

Atrophied Edentulous Mandible with Implant-Supported Overdenture; A 10-year follow-up

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Abstract: Severe atrophy of the inferior alveolar process and underlying basal bone often results in problems with a lower denture. These problems include insufficient retention of the lower denture, intolerance to loading by the mucosa, pain, difficulties with eating and speech, loss of soft-tissue support, and altered facial appearance. These problems are a challenge for the prosthodontist and surgeon. In this case report, patient with resorbed edentulous mandible was successfully rehabilitated using two dental implants placed in the interforaminal region with ball abutments opposing conventional maxillary complete denture.

Key Words: dental implants; dental prosthesis, implant-supported; resorption,

I. Introduction

Dental implants in different forms are believed to have been used since Egyptian times. Although the currently used titanium root-form implants are a virtually serendipitous discovery from the 1950s by Dr. Per-Ingvar Brånemark of Gothenburg Sweden.[1] Since their introduction, dental implants, that are tooth-root analogue devices inserted into the jaw-bone (endosseous), have been increasingly used to support different types of dental prostheses, such as fixed partial dentures, fixed complete dentures and removable complete dentures.[2,3,4]

In 2002, two dental implants in the mandible to support removable complete dentures were advocated as the minimum standard of care for edentulous individuals by a panel of expert clinicians and scientists.[4] This consensus stemmed from a decade of longitudinal clinical studies that signify the clinical benefits and patient satisfaction with mandibular two-implant overdentures over conventional dentures. Fig.1

Dental implants are prosthetic devices, made of alloplastic materials that are inserted into the oral cavity to provide retention and support to removable and fixed dental prostheses.[1,2] The concept of using implants to replace teeth is age old. In fact, in ancient history thousands of years ago, ivory teeth were used as implants in Egyptian mummies. However, the era of modern dental implantology began much later, in the 1940's, with the discovery of screw type implants by Formigini et al.[3,4] The introduction of the concept and the biology of osseointegration, by Brånemark et al., added another milestone in the history of dental implantology.[5] Over the years, this field has significantly evolved and emerged as an extensively used treatment modality for oral rehabilitation.



Fig.1; Overdentures

The first clinical outcome of surgical procedure is the primary stability of the implant. Primary stability is rigid fixation and lack of micro motion of the implant into the bone cavity.[1,6,7] The absence of stability can lead to excessive mobility and cause fibrous tissue formation around the implants inhibiting osseointegration.[7,9] Primary stability depends on the surgical technique, implant design, and the implant site.[1,4,10] Fig.2

Currently, various forms of treatment for edentulous patients complaining of retention and / or unsatisfactory stability are available, as such, new conventional denture, implant-retained implant-supported overdentures and fixed prostheses. Accordingly, treatments involving oral rehabilitation with overdentures have been widely used by experts in the field of dentistry. Overdentures operate similarly to conventional dentures, predominantly mucosal support, but the retention and stabilization of the device are significantly improved by fixing the implants presenting as prosthesis mucus-supported and implant-retained[1,4]. The technique allows the use of the prosthesis immediately after implant placement (immediate loading) due to the use of transitional implants that are activated in conventional implant overdenture while awaiting the period of osseointegration. This is an alternative therapy to obtain retention and stability to conventional full denture, two implants sufficient to ensure satisfactory fixing. [3, 4, 8] Fig.3

One determining factor in the success of this treatment lies in the correct choice of restraint to be used; there are many restraints overdentures, each with its own peculiarities. Being the professional's responsibility to evaluate each system and indicate that offers the best results for each clinical situation. Therefore, to achieve success is a prerequisite prior planning aimed at meeting the individual characteristics of each patient.



Fig.2;Ball abutment

Many concepts have been put forward to increase stability and retention of mandibular complete denture including the mechanical principles[2,3] biometric guides etc. These techniques have been challenged and found insufficient. These techniques fail to restore function, aesthetics and comfort in patient with severely

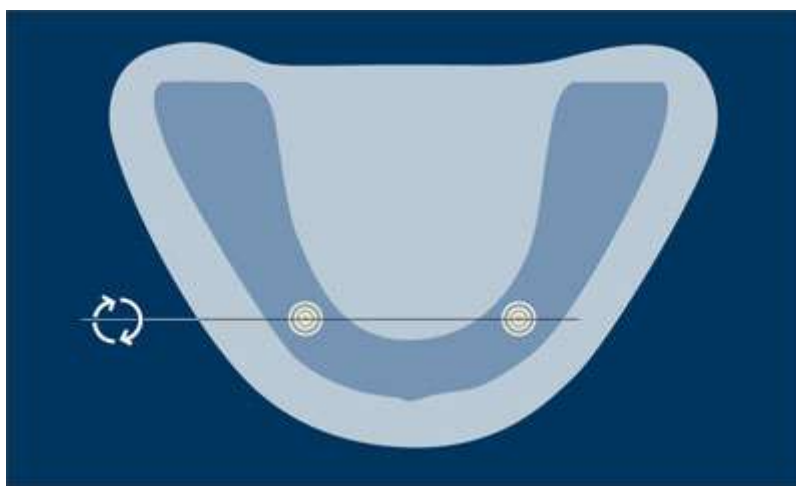


Fig.3; Two solitary abutments form an axis of rotation.

