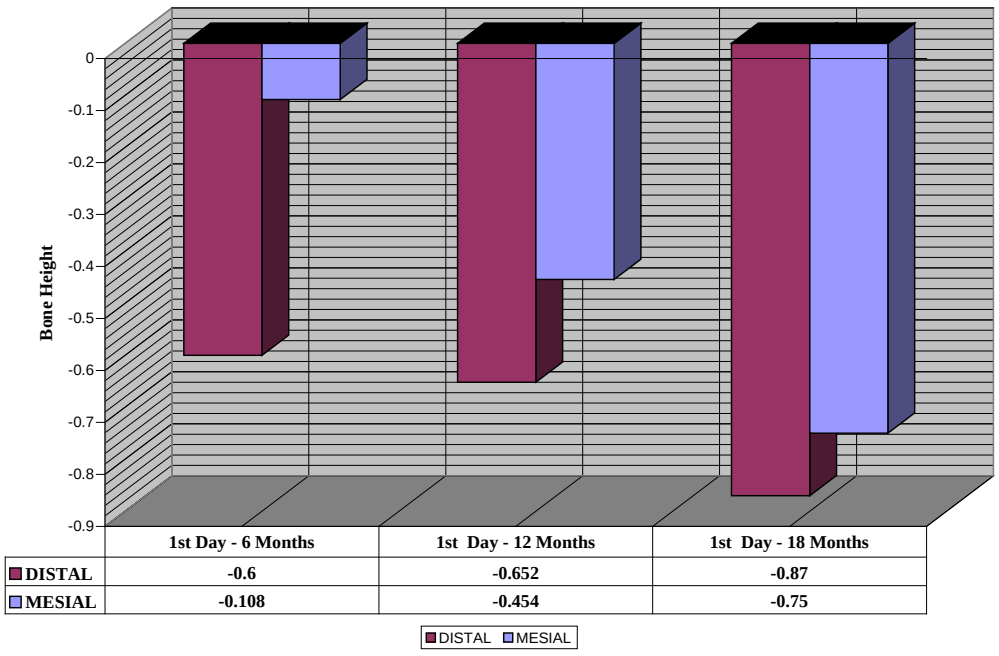


Figure (57): Comparison Between Mean Value of Mesial and Distal Bone in Group (II) at Different Interval.

Table (11): Comparison Between Mean Value of Mesial and Distal Bone in Group (I) at Different Interval.

Period	Mean	
	Mesial	Distal
1st Day - 6 Months	- 0.598	- 0.484
1st Day - 12 Months	-1.184	- 0.784
1st Day - 18 Months	-1.284	-1.544

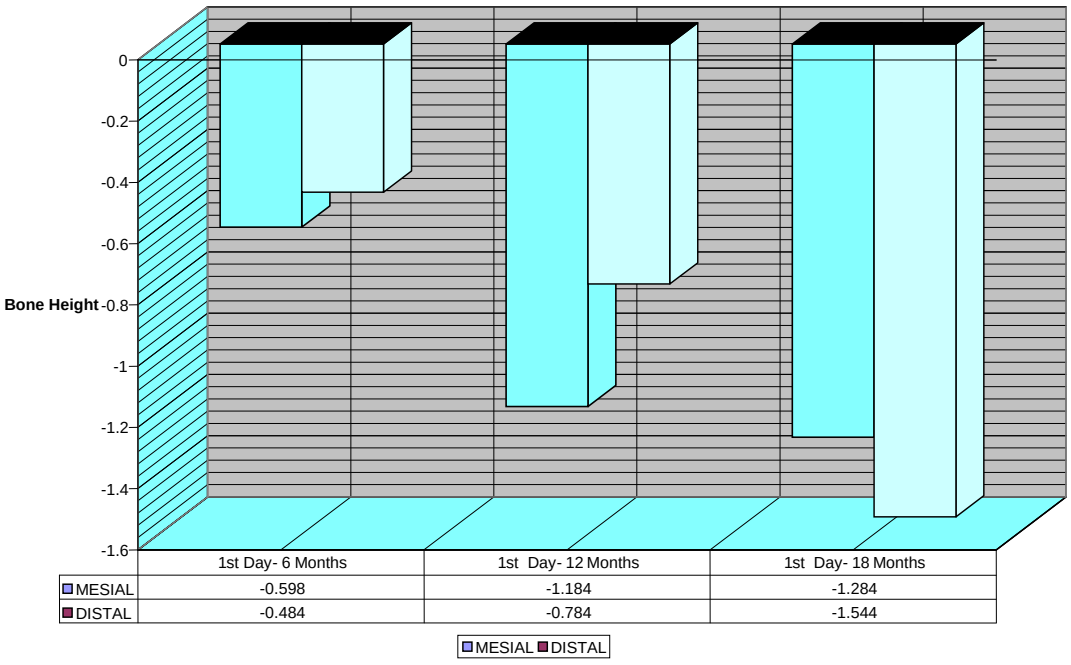


Figure (58): Comparison Between Mean Value of Mesial and Distal Bone in Group (I) at Different Interval.

A decrease in bone height distal to the implant was -.108 mm. from 1st day till six months, -.454 mm from 1st day till twelve months and -.75 mm from 1st day till eighteen months.

It was revealed that there were a statistically non significant difference in the distal bone height between group (I) and group (II) at the first day of denture delivery and after 6 months significant difference after 12 months & highly significant difference after 18 months.

2- Results of Bone density

Mesial aspect

The results of bone density in both groups at the different follow-up periods are summarized in tables (12, 13) and Figures (59, 60).

Group (I):

The mean values of the mesial bone density of the group (I) were 81.296 pixels at the first day of denture delivery, 89.60 pixels after six months, 88.526 pixels after twelve months and 93.46 pixels after eighteen months.

Collectively, in group (I) the mesial bone density was increased by 8.304 pixels from 1st day of denture insertion till six months, -7.23 pixels from 1st day till twelve months and 12.164 pixels from 1st day till eighteen months.

Group (II)

The mean value of the mesial bone density of the group (II) was 81.310 pixels at the first day of denture delivery, 93.748 pixels after six months, 95.63 pixels after twelve months and 97.8 pixels after eighteen month.

Table (12): Mesial Bone Density Expressed by Pixels at Different Follow up Periods in Group (I) and Group (II).

Period	Group (I)			Group (II)			F	t	Sign.
	Mean	SD	Std. Error Mean	Mean	SD	Std. Error Mean			
1st Day	81.296	0.11283	0.05046	81.310	0.34713	0.15524	2.221	- 0.086	N.S
6 Months	89.600	1.74642	0.78102	93.748	0.99477	0.44488	1.488	- 4.615	S.
12 Months	88.526	0.85081	0.38049	95.630	0.54704	0.24464	0.918	-15.704	S.
18 Months	93.460	1.32778	0.59380	97.800	0.55678	0.24900	8.345	- 6.740	H.S

SD = Standard deviation t-value: t-test F=Fisher-test
Sign. = Significance (**S. • 0.05)** N.S = Not Significant
H.S = Highly significant (**H.S. • 0.001)**

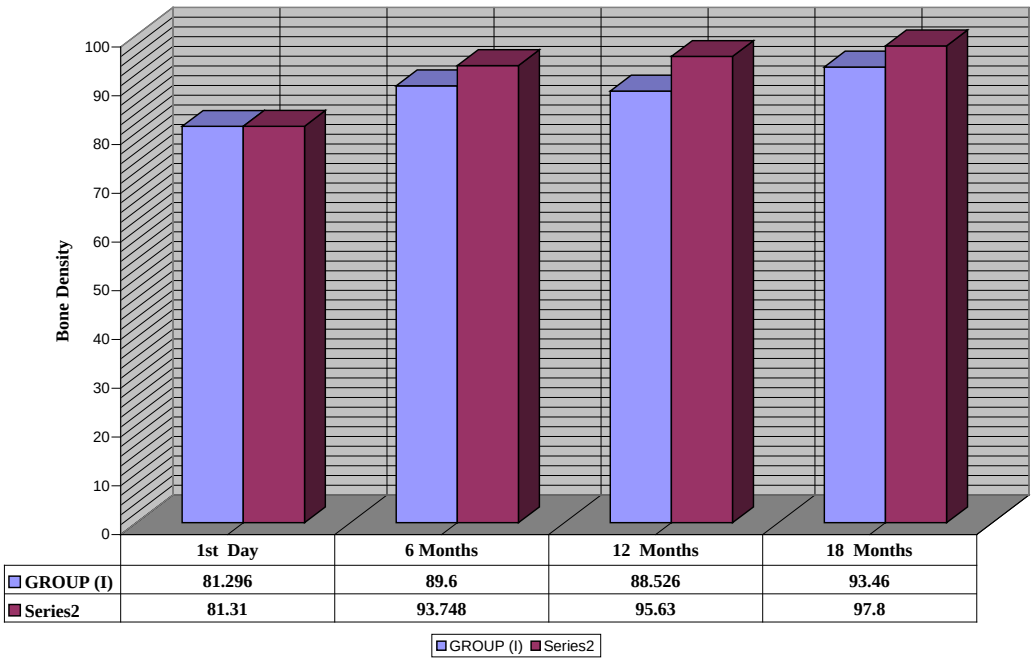


Figure (59) Mesial Bone Density Expressed by Pixels at Different Follow up Periods in Group (I) and Group (II).