Atrophic mandibular ridges (Atwood's Class V). [4,12] Implant overdenture treatment is generally considered to be an effective treatment modality in these cases. [13] Fig.4

The feasibility of implant-supported overdentures was first tested at the University of Toronto, in early 1980's. Early positive observations lead to further studies establishing the efficacy and effectiveness of implant supported overdentures. An implant supported mandibular overdenture with two implants is a simple treatment option for edentulous patients. Since the past 20 years, a variety of options have become available for retention of these implant retained prosthesis e.g. Magnets, clips, bars and ball attachments. Many reports on patient – base assessment of the outcome and functional effects of such therapy have shown greater patient satisfaction, comfort, stability, better chewing and speaking performance, higher jaw closing force and less residual ridge resorption as compared to the conventional mandibular dentures. [1,4,13]

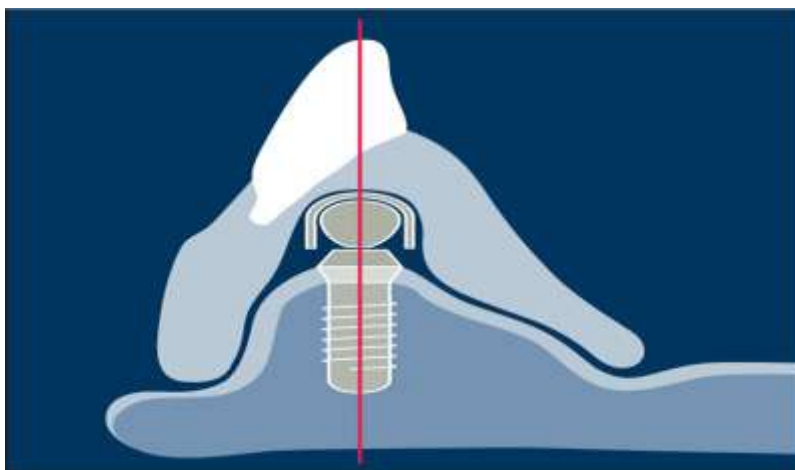


Fig.4; Occlusal loading posterior or anterior to the axis of rotation causes the overdenture to rock and become unstable.

Some clinicians favor the use of bar retained implant supported mandibular overdenture while others prefer ball attachment implant supported mandibular overdenture for reasons of relatively low costs, relative ease of fabrication, and ease of implant cleaning by the patient. [8,9] Likewise, the debate continues on whether to load the implants with the denture at an early stage or to wait for a certain period prior to loading to allow osseointegration. These decisions may affect the outcomes of the treatment and have a sizable financial impact on the treatment and inevitably, the clinician and the patient [3,7,11,12].

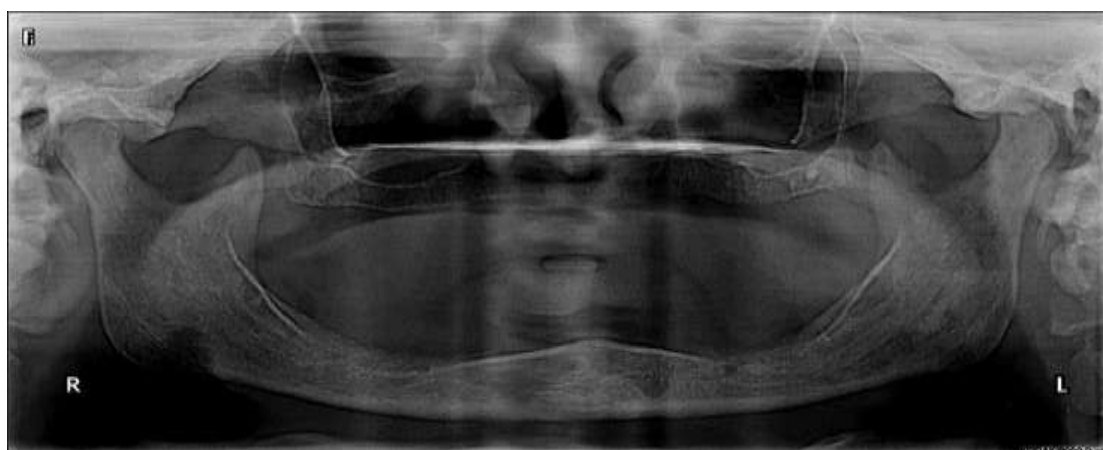


Fig.5; Orthopantomograph showing severe mandibular atrophy

In this case report, patient with resorbed edentulous mandible was successfully rehabilitated using two dental implants placed in the interforaminal region with ball abutments opposing conventional maxillary complete denture.