Table (13): Change of Mesial Bone Density at Different Time Intervals in Group (I) & (II)

Period	Mean	
	Group (I)	Group (II)
1st Day - 6 Months	8.304	12.438
1st Day - 12 Months	7.23	14.32
1st Day - 18 Months	12.164	16.49

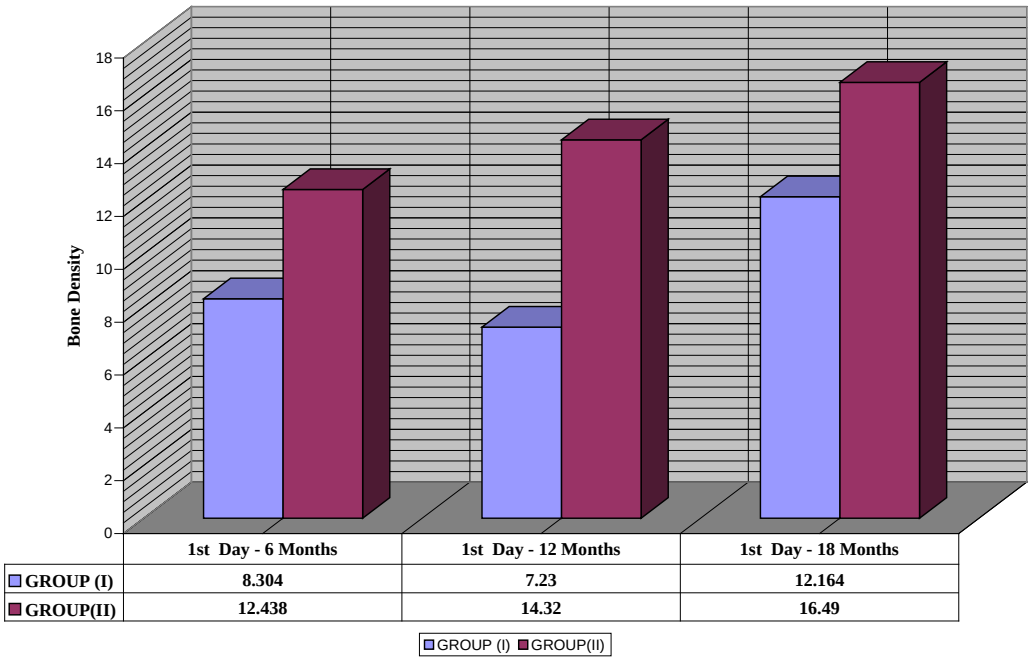


Figure (60): Change of Mesial Bone Density at Different Time Intervals in Group (I) & (II)

It was revealed that there were a statistically non significant difference at the first day of denture delivery , significant difference after 6 and 12months and highly significant difference after 18 months.

Collectively, in group (II) the mesial bone density was increased by 12.438 pixels from 1st day of denture insertion till six months, 14.32 pixels from 1st day till twelve months and 16.49 pixels from 1st day till eighteen months.

Distal aspect

The results of distal bone density in both groups at the different follow-up periods are summarized in tables (14,15) and Figures (61, 62).

Group (I):

The mean values of the distal bone density of the group (I) were 82.918 pixels at the first day of denture delivery, 90.744 pixels after six months, 117.028 pixels after twelve months and 126.608 pixels after eighteen months.

Collectively, in group (I) the distal bone density was increased by 7.826 pixels from 1st day of denture insertion till six months, 34.11 pixels from 1st day till twelve months and 43.69 Pixels from 1st day till eighteen months.

Group (II)

The mean values of the distal bone density of the group (II) were 82.996 pixels. at the first day of denture delivery, 92.734 pixels after six months, 97.004 pixels after twelve months and 104.842 pixels after eighteen months.

It was revealed that there were a statistically non significant difference at the first day of denture delivery and after 6 months and highly significant difference after 12months and after 18 months.

Collectively, in group (II) the distal bone density was increased by 9.738 pixels from 1st day of denture insertion till six months, 14.008 pixels from 1st day till twelve months and 21.846 pixels from 1st day till eighteen months.

Apical aspect

The results of bone density in both groups at the different follow-up periods are summarized in tables (16.17) and Figures (63, 64).

Group (I):

The mean values of the apical bone density of the group (I) were 102.770 pixels. at the first day of denture delivery, 108.334 pixels after six months, 123.528 pixels after twelve months and 126.794 pixels after eighteen months.

Collectively, in group (I) the apical bone density was increased by 5.564 pixels from 1st day of denture insertion till six months, 20.758 pixels from 1st day till twelve months and 24.024 pixels from 1st day till eighteen months.

Group (II)

The mean values of the apical bone density of the group (II) were 102.226 pixels at the first day of denture delivery, 114.248pixels after six months, 116.878pixels after twelve months and 125.192 pixels after eighteen months.

It was revealed that there were a statistically non significant difference at the first day of denture delivery, significant difference after 6 months and highly significant difference after 12months and after 18 months.

Collectively, in group (II) the apical bone density was increased by 12.022 pixels from 1st day of denture insertion till six months, 14.652 pixels from 1st day till twelve months and 22.966 pixels from 1st day till eighteen months.

Table (14) Distal Bone Density Expressed by Pixels at Different Follow up Periods in Group (I) and Group (II).

Period	Group (I)			Group (II)			F	t	Sign.
	Mean	SD	Std. Error Mean	Mean	SD	Std. Error Mean			
1st Day	82.918	0.13274	0.05046	82.996	.48278	.21591	4.064	-.348	N.S
6 Months	90.744	1.70138	0.78102	92.734	2.53619	1.13422	0.545	-1.457	N.S
12 Months	117.028	0.96898	0.43334	97.004	0.21698	0.09704	6.129	45.092	H.S
18 Months	126.608	1.27227	0.56898	104.842	1.18314	0.52912	0.003	28.014	H.S

SD = Standard deviation t-value: t-test F=Fisher-test
Sign. = Significance (**S. • 0.05)** N.S = Not Significant
H.S = Highly significant (**H.S. • 0.001)**

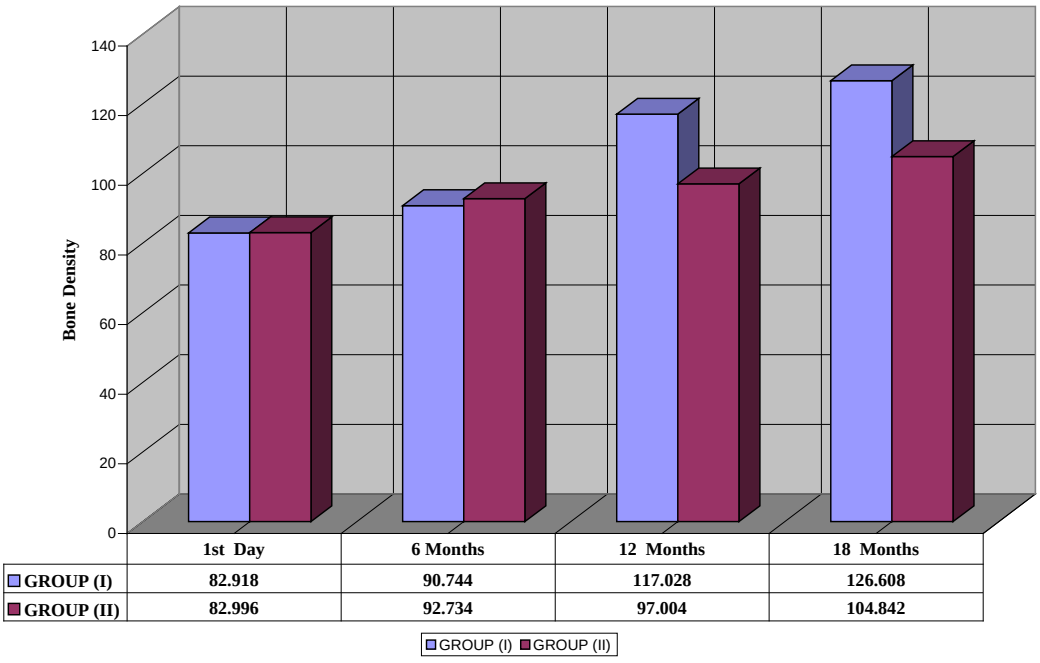


Figure (61) Distal Bone Density Expressed by Pixels at Different Follow up

Periods in Group (I) and Group (II).

Table (15): Change of Distal Bone Density at Different Time Intervals in Group (I) & (II)

Period	Mean	
	Group (I)	Group (II)
1st Day - 6 Months	7.826	9.738
1st Day - 12 Months	34.11	14.008
1st Day - 18 Months	43.69	21.846

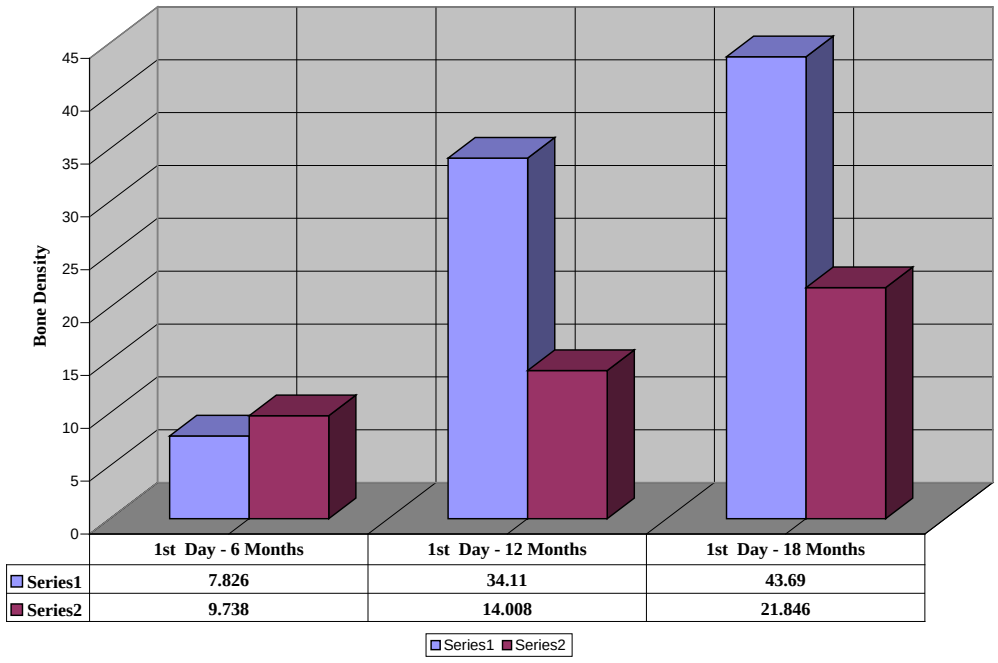


Figure (62): Change of Distal Bone Density at Different Time Intervals in Group (I) & (II)

Table (16) Apical Bone Density Expressed by Pixels at Different Follow up periods in Group (I) and Group (II).

Period	Group (I)			Group (II)			F	t	Sign.
	Mean	SD	Std. Error Mean	Mean	SD	Std. Error Mean			
1st Day	102.770	0.36715	0.16420	102.226	.77128	0.34493	1.067	1.424	N.S
6 Months	108.334	0.85351	0.38170	114.248	1.60654	0.71847	1.585	-7.269	S
12 Months	123.528	0.84942	0.37987	126.878	1.02253	0.45729	0.002	-5.635	H.S
18 Months	126.794	0.68376	0.30579	125.192	0.38114	0.17045	1.552	4.576	H.S

SD = Standard deviation t-value: t-test F=Fisher-test

Sign. = Significance (**S. • 0.05)** N.S = Not Significant

H.S = Highly significant (**H.S. • 0.001)**

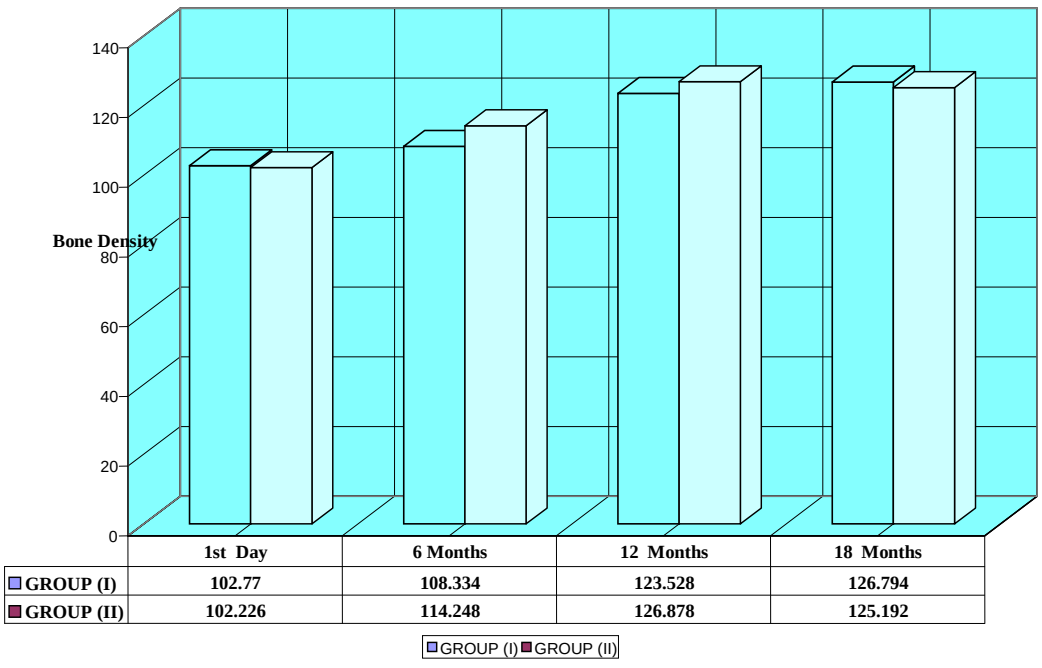


Figure (63) : Apical Bone Density Expressed by Pixels at Different Follow up Periods in Group (I) and Group (II).

Table (17): Change of Apical Bone Density at Different time Intervals in Group (I) & (II)

Period	Mean	
	Group (I)	Group (II)
1st Day - 6 Months	5.564	12.022
1st Day - 12 Months	20.758	24.652
1st Day - 18 Months	24.024	22.966

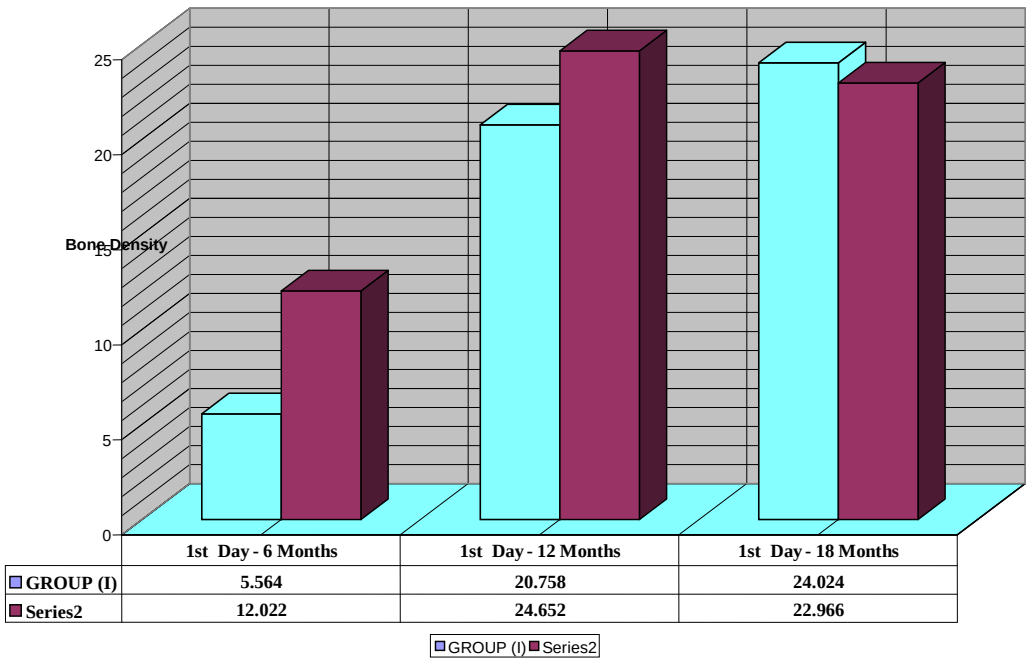


Figure (64): Change of Apical Bone Density at Different Time Intervals in Group (I) & (II)

DISCUSSION

DISCISSION

Completely edentulous patients for at least six months before the beginning of the study were selected to make sure of the proper healing of the extracted sockets [123].

The mandibular arch was selected for implant placement because problems involving lack of stability and retention were always encountered with mandibular denture [124]

Patients' selection is very important for success of dental implant. Some conditions may interfere with the success of dental implants so exclusion criteria included; insufficient bone volume in anterior mandibular area to receive two implants with length of 13mm, [125] cases with abnormal ridge relation, [126] parafunctional activities as bruxism in which the magnitude of force is increased, and the direction of the force is more horizontal than axial to the implants with a greater shear component. Thus extra load on the implant can lead to bone loss, [1, 127] and higher rates of implant failure. [128] Abnormal tongue size and/or position, high labial frenum or tongue-tie require prosthetic and surgical treatments. [129]

Angles' class I jaw relationship patients were selected to avoid abnormal forces which are exerted on the expected implant site. [130]

Patients were selected with good bone quality and quantity to help in immobilization during healing and permit better distribution and transmission of stresses at the implant bone interface. [131]

A critical factor that needs to be evaluated during the diagnosis and treatment planning phase for patients seeking for implant-tissue-supported overdentures is the presence of adequate interarch distance. The amount of interarch distance is critical to the selection of appropriate implant abutments and attachments. [129]

Each subject was required to have a minimum inter arch distance of 20 mm and a fairly equally divided intermaxillary spacing, this was necessary to ensure room for placement of the attachment within the mandible overdenture. [130]

Moreover uncooperative patients with bad oral hygiene were excluded as it has a bad effect on the marginal gingiva and marginal bone height. [129- 132]

The implant patient's mental status should be evaluated and never neglected during diagnostic procedures, assuring that it has a direct effect on implant success. Recognizing the mental attitude of the patient will help in the selection of the proper treatment and will aid in proper dealing and communication with the implant patient. [15]

Also, patients should be free from any systemic diseases (cardiac disease, diabetus mellitus, and debilitating diseases) that may affect the rate of bone resorption, gingival health, healing processes and the prognosis of implant-overdenture. [11]

Heavy smoking patients (more than 20 cigarettes) were avoided to avoid the affect of smoking on the healing of gingival tissues. [112]

These patients may exhibit generalized bone loss to all implants due to compromising the blood supply in bone during healing as nicotine is known to be a potent vasoconstrictor. [133]

Examination of tempromandibular joints was done to exclude patients with any TMJ disturbances to avoid any undesirable effect of muscle on implant. [134]

Two weeks after removing sutures, the patients were not allowed to wear the denture and kept on soft diet and drinks to protect the fixtures from any undesired loading. [85]

In this study the use of push in implant has many advantages, the surgical procedures are easy, minimizing operating time and postoperative complications. The serrated design of implant was chosen because of its initial resistance to shear stress which is apre-request for successful osseointegration**.** [19]

The length of implant fixture was 13 mm where strong statistical differences were demonstrated for bone quality, jaw shape, and implant length. Implant length of 7mm

was noted to have the highest failure rate, a significant correlation was found between shorter implants and failure rate. (1) For every 3mm increase in length, the surface area of a cylinder-shaped implant increases by more than 10% [109], while implant survival rates were reduced when implants of 10 mm or less were used in traditional healing formats. [135]

Patients with adequate bone width was selected where patients with bone width less than 7mm at the prospective implant site and cases with severe bony undercuts (especially lingual bony undercut), sharp bony edges and wiry ridges were excluded from the study as at least 1 mm thickness buccal and lingual bone are needed to the fixtures. [11]