II. Case Report

A 48- year old female patient sought treatment to improve retention and chewing efficiency of his lower complete denture. Patient gave a history of losing his teeth 2 years back. He got one denture made few months back but there was problem in retention of lower denture. Patient was also using denture adhesive. By intraoral examination completely edentulous maxillary and mandibular arches with smooth ridges were observed but mandibular ridge was greatly resorbed . Maxillary and mandibular diagnostic casts were made and an OPG was taken to evaluate underlying bone. Radiograph examination showed dense compact bone in mandibular anterior region. Patient was in good health. Blood reports of patient were checked. Fig.5, Fig.6



Fig.6; Mandibular edentulous arches

Under antibiotic prophylaxis and standard aseptic protocol nerve block and infiltration anesthesia was administered. Full thickness crestal incision bisecting the keratinized gingiva from first premolar to first premolar was given and muco periosteal flap was reflected . The surgical template was then



Fig.7a; Reflected periosteal flap

placed inside the patient mouth and proposed implant tsite was marked with round surgical bur. Keeping the template in position the right and left canine implant sites were prepared. A paralleling tool was placed to check the implant parallelism and the implants were then threaded into position using a hand ratchet at 30 N cm countersinking the implant crest module at the crestal bone level and cover screw was placed On the 8th day of surgery, suture was removed and after 4 weeks the patient existing denture was relined with temporary relining material for further use existing denture Fig.7a,b

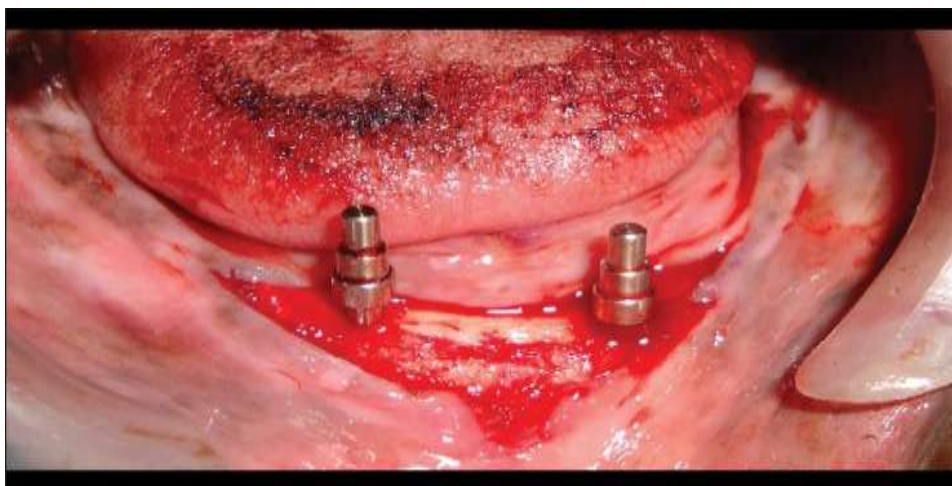


Fig.7b; Checking parallelism

Twelve weeks postoperatively osseointegration was evaluated clinically as well as radiographically and implants were found rigidly fixed with an adequate zone of healthy, keratinized gingiva without any sign of crestal bone loss and the implants were ready to receive the prosthesis. The second-stage surgery was performed. The implants cover screws were removed and healing abutment were screwed into the implant body . After 2 weeks periimplant soft tissue healing was evaluated, and existing denture was relined further after relieving at the abutment site. The patient was recalled after 2 weeks, healing abutments were removed , Fig.7c,d and a periodontal probe was used to measure the gingival cuff height at the right and left canine site implant position.



Fig.7c,d;©; Cover screw placed on implants(d) Healing abutments removed

Ball abutments were tightened to the implants Fig.8 . A very small amount of light body material was placed into the nylon rings and the nylon rings were then placed on the abutments. Self cure acrylic was placed into the relieved space and denture was seated into patient's mouth and allowed to cure within the patient biting in centric relation . After the acrylic is set, dentures were removed and modified surface was finished and polished . The patient was instructed for the use of soft brush and floss for maintenance of area around the implant abutments. The patient was recalled at 1 week, 1 month, 3 month, 6 month follow up appointments.