Regarding the control of infection during implant installation the surgical steps were done under complete aseptic conditions, reducing the surgical trauma as much as possible**.** [1]

The selection of Dyna implant system was preferred due to its easy surgical procedures, many different attachments are available, excellent biomechanical properties, and in addition the success rate of this type is very high comparing to other systems. The hydroxylapatite (HA) coated, two stage implant is based on the push-in principle (press-fit) for which a minimum of instruments is required, and surgery time is reduced. [49, 136]

The insertion of 2 implants about l cm from the midline can be achieved with a relatively small incision and restricted reflection of the mucoperiosteoum far from the mental foramina. The horizontal incision was done just 5-mm labial to the crest of the ridge at the attached gingiva to allow lingual reflection of the flap assuring better surgical access by exposing a broad area of the ridge with minimum damage of tissues. By this way the suture line would not overlie directly on the implant site, minimizing the risk of contamination and preventing epithelial cell interference. [11, 137, 138]

Moreover, the sutures would be at the level of the attached gingiva away from muscular displacing action at the depth of the vestibule. [11, 138]

The diagnostic guide was modified and used as a surgical stent, to facilitate initial working at the area of the prospective implant site. Moreover, it was used to help in detection of the location of the implants in the second stage surgery. [138, 139]

Flattening of the bone crest using the crestotom drill in some cases was essential to reach to the minimum width needed in implant surgery (6 mm). [130]

The flap reflection was carefully done without tearing or injuring the periosteoum, where the flap reflection should be carefully done to minimize tissue trauma which is directly proportional to bone resorption during the healing period**.** [11, 137]

The procedure of drilling was performed at a maximum rotation speed of 2500 rpm. As The bone drilling at 2500 rpm in dense bone generates less heat than at slower speeds because it reduces the time of drilling. [139]

Drilling was carried out with a sharp new drills for fixture site preparation with high torque motor system and handpiece with internally irrigated drills, and external irrigations carrying the irrigating solution deep inside the bone, to avoid over heating which causes bone necrosis and may prevent or reduce the amount of bone regeneration. [1]

As the critical temperature which causes no damage for bone was found to be not more than 44̊c, and heating of the bone above 47̊c for one minute results in necrosis of surrounding bone cells, leading to primary cause for failed bone integration. [11]

The procedure of drilling was performed under profuse internal and external irrigation because without irrigation, drill temperatures above 100°C are reached within seconds during the osteotomy preparation, and consistent temperatures above 47°C are measured several millimeters away from the implant osteotomy [1]

All preparations were carried out with a pump-up-and-down movement with moderate finger pressure force while it was still rotating to help the cut bone to be removed from depth of the drilling hole, avoiding bone trauma and attaining proper angulations.[140]

Radiographs were not made immediately after implant placement to avoid interference of radiations with the healing process. [141]

Healing period of 3-4 months before implant loading was mandatory, this unloaded healing time was one of the most important factors in achievement of osseointegration. [2, 85]

In this study, great effort was done trying to control and dissipate forces falling on both implant abutments and relieving stresses induced abutments, as much as possible through gradual and early bone loading. This required the construction of interim dentures, which were relined with tissue conditioning material to absorb and redistribute occlusal forces.[142] This improved the amount of the implant-bone contact, as the body respond actively to the progressive increase in occlusal load increasing both quality and quantity of bone at the implant interface. [143] The use of narrow occlusal table teeth with 20 °cusp/angle which decreased the lateral component of occlusal forces on the implant by decreasing this force on the denture.[144]

Moreover, in the implant-bone interface region the elasticity of the bone may help to reduce the stresses induced in the implants.[145]

Healing abutment was placed over the fixture for 2 weeks to ensure formation of the healthy peri-implant gingival collar around the implant before connection of
the abutment. [11]

Correct implant placement is essential to establish proper esthetics, occlusion, and preservation of peri-implant tissue health.The implant was inserted at or above the bone crest to avoid an increase in the sulcus depth around the implant related to the crestal bone loss following abutment placement. Initial bone loss during the surgical healing phase also may vary for submerged and unsubmerged healing protocols.[146]

In this study, parallel depth instruments were successively installed into the prepared sites where implant parallelism occurs in both the buccolingual and mesiodistal directions. The buccolingual angulation of an implant is often restricted by the structural form and angulation of the available bone, which may be determined and provided by direct visualization during surgery.[147]

The mesiodistal paralleling of implants could be ensured with the use of surgical stents. [147, 148]

Two metal balls were attached to the diagnostic stent at the area of canine region to provide detailed information regarding the dimensions about the height of available bone by comparing the actual lengths with the insisted magnifications. [109]

In this study, panoramic x ray was used as it has several advantages including visualization of many anatomic features, low cost, and availability. Their disadvantages include the nonuniform horizontal magnification, the possibility of positioning artifacts, and the lack of cross-sectional information. Although magnification in the vertical plane is relatively stable, magnification in the horizontal plane is highly variable, depending on location in the arch, distance, and position of object with respect to the focal trough and positioning of the patient [15]

Radiographic interpretation is one of the easiest clinical tools to assess implant marginal bone loss but has many limitations. A radiograph only illustrates the mesial and distal crestal levels of bone. Assessment of implanted fixture typically is performed with periapical and panoramic radiography. [148]

Radiographs were obtained immediately after implant placement and periodically after 6, 12 and 18 months from the abutment connection postoperatively to start measurement of marginal bone level with the threads of the implant as references.[109]

Pain and discomfort are probably the most common causes for removal of an implant. Fixture was considered non-integrated: (I) if the un-connected fixture showed the slightest

mobility when tapped back and forward between 2 instrument handles; (II) if a peri-implant radiolucency could be detected; (III) if the fixture showed signs or symptoms of pain or infection. [149, 150]

In the present study, mobility was recorded clinically. where supragingival portion of the implants were subjects to firm pressure in all directions (labio-lingual and mesio-distal) by the using two sterilized hard instruments. Any degree of implant movement is considered failure of osseointegration. [150] It was shown that there was no mobility in this study in any implant in any direction for all implants. Most of the implant literature suggested that any detected mobility indicated implant failure. [151]

However, Lack of clinically observable movement does not mean the true absence of any movement.[1] A health implant moves less than 73 µm; hence, it appears as zero clinical mobility. [107] Lack of implant mobility does not always coincide with a direct bone-implant interface.[9] However, when observed clinically, rigid fixation usually means that at least a portion of the implant is in direct contact with bone, although the percentage of bone contact cannot be specified. [108]

In the present study, crestal bone loss was observed around all implants. This bone loss may be related to the polished neck of dental implants which does not osseointegrate as do textured surfaces. Lack of osseointegration was postulated to be due to increased pressure on the osseous bed during implant placement, establishment of a physiologic stress shielding, and lack of adequate biomechanical coupling between the load-bearing implant surface and the surrounding bone.[152]

Reduction of the marginal bone height around the fixture abutments could thus be partly during healing phase as a result of the surgical trauma and bone removal during drilling. [153]

The results of the bone height in this study showed highly significant difference in mesial and distal aspects between both tested groups .

These results were accepted on the basis of the findings of Adell et al, (1986) [154], Albrektsson, (1986)[13]; Smith and Zarb, (1989)[155] , Patsiatzi, (2006)[156], who documented average loss of bone height adjacent to the fixtures of not more than 1.2 mm at the end of the

first year and average of 0.2 mm annually thereafter as a radiographic criterion of implant success.

The increase in bone loss in cast bar group more than prefabricated bar group may be attributed to the more accuracy in fabrication of the prefabricated bar, where it has high precision, stress free properties where it adjusts itself automatically to the implants up to an angulation of 18°, when threading the fixation screws.

It was observed that bone loss in mesial surface in both groups was less than that in distal surface in both groups at the same intervals. These results agree with Eckert, Laney (1989) [157] who suggested that overdentures may cause bone resorption in the areas distal to the last abutment where compressive forces are transmitted to the bone.

These results may be attributed to the amount of load transmitted to the supporting structures by rigid cast bar [group (I)] and flexible prefabricated bar [group (II)] retaining mandibular overdentures. These results agree with Naert et al (1998) [158], Wowern et al (1991) [159] who concluded that the force transmitted to the underlying edentulous ridge area in splinted implants (rigid cast bar) will be more than separate implants which is expressed as physiological massaging and stimulation of the underlying bone.

It is interesting that changes in both bone height and density came parallel to the biological findings in the two studied groups as evident from the results of this study. These results were accepted on the basis of the findings of Adell et al (1986) [154], Albrektsson (1986) [13], Smith,Zarb (1989) [155] Patsiatzi, (2006)[156] They documented that the average loss of bone height adjacent to the fixtures of not more than 1.2mm at the end of the first year and average of 0.2mm annually thereafter as a radiographic criterion of implant success, and with Meijer et al (2003)[160] who found after one year functional period with overdenture retained with a bar-clip attachment system that the mean bone loss during the functional period was 0.6 mm.

Gingival index around the dental implant is considered as a reflecting mirror of the periodontal condition of implant, which in turn highlights its success or failure. (Johns et al 1992) [161]

After 12&18 months, the group treated with cast bar showed moderate inflammation in the gingival tissues surrounding some implants (score ranged between 1 and 2), while the group treated with prefabricated bar showed slight inflammation in the gingival tissues surrounding the implants (score ranged between 0 and 1). The increase in inflammation in the group treated with cast bar may be attributed to the presences of hyperplasia of the gingival tissues under the bar and around the abutments trying to fill the space between the alveolar ridge and the bar . Moreover in the group (II) treated with prefabricated bar the slight inflammation in the gingival tissues surrounding the implants may be attributed to the fact that the prefabricated bar was fully titanium fabricated and has smooth homogenous surface which allow the patient to follow strict oral hygiene measures to control plaque accumulation around the implant.

The results of gingival index showed statistically significant difference between the groups treated with cast and prefabricated bar. These results agree with the results of Akagawa et al (1993) [162], Burns et al (1995) [163], Naert et al (2004) [54] who stated that hyperplasia was observed around the implant in 25% of the patient. However, in the present study only a little amount of hyperplasia was observed in the prefabricated bar group.

Plaque index score in this study ranged between 5.95 % and 38 % for cast bar group (I), and between 5.9% and 22.5 % for prefabricated bar group (II). The reason for this high score in cast bar group (I) may be attributed to that the group treated with bar attachment may face difficulty in cleaning the gingiva under and around the bar and the irregularity of the bar thus the patient face difficulty in cleaning the cast bar . These results agree with the results of Behneke et al (2003) [164] who noted that the increasing incidence of remarkable plaque deposits represented the difficulty of the patients in maintaining a high level of oral hygiene.

Otherwise the reason for low score in prefabricated bar group (II) may be attributed to that the prefabricated bar was fully titanium fabricated and has smooth homogenous surface which allow the patient to follow strict oral hygiene measures to control plaque accumulation around the implant and/or the remnants of food don’t stagnate below it .

Lekholm et al (1985) [165] reported a retrospective cross-sectional study on 20 patients with 125 fixtures. They found that plaque and gingivitis were significantly correlated.

In the present study, the results of plaque index were much less than that recorded by Gotfredson et al (1993) [134] as they concluded that clinical evaluation showed a plaque incidence that varied between 40 % and 90%.

REFERENCES

REFERENCES

1- Misch C. E.: Dental Implant Prosthetics, Missouri, Elsevier Mosby, 2005.

2- Branemark P. I.: Osseointegration and its experimental back ground, J. Prosthet Dent, 1983; 50: 399-405.

3- Straioto F. G., de Azevedo A. M., Do Prado C. J., Das Neves F. D., Neto A. J.: Rehabilitation of maxillary edentulism with implant-supported milled-bar prostheses, Implant Dent. 2006; 4: 366-71.

4- Stanford C. M.: Application of oral implants to the general dental practice, J Am Dent Assoc, 2005; 8: 1092-100.

5- Cho S. C., Froum S., Tai C. H., Cho Y. S., Elian N., Tarnow D. P.: Immediate loading of narrow-diameter implants with overdentures in severely atrophic mandibles, Pract Proced Aesthet Dent. 2007; 3: 167-74. (Abstract)

6-Rustemeyer J., Bremerich A.: Patients' knowledge and expectations regarding dental implants, Assessment by questionnaire, Int. J. Oral Maxillofac Surg., 2007; 9: 814-7.

7- Edward P., Allen, Stephen C., Bayne, Alan H., Brodine et al: Annual review of selected dental literature, Report of the Committee on Scientific Investigation of the American Academy of Restorative Dentistry, The Journal of Prosthetic Dentistry, 2002; 88: 60-88.

8- De Baat C., Cune M. S., Carlsson G. E.: A survey of implant-retained superstructure types in the edentulous mandible in The Netherlands, Ned Tijdschr Tandheelkd, 2005; 10: 363-7. (Abstract)

9- The Glossary of Prosthodontic Terms: J. Prosthet Dent, 2005; 94: 10-92.

10- Adel M. Abd -Elmonem: Ball and socket attachments for implant-retained overdentures, A prosthetic management of peri-implant bone resorption, Egyptian Dental Journal, 1998; 44: 2713 -2717.

11- Misch, C. E.: Contemporary implant dentistry, 2nd ed., Mosby co., St. Louis, Chicago, London, Toronto, 1999.

12- Schnitman P. A., Schulman L. B.: Recommendations of the consensus development conference on dental implants, J. Am. Dent Assoc., 1979; 98: 373- 7.

13- Albrektsson T., Zarb G. A., Worthington P., Eriksson A. R. : The long-term efficacy of currently used dental implants, A review and proposed criteria of success, J. Oral Maxillofac implants, 1986; 1: 11-25.

14- Wismeijer D., Van Waas M. A. J., Kalk W.: Factors to consider in selecting an occlusal concept for patients with implants in the edentulous mandible, J. Prosthetic dentistry, 1995; 74: 380- 384.

15- Davarpanah M., Martinez H., Kebir M., Tecucianu J-F: Clinical manual of implant dentistry, U. K., Quintessence Publishing, 2003; pp: 113- 132.

16- Ekfeldt A., Åke Johnsson L., Isaksson S.: Implant-supported overdenture Therapy, A Retrospective Study, Int. J. Prosthodont, 1997; 10: 366- 374.

17- Sadoowsky S. J.: The implant-supported prosthesis for the edentulous arch, Design considerations, J. Prosthet. Dent, 1997; 78: 28-33.

18- Wismeijer D., Van Waas M. A. J., Mulder J., Vermeeren J., Kalk W.: Clinical and radiological results of patients treated with three treatment modalities for overdentures on implants of the ITI dental implant system, A randomized controlled clinical trial. Clin. Oral Impl. Res. 1999; 10: 297-306.

19- Timo O. Närhi, Mariëlle, Geertman, Miluska Hevinga, Hanan Abdo, Warner Kalk: Changes in the edentulous maxilla in persons wearing implant –retained mandibular overdentures, J. Prosthet. Dent, 2000; 84: 43-9.

20- Galindo DF. The implant-supported milled-bar mandibular overdenture. J Prosthodont. 2001; 10(1):46-51.

21- Wright: Two implants for all edentulous mandibles British Dental Journal, 2006; 200, 469.

22- Att W., Stappert C.: Implant therapy to improve quality of life, Quintessence Int., 2003; 8 : 573- 81.

23- Esa Klemetti, Antoine Chehade, Yoshiaki Takanashi, Jocelyne S. Feine: Two-Implant Mandibular Overdentures, Simple to Fabricate and Easy to Wear, J. Can. Dent Assoc., 2003; 1: 29- 33.

24- Mericske-Stern, R., Steinlin Schaffner, T., Marti, P., Geering, A. H.: Peri-implant mucosal aspects of ITI implants supporting overdentures, A five-year longitudinal study, Clinical Oral Implants Research, 1994; 59-19.

25- Versteegh, P. A., Van Beek, G. J., Slagter, A. P., Ottervanger, J. P., Clinical evaluation of mandibular overdentures supported by multiple bar fabrication, A follow-up study of two implant systems, International Journal of Oral and Maxillofacial Implants, 1995; 10: 595-603.

26- Jemt, T., Chai, J., Harnett, J., Heath, M. R., Hutton, J. E., Johns, R. B. McKenna, S., McNamara, D. C., Taylor, R., Watson, R. M., Hermann, I.: A 5-year prospective multicenter follow-up report on overdentures supported by osseointegrated implants, International Journal of Oral and Maxillofacial Implants, 1996; 11: 291-298.

27- Boerrigter, E. M., Van Oort, R. P., Raghoebar, G. M., Stegenga, B., Schoen, P. J., Boering, G.: A controlled clinical trial of implant-retained mandibular overdentures, Clinical aspects, Journal of Oral Rehabilitation, 1997; 24: 182-190.

28- Heydenrijk, K., Batenburg, R. H. K., Raghoebar, G. M., Meijer, H. J. A., Van Oort, R. P. & Stegenga, B.: Overdentures stabilised by two IMZ implants in the lower jaw-a 5-8 year retrospective study, European Journal of Prosthodontics and Restorative Dentistry, 1998; 6: 19-24.

29- Batenburg, R. H. K., Meijer, H. J. A., Raghoebar, G. M., Van Oort, R. P., Boering, G.: Mandibular overdentures supported by two Brånemark, IMZ or ITI implants, A prospective comparative preliminary study, One-year results, Clinical Oral Implants Research, 1998; 9: 374-383.

30- Caruso G., Cattaneo A.: Removable prosthesis supported by implants according to the Cagliari modified conometry technique, Case report, Int. J. Periodontics Restorative Dent, 2007; 3: 259-65.

31- Luo X, Ouyang G, Ma X, Jia A, Guo T.: The three-dimensional analysis of mandibular overdenture supported by implants Sheng Wu Yi Xue Gong Cheng Xue Za Zhi, 1998; 2: 167-71 (Abstract)

32- Van Kampen F. M., Van Der Bilt A., Cune M. S., Bosman F.: The influence of various attachment types in mandibular implant- retained overdentures on maximum bite force and EMG, J. Dent Res., 2002; 81: 170-3.

33- Lachmann S., Kimmerle-Müller E., Gehring K., Axmann D., Gomez-Roman G., Watzek G., Weber H.: A comparison of implant-supported, bar- or ball-retained mandibular overdentures, A retrospective clinical, microbiologic, and immunologic study of 10 edentulous patients attending a recall visit, Int. J. Prosthodont., 2007; 1: 37-42.

34- Manal A. Awad: Patient's ratings can be used to measure the satisfaction of different mandibular implant - retained Overdenture, Journal of Evidence Based Dental Practice, 2005; 3: 154-155.

35- Ohkubo C., Kobayashi M., Suzuki Y., Sato J., Hosoi T., Kurtz K. S.: Evaluation of transitional implant stabilized overdentures, A case series report, J. Oral Rehabil., 2006; 6: 416-22.

36- Carpentieri J.: Treatment options for the edentulous mandible, Clinical application of the two-implant overdenture, Pract Proced Aesthet Dent, 2004; 2: 105-12. (Abstract)

37- Fontijn-Tekamp F. A., Slagter A. P., Van der Bilt A., Van't Hof M. A., Kalk W., Jansen J. A.: Swallowing thresholds of mandibular implant-retained overdentures with variable portion sizes, Clin. Oral Implants Res., 2004; 3: 375-80.

38- Hoffmann O., Beaumont C., Tatakis D. N., Zafiropoulos G. G.: Telescopic crowns as attachments for implant supported restorations, A case series, J. Oral Implantol., 2006; 6: 291-9.

39- Geertman M.E., Slagter A. P., Van Waas M. A. J., Kalk W.: Comminution of food with mandibular implant-retained overdentures, J. Dent Res., 1994; 73: 1858-64.

40- Bosman F., Van Kampen F. M., Van Der Bilt A., Cune M. S., Fontijn-Tekamp F. A., Masticatory function with implant-supported overdentures, J. Dent Res., 2004; 9: 708-11.

41- Stellingsma K., Slagter A. P., Stegenga B., Raghoebar G. M., Meijer H. J.: Masticatory function in patients with an extremely resorbed mandible restored with mandibular implant-retained overdentures, Comparison of three types of treatment protocols, J. Oral Rehabil., 2005; 6: 403-10.

42- Kimoto K., Garrett N. R.: Effect of mandibular ridge height on patients' perceptions with mandibular conventional and implant-assisted overdentures, Int. J. Oral Maxillofac. Implants. 2005;5: 762-8.

43- Toothaker R., Soultanis I., Ojha A., Ashcraft-Olmscheid D. L., Chang M. W.: Retrofitting an existing implant overdenture to a new and redesigned intraoral framework, A clinical report, J. Prosthodont, 2004; 1: 47-51.

44- Gordon J.: Christensen Restorative dentistry for pediatric teeth, J. Am. Dent Assoc., 2001; 132: 16-17.

45- Raghoeba K. R., G. M. Heydenrijk, Batenburg, R. H. K., Stegenga, B.: A comparison of labial and crestal incisions for the 1-stage placement of IMZ implants, a pilot study, Journal of Oral and Maxillofacial Surgery, 58: 1119-1123.

46- McKenna G., Lillywhite G.: Accelerated rehabilitation of an edentulous patient with an implant retained dental prosthesis, A case report, Gerodontology, 2007; 3: 181-4. (Abstract)

47- Quirynen M, Alsaadi G, Pauwels M, Haffajee A, Van Steenberghe D, Naert I.: Microbiological and clinical outcomes and patient satisfaction for two treatment options in the edentulous lower jaw after 10 years of function, Clin. Oral Implants Res., 2005; 3: 277-87.

48- Raghoebar G. M., Meijer H. J., Van't Hof M., Stegenga B., Vissink A.: A randomized prospective clinical trial on the effectiveness of three treatment modalities for patients with lower denture problems, A 10 year follow-up study on patient satisfaction, Int. J. Oral Maxillofac Surg., 5: 498-503.

49- Meijer H. J., Raghoebar G. M., Visser A.: Mandibular fracture caused by peri-implant bone loss, Report of a case, J. Periodontol., 2003; 7: 1067-70.

50- Wismeijer D., Vermeeren J. I., Van Waas M. A., Patient satisfaction with overdentures supported by one-stage T. P. S. implants, Int. J. Oral Maxillofac Implants, 1992; 7: 51-5.

51- Krennmair G., Furhauser R., Weinlander M., Piehslinger E.: Maxillary interim overdentures retained by splinted or unsplinted provisional implants, Int. J. Prosthodont., 2005; 3: 195-200.

52- Awad Schwartz-Arad D., Kidron N., Dolev E.: A long-term study of implants supporting overdentures as a model for implant success, J. Periodontol., 2005; 9: 1431-5.

53- Wittwer G., Adeyemo W. L., Wagner A., Enislidis G.: Computer-guided flapless placement and immediate loading of four conical screw-type implants in the edentulous mandible, Clin. Oral Implants Res., 2007; 4: 534-9.

54- Naert I., Alsaadi G., Van Steenberghe D., Quirynen M.: A 10-year randomized clinical trial on the influence of splinted and unsplinted oral implants retaining mandibular overdentures, Peri-implant outcome, Int. J. Oral Maxillofac Implants, 2004; 5: 695-702.

55- Meijer H. J., Raghoebar G. M., Van't Hof M. A.: Implant-retained overdentures compared with complete dentures with or without preprosthetic surgery, A prospective study followed over 10 years Ned Tijdschr Tandheelkd, 2005; 1: 7-12. (Abstract)

56- Widbom C., Soderfeldt B., Kronstrom M.: A retrospective evaluation of treatments with implant-supported maxillary overdentures, Clin. Implant Dent Relat. Res., 2005; 3: 166-71.

57- Tipton P. A.: The milled bar-retained removable bridge implant-supported prosthesis, A treatment alternative for the edentulous maxilla, J. Esthet Restor Dent, 2002; 4: 208-16.

58- Tinsley D., Watson C. J., Russell J. L.: A comparison of hydroxylapatite coated implant retained fixed and removable mandibular prostheses over 4 to 6 years Clinical Oral Implants Research, 2001; 12: pp. 159-166.

59- Shor A., Goto Y., Shor K.: Mandibular two-implant-retained overdenture, Prosthetic design and fabrication protocol, Compend Contin Educ. Dent, 2007; 2: 80-8.

60- Carlson-Mann, L. D., Ibbott, C. G.: The maintenance of osseointegrated implants, J. Am. Dent. Assoc., 1991; 57: 649-653.

61- Peterson L. J., Ellis E., Hupp J. R., Tucker M. R.: Contemporary Oral and Maxillofacial surgery, Missouri, Mosby, 2003; pp: 305-342.

62- Attard N., Wei X., Laporte A., Zarb G. A., Ungar W. J.: A cost minimization analysis of implant treatment in mandibular edentulous patients, Int. J. Prosthodont., 2003; 3: 271-6.

63- Heydecke G., Thomason J. M., Lund J. P., Feine J. S.: The impact of conventional and implant supported prostheses on social and sexual activities in edentulous adults, Results from a randomized trial 2 months after treatment, J. Dent, 2005; 8: 649-57.

64- Geertman M. E., Van Waas M. A., Van't Hof M. A., Kalk W.: Denture satisfaction in a comparative study of implant-retained mandibular overdentures, A randomized clinical trial, Int. J. Oral Maxillofac Implants, 1996; 11: 194-200.

65- Kent G., Johns R.: Effects of osseointegrated implants on psychologicaland social well being, A comparison with replacement removable prostheses, Int. J. Oral Maxillofac Implants, 1994; 9: 103-6.

66- Heydenrijk, K., Raghoebar, G. M., Batenburg, R. H. K., Stegenga B.: Comparison of labial and crystal incisions for the 1-stage placement of IMZ implants, A pilot stud. Journal of Oral and Maxillofacial Surgery, 2000; 58: 1119-1123.

67- Rad A. S., Siadat H., Monzavi A., Mangoli A. A.: Full mouth rehabilitation of a hypohidrotic ectodermal dysplasia patient with dental implants, A clinical report, J. Prosthodont, Dental Research Center, Tehran University, 2007; 3: 209-13.

68- Schmitt A., Zarb G. A.: The notion of implant-supported overdentures, J. Prosthet Dent, 1998; 79: 60-5.

69- MacEntee M. I., Walton J. N.: The economics of complete dentures and implant- related services, A framework for analysis and preliminary outcomes, J. Prosthet Dent, 1998; 79:24-30.

70- Carlsson G. E., Lindquist L. W.: Ten-year longitudinal study of masticatory function in edentulous patients treated with fixed complete dentures on osseointegrated implants, Int. J. Prosthodont, 1994; 7: 448-53.

71- Haraldson T., Jemt T., Stalblad P. A., Lekholm U.: Oral function in subjects with overdentures supported by osseointegrated implants, Scand. J. Dent Res., 1988; 3: 235-42.

72- Takanashi Y., Penrod J. R., Chehade A., Klemetti E., Lund J. P., Feine J. S.: Surgical placement of two implants in the anterior edentulous mandible--how much time does it take? Clin Oral Implants Res., 2003; 2: 188-92.

73- Jagger R., General dentists can provide successful implant overdentures with minimal training, Evid Based Dent. 2007; 2: 50. (Abstract)

74- Stewart, K. L., Edward, R. O.: Retention and wear of percussion type attachments, J. Prosthet. Dent, 1992; 67: 761-768.

75- Zhonghua Kou Qiang Yi : Clinical application of implant supported magnet-retained overdenture, Xue Za Zhi, 2006; 4: 193-5.

76- Aydin M., Yilmaz A., Katiboglu B., Tunc E. P.: ITI implants and Dolder bars in the treatment of large traumatic defect of mandible, A clinical report, Dent Traumatol, 2004; 6: 348-5.

77- Uludag B., Sahin V., Celik G.: Fabrication of a maxillary implant-supported overdenture retained by two cemented bars, A clinical report, J. Prosthet Dent, 2007; 5: 249-51.

78- Cune M. S., Van Kampen F. M., Van der Bilt A.: Patient satisfaction with different types of implant-retained overdentures in the edentate mandible, Ned Tijdschr Tandheelkd, 2006; 10: 401-7. (Abstract)

79- Nedir R., Bischof M., Szmukler-Moncler S., Belser U.C., Samson J.: Prosthetic complications with dental implants, From an up-to-8-year experience in private practice, Int. J. Oral Maxillofac Implants, 2006; 6: 919-28.

80- Bolouri A., Zartman R. R.: Fabrication of custom clips for bar-and-clip attachments for implant-supported overdentures, J. Prosthet Dent, 2006; 5: 379-80.

81- Waddell J. N., Payne A. G., Swain M. V.: Physical and metallurgical considerations of failures of soldered bars in bar attachment systems for implant overdentures, A review of the literature, J. Prosthet Dent, 2006; 4: 283-8.

82- J. Dong, K. Ikebe, T. Gonda, T. Nokubi: Influence of abutment height on strain in a mandibular overdenture Journal of Oral Rehabilitation, 2006; 8: 594–599.

83- Basker R. M., Harrison A., Ralph J. P.: Overdentures in general dental practice, Brit Dent J., 1983; 154: 285-9.

84- Mendez A., Guerra L.: Implant Overdentures In: Block MS, Kent JN: Endosseous Implants for Maxillofacial Reconstruction. Philadelphia: WB Sounders Co., 1995; pp: 158-77.

85- Block M. S., Kent J. N., Guerra L. R.: Implants in dentistry, Essentials of endosseous implants for maxillofacial reconstruction, Philadelphia, Saunders, 1997; pp: 54- 62, 260- 273.

86- Jumber, J. F., Jumber, Mj; Anderson F. H.: An atlas for over dentures and precision. Attachments, Quint. Public. Co. Inc., Chicago, 1981; pp: 45-99.

87- Periskel, H. W.: Precision attachments in prosthodontics, 3rd ed, Henry Klompoton publishers Lted. London, 1979; pp: 109-147, 212-227.

88- Barley C. W., Wellesley A. D.: Fixed and removable prosthodontics, Churchill Livingstone, 1998; 13: 97, 99,100.

89- Dolder E. J., Durrer G. T.: The bar-Joint Denture, A Practical Approach, Chicago, Quint. Pub. Co., 1978; 1: 11-112.

90- Defranco R. L.: Overdentures, Dent Clin., North Am., 1977; 21: 379 - 94.

91- Thayer H. H., Caputo A. A.: Photoelastic stress analysis of overdenture attachments, J. Prosthet. Dent, 1980; 43: 611 - 17.

92- Winkler S. H.: Essential of Complete Denture Prosthodontics, 1st ed, Philadelphia, W. B. Saunders Co., 1979; pp: 581 - 596.

93- Thayer H. H., Caputo A. A.: Effects of overdentures upon remaining oral structures, J. Prosthet. Dent, 1977; 37: 374 - 81.

94- Mensor M. C.: Attachment for Overdentures, Vol. 3, 2nd ed., St. Louis, C. V. Mosby Co, 1986; pp: 577 - 616.

95- Mensor M. C.: Removable partial overdentures with mechanical precision attachments, Dent Clin., North Am., 1990; 4: 669-74.

96- Jacobs R., Van Steenberghe D., Nys M., Naert I.: Maxillary bone resorption in patients with mandibular implant-supported overdentures o fixed prostheses, J. Prosthet Dent, 1993; 70: 135-140.

97- Naert I., Gizani S., Vuylsteke M., Van Steenberghe D.: A 5-year prospective randomized clinical trial on the influence of splinted and unsplinted oral implants retaining a mandibular overdenture, Prosthetic aspects and patient satisfaction, J. Oral Rehabil, 1999; 26: 195-202.

98- Walton J. N., Rose N. D.: In vitro changes in clips and bars used to retain implant overdentures, J. Prosthet. Dent, 1995; 74: 482-486.

99- Robert K. Biesaga: Manual Dyna Instant Adjusting Bar, Dental Engineering, Bergen op zoom, Netherlands, 2004; pp: 4 - 6 .

100- Petropoulos V. C., Smith W., Kousvelari E.: Comparison of retention and release periods for implant overdenture attachments, Int. J. Oral Maxillofac Implants, 1997; 12: 176-185.

101- Naert I., Quriynen M., Hooghe M., Van Steenberghe D.: Acomparative prospective study of splinted and unsplinted Bränemark implants in mandibular overdenture therapy, A preliminary report, J. Prosthet Dent, 1994; 71: 486-92.

102- Misch C. E.: Density of bone, Effect on treatment plans, surgical approach, healing, and progressive bone loading, Int. J. Oral Implantol 1990; 6: 23-31.

103- Misch C. E.: Contemporary implant dentistry, 2nd ed., St. Louis, Mosby, 1998; pp: 109-34, 207-17, 329-43, 595-608.

104- Quirynen M., Naert I., and Van Steenberghe D.: Fixture design and overload influence marginal bone loss and fixture success in the Bränemark system, Clin. Oral Implants Res. 1992; 3: 104-11.

105- Linkow L. I., Chercheve R.: Theories and techniques of oral and implantology, Vol. 1, St. Louis, Mosby, 1970.

106- Lekholm U., Zarb G. A.: Patient selection and preparation, In Bränemark P-I, Albrektsson T., editors, Tissue integrated prostheses, Osseointegration in clinical dentistry, Chicago, Quintessence, 1985.

107- Lang N. P., Wilson T. G., Corbet E. E.: Biological complications with dental implants, Their prevention, diagnosis and treatment, Clin. Oral Impl. Res., 2000; 5 :146-155.

108- Sekine H., Komiyama Y., Hotta H,: Mobility Character Isitics and Tactile Sensitivity of Osseointegrated Fixture-Supporting Systems, In Van Steeberghe D. Editor, Tissue Integration In Oral Maxillofacial Reconstruction, Amesterdam, 1986; Excerpta Medica.

109- Steflik D. E., Koth D. L., McKinney Jr.: Human clinical trials with the single crystal sapphire endosteal dental implant, three year results, statistical analysis, and validation of an evaluation protocol, J. Oral Implantol., 1987; 13: 39-53.

110- Misch C. E.: Contemporary implant dentistry, St. Louis, Mosby, 1993; pp: 29-41, 123-155, 223-225, 369-384, 705-734.

111- Babbush CA: Dental implants, the art and science, Philadelphia, Saunders, 2001, pp 35-58 & 423-444.

112- Gatti C., Haefliger W., Chiapasco M.: Implant-retained mandibular overdentures with immediate loading, A prospective study of ITI implants. Int. J. Oral Maxillofac Implants, 2000; 15: 383-388.

113- kholm U., Adell R., Lindhe J., Brånemark P. I., Eriksson B., Rockler B., Lindvall A. M., Toneyama T.: Marginal tissue reactions at osseointegrated titanium fixtures, (II) A cross-sectional retrospective study, Int. J. Oral Maxillofac Surg., 1986; 15: 53-61.

114- Hodges K. O.: Concepts in nonsurgical periodontal therapy, New York, Delmar publishers, 1998; pp: 367-411.

115- Mericske-Stern R., Grutter L., Rosch R., Mericske E.: Clinical evaluation and prosthetic complications of single tooth replacements by non-submerged implants, Clin. Oral Implants Res., 2001; 4: 309-18.

116- Naert I, Alsaadi G, van Steenberghe D, Quirynen M: A 10-year randomized clinical trial on the influence of splinted and unsplinted oral implants retaining mandibular overdentures: Peri-implant outcome. Int J Oral Maxillofac Implants 2004; 19: 695-702.

117- Shimpuku H., Nosaka Y., Kawamura T., Tachi Y., Shinohara M., Ohura K.: Genetic polymorphisms of the interleukin-1 gene and early marginal bone loss around endosseous dental implants, Clin. Oral Implants Res., 2003; 4: 423-9.

118- Mombelli, A.; Buser, D. and Lang, N.P.: Colonization of osseointegrated titanium implants in edentulous patients. Early results. Oral Microbiology and Immunology 3 : 113, 1988.

119- Gher, M. E., Quintero, G. Assad D., Monaco E., Richardson, A. C.: Bone grafting and guided bone regeneration for immediate dental implants in humans, J. Periodontol., 1994; 65: 881-887.

120- Loe, H. and Silness, J.: Periodontal disease in pregnancy. Prevalence and severity. Acta Odont. Scand. 1963; 21 : 533.

121- Wenzel A (1991): Effect of image enhancement for detectability of bone lesion in digitized intraoral radiographs. Scand. J. Dent. Res.; 46: 199 -205.

122- Karin A., Southard F., Thomas E.: Quantities feature of digitized Radiographic bone profile, Oral Surg., Oral Med., Oral Path., 1992; 73: 75-80.

123- El-Guindy M., El-Tonsy M., Abdel Razzak Y.: Longitudinal evaluation of tricalcium phosphate ceramic combined with tetracycline HCL root conditioning in treatment of periodontal osseous defects. Med. Cairo Univ. 199664: 195-205.

124- Ohrnell, L. O., Hirsch, J. M., Ericsson, Iand Bränemark-I: Single teeth rehabilitation using osseointegration, A modified surgical and prosthetic approach, Quintessence Int., 1988; 19: 871-872.

125- Meijer H. J. A., Raghoebar G. M., Hof M. A. V., Visser A.: A controlled clinical trial of implant-retained mandibular overdentures, 10 years' results of clinical aspects and aftercare of IMZ implants and Brånemark implants, Clin. Oral Impl. Res., 2004; 15: 421-427.

126- Adel Abdel-Monem A. M.: Ball and Silicone Socket Attachments for implant-retained overdentures, A Prosthetic Management of Peri-implant Bone Resorption, Egyptian Dental Journal, 1998; 44: 2713-2717.

127- Desjardins R. P.: Tissue integrated prostheses for edentulous patients with normal and abnormal jaw relationships, J. Prosthet. Dent, 1988; 59: 180.

128- P. L. Bränemark: Osseointegration and its experimental background, J. Prosthet Dent, 50 (1983) , pp. 399–410.

129- Colomina L. E.: Immediate loading of implant-fixed mandibular prosthesis, A prospective 18-month follow-up clinical study-preliminary report, Implant Dent, 2001; 10: 23-29.

130- Becker, W Becker B. E.: Replacement of maxillary and mandibular molars with single endosseous implant restorations, A retrospective study, J. Prosthet Dent, 1995; 74: 51-56.

131- Worthington P., Lang B. R., LaVelle W. E.: Osseointegration in Dentistry, An introduction, Quintessence Co., Inc., Carol Stream, Illiois, 1994.

132- Dvid R. Burns, John W. Unger, Ronald K. Elswick, J. R., David A., Beck 1995, Prospective clinical evaluation of mandibular implants overdentures, Part I-retention, stability and tissue response, J. Prosthet Dent, 1995; 73: 354-63.

133- Gotfredsen K., Holm, B., Sewerin, I., Hjrting-Hansen, E, Pedersen, C. S., Christensen: Marginal tissue response adjacent to Astra dental implants supporting, Overdentures in the mandible, A 2 year follow-up study, Clinical Oral Implants Research, 1993; 4: 83-89.

134- Schnitman P. A., Wöhrle P. S., Rubenstein J. E., DaSilva J. D., Wang N. H.: Ten-year results for Brånemark implants immediately loaded with fixed prostheses at implant placement, Int. J. Oral Maxillofac Implants, 1997; 12: 495-503.

135- Von Gonten A. S., Palik J. F., Oberlander B. A., Rugh J.: Nocturnal electromyographic, Evaluation of the masseter muscle activity in the complete edentulous patients, J. Prosthet. Dent., 1986; 56: 624-629.

136- Sung-Kiang Chuang D. M. D., M. D, DMSc Jawbone quality, jaw shape, implant (1) length, and overdenture treatment protocol were associated with implant failures Journal of Evidence Based Dental Practice Volume 5, Issue 4, 2005; pp: 215-216

137- Strietzel F. P., Nowak M., Kuchler I., Friedmann A., Peri- implant alveolar bone loss with respect to bone quality after use of the osteotome technique, Results of a retrospectivestudy, Clin Oral Implants Res., 2002; 13: 508-13.

138- Siegele D., Soltesz U.: Numerical investigation of the influence of implant shape and stress distribution in the jaw bone, Int. J. Oral maxillofacial implants, 1989; 4: 333-340.

139- Cranine A. N., Klein M., Simson A.: Atlas of Oral Implantology, Theme Medical Publishers, Inc. New York, Germany, 1993; 42-43.

140- Greenstein G., Cavallaro J.: The relationship between biologic concepts and fabrication of surgical guides for dental implant placement, Compend Contin. Educ. Dent, 2007; 4: 196-203.

141- Cranine, A. N., Sirakian A.: Preparing host sites for generic root form implant, Oral heal., 1994; 25-32.

142- Pylant, Triplett, Key, Brunsvold: A retrospective evaluation of endosseous titanium implants in the partially endentulous patient, International Journal of Oral & Maxillofacial Implants, 1992 : 7 , 195 – 202.

143- Block M. S., Kent J. N.: Endosseous implants for maxillofacial reconstruction, 1st ed., W. B. Sunders Co., Philadelphia, London, Toronto, Montreal, Sydney, Tokyo, 1995.

144- Misch C. E.: Density of bone, Effect on treatment plans, surgical approach, healing, and progressive bone loading, Int. J. Oral Implantol 1990; 6: 23-31.

145- Caswel C. W., Clark A. E. (1991) : Dental implant Prosthodontics. J. B. Lippincott Co., Philadelphia Rieder, and Parel,1993

146- Rieder, Parel: A survey of natural tooth abutment intrusion with implant-connected fixed partial dentures, The International Journal of Periodontics & Restorative Dentistry, 1993;13: 335-347.

147- Lekholm U.: Clinical procedures for treatment with osseointegrated dental implants, J. Prosthet Dent, 1983; 50: 116-20.

148- Çehreli, Kıvanç Akça, Haldun Iplikçioglu, Murat C.: A surgical guide for accurate mesiodistal paralleling of implants in the posterior edentulous mandible, J. Prosthet Dent, 2002; 87: 233-5.

149- White S. C., Pharoah M.: Oral radiology, Principles and interpretation, 5th ed., Missouri, Mosby, 2004; pp: 677-692.

150- Riynen M., Naert I., Van Steenberghe D., Darius P.: A six-year prosthodontic study of 509 consecutively inserted implants for the treatment of partial edentulism, J. Prosthet Dent, 1992; 67: 236-45.

151- Smith D. E., Zarb G. A.: Criteria for success of osseointegrates endosseous implants, J. Prosthet. Dent, 1989; 62: 567.

152- Chafez H., Ortman L. F., De France R. l., Medige J.: Assessment of oral implant mobility, J. Prosthet. Dent, 1993; 70: 241-245.

153- Gregory Stephan, Fabien Vidot, Renaud Noharet, Paul Mariani: Implant-retained mandibular overdentures, A comparative pilot study of immediate loading versus delayed loading after two years, J. Prosthet Dent 2007; 97: S138-S145.

154- Brånemark P.I., Hansson B. O., Adell R., Breine U., Lendstorm J., Hallen O., Ohman A.: Osseointegrated implants in the treatment of the edentulous jaw, Experience from a 10-year period, Scand., J. Plast. Reconst. Surg., 1977; 11: suppl. 16.

155- Adell R., Eriksson B., Lekholm U., Rockler B., Brånemark P. I., Lindhe U. L.: Marginal tissue reaction at osseointegrated titanium fixtures, A 3-year longitudinal prospective study, Int. J. of Oral and maxillofacial implants, 1986; 15:39.

156- Smith D. E., Zarb G. A.: Criteria of success of osseointegrated endosseous implants, J. prosthere. Dent, 1989; 62: 567- 572.

157- Patsiatzi E., Malden N., Ibbetson R.: A radiographic review of bone levels around Calcitek dental implants supporting mandibular over-dentures, Preliminary results at 3 to 6 years, Eur. J. Prosthodont Restor Dent, 2006; 4: 169-73.

158- Eckert S. E., Laney W. R.: Patient evaluation and prosthodontic treatment planning for osseointegrated implants, Dent Clin., North Am., 1989; 33: 599-618.

159- Wowern N. Von, Hjorting-Hansen E.: The mandibular bone mineral content in relation to vestibular sulcoplasty, A 2-year follow up, J. Prosthetic dentistry, 1991; 65: 804-808.

160- Meijer H. J., Heijdenrijk K., Raghoebar G. M.: Mucosal and radiographic aspects during the healing period of implants placed in a one stage procedure, J. Prosthodont. Jun, 2003; 2: 138-142.

161- Johns R. B., Jemt T., Heath M. R., Hutton J. E., McKenna S., McNamara D. C., Van Steenberghe D., Tayler R., Watson R. M., Herrmann I.: A multicenter study of overdenture supported by Brånemark implants, Inter, J. of Oral and maxillofacial implants, 1992; 7: 513-522.

162- Akagawa, Y. I.,Chikawa, Y., Nikai, H., Touru, H.: Interface histology of unloaded and early loaded partially stabilized zirconia endosseous implant in initial bone healing, J. Prosthet Dent, 1993; 69: 599-604.

163- Burns D. R., Unger J. W., Elswick R. K., Beck D. A.: Prospective clinical evaluation of mandibular implant overdentures, Part I, Retention, Stability and tissue response, J. of Prosthet. Dentistry, 1995; 73: 354-363.

164- Behneke A., Behneke N., D' Hoedt B.: A 5-year longitudinal study of the clinical effectiveness of ITI solid – screw implants in the treatment of mandibular edentulism, J. Dent Res., 2003;1: 53-58.

165- Lekholm U., Zarb G. A.: Patient selection and preparation in Brånemark, P-L; Zarb, G. A. and Albrektsson, T.: Tissue in integrated prostheses. Osseointegration in clinical dentistry; 2nd Ed. Quintessence Co., Berlin. 1985.

SUMMARY AND CONCLUSIONS

SUMMARY

Ten completely edentulous patients received twenty push inform titanium DYNA dental implants, with 13mm length and 3.6 mm diameter.

Patients sharing in this study were randomly divided into two equal groups, each containing five edentulous patients. Both groups had stage one surgery for placing 2 dental implant fixtures, one implant on each side anterior to the mental foramina.

Group (I) : Cast Bar Group

Patients in this group received conventional maxillary complete denture and mandibular bar-retained overdenture supported by two endosseous implants that remained submerged for a period of four months. The implants were uncovered, and after one weeks the steps for construction of mandibular bar overdenture was started.

Group (II) : Prefabricated Bar Group

Patients in this group received conventional maxillary complete denture and mandibular prefabrecated bar-retained overdenture supported by two endosseous implants that remained submerged for a period of four months. The implants were uncovered, and after one weeks the steps for construction of mandibular bar overdenture was started.

The patients were evaluated clinically and radiographically immediately after overdenture delivery, after 6 months, 12 months and 18 months.

Clinical evaluation of the patients included recording of gingival index scores, plaque index scores, probing depth using implant mobility and percussion.

All patients were satisfied with their dentures, no mobility was detected in both groups and all implants gave a solid ringing sound on percussion indicating direct contact between the bone and implants i.e. successful osseointegration.

Gingival index scores and plaque index scores in both groups showed increase through the 18 months follow-up period. This increase was attributed to the difficulty the patients found in maintaining a high level of oral hygiene. There was statistical significant difference between the 2 groups regarding the effect of treatment.

Plaque index score was significantly higher in group I (cast bar) after 18 months than patients of group II (prefabricated bar).

Radiographic assessment of the mesial and distal alveolar bone heights around dental implants was performed utilizing the cefalometric x ray (sidexes). The results of the study showed minimal marginal bone loss in group treated with prefabricated bar, which did not exceed a mean of 0.87mm, at the end of 18 months follow-up period.

According to bone density there was statistically significant difference between the two groups in Mesial and apical aspects. after 18 months.

CONCLUSIONS

The following points were concluded from this study:-

- The use of two implants at the canine areas is adequate to retain bar attachment overdentures.
- From the clinical point of view, satisfactory results were obtained when an implant was used to retain mandibular overdenture.
- The prefabricated bar overdentures showed less bone resorption distal to the implant in comparison to the cast bar implant retained overdentures.
- Both the Gingival index and Plaque index score was significantly high in the group treated with cast bar retained over denture.
- The prefabricated bar implant retained over denture showed low significant reduction in the bone height after one year, and a very highly significant reduction after eighteen months.

Recommendation

Prefabricated bar in implant retained mandibular complete over denture must be clearly investigated.