Fig.8 Ball abutments in place

The patient was delighted with the adequate retention, stability, comfort, and function of the mandibular implant retained overdenture to his complete satisfaction Fig.9. The occlusion was found stable; the denture and attachments were clean. The attachment system was devoid of any sign of wearing during the period. The patient was highly satisfied with the retention comfort and function of the prostheses after 10 years of use. Fig.10



Fig.9; Attachment-retained restorations

III. Discussion

In patients with severely resorbed ridges where retention of denture is extremely difficult or impossible, placement of two or more implants that retain and support an overdenture allows optimal results with patient satisfaction and function. In this

article patient's mandibular conventional denture is converted into implant supported overdenture. Moreover when implants are placed, bone gets stimulated by the forces transmitted from implants resulting minimal bone loss. Two implants in the mandible and four implants in the maxilla is normal minimum requirement [14]. Two implants usually provide sufficient stability, although the support is shared by the tissues covered by the denture base [15].

The tongue, oral and perioral musculature may resume a more normal position because they are not required to limit mandibular movement. Hygiene condition and home maintenance procedures are improved with an overdenture. [16] For all these reasons mandibular two implant overdenture has been described as a standard of care for edentulous mandibles [17].

The two-implant overdenture therapy is a very reliable therapy for patients with an edentulous mandible . A several authors hypothesizes that it is appropriate to use two implants with an interconnector parallel to the hinge axis and a resilient overdenture on an ovoid or round bar[1,2,18] . The bar's purpose is to enhance free rotation during dorsal loading with twist-free load transmission to the implants . Comparative prospective studies validate the benefit of two or four implants in the edentulous mandible . Survival rates in the two-implants overdenture groups compared with four-implant overdenture groups appear to be equivalent for patient satisfaction [19]. One ten-year trial displays no significant clinical and radiographic differences in patients treated with two or four implants overdenture . However, a mandibular overdenture with two implants and a bar has fewer complications .[18,19,20]



Fig.10; Finished and polished maxillary and mandibular complete-denture prosthetics in the oral environment

The implant diameter depends on the alveolar width, whereas the available bone height determines the implant length. The implant length should be ≥ 10 mm, and a minimum diameter of 3.3 – 4.1mm for the mandibular anterior while 4.1mm for the maxilla. The literature provides evidence of an increased failure rate for short implants – 7 and 10 mm. Narrow diameter implants (2.5 to 3 mm) can be successfully used to treat narrow bone ridges although more long-term studies are needed to compare narrow and conventional diameter implant outcomes. In both the maxilla and the mandible, wide-diameter implants may provide additional support for removable partial dentures.[1,2]

The literature review draws the following conclusions about mandibular overdentures: success or survival of implant is not in jeopardy with early-loading, but few studies exist; both splinted and unsplinted implants with-stand the biomechanical demands of early-loading; success is a function of bone quality and primary stability; and, survival and success rates for early-loaded implants are comparable to conventionally-loading protocols.[21]

No deleterious effects up to twenty-four months exist with immediate or early-loading, although there appears to be more support for early over immediate-loading. In order to provide the most astute evidence to support the most appropriate time to load implants, study designs should be randomized-controlled clinical and a follow-up period greater than twenty-four months.[2,21,22]

The implant-supported overdenture's biggest advantage is a better distribution of occlusal forces between implant and bone. This results in a reduction of alveolar ridge resorption; longitudinal clinical studies report a loss of bone height adjacent to implants of approximately 1.2 mm at the end of the first-year and 0.2 mm annually. This resorption is lower compared with a reduction of 4 mm at the end of the first year and 0.4 mm annually after tooth extraction when fitting with conventional dentures. Many options are available for retention of the prosthesis, including magnets, clips, bars and ball. The resultant implant-supported overdenture has good stability and retention. Most authors agree on a requirement of a passive fit between the prosthesis framework and osseointegrated dental implants.[2,23]

Branemark defined passive fit, and he proposed this should be at the level of 10 μ m to enable bone maturation and remodeling in response to occlusal loads [24]. In 1991, Jemt defined passive fit as the level that did not cause any long-term clinical complications. And he suggests misfits of smaller than 150 μ m as acceptable. Although these preceding values are a reference, they are of empirical origin.[25]

The ball attachments transfers less stress than bar and clips when applying vertical forces on a two implant supported mandibular overdenture. In vitro and in vivo studies compare the stresses on the bone surrounding two implants with either a bar-clip or ball attachments for overdentures [26]. Their discovery is a greater stress exist on the peri-implant bone with a bar-clip attachment. Photoelastic studies reproduce the findings. In vitro and in vivo studies verify the higher stability with ball attachments and how load is evenly dispersed onto the residual ridge of both site of the dental arch. This finding may result from an allowed flexure of the mandible.[27,28]

The implant-retained overdenture proves to be predictable and effective management for edentulous patients. Biological (e.g. non-osseointegration, peri-implantitis, mucositis with or without inflammatory hyperplasia) and biomechanical complications (e.g. bar fracture, fracture or detachment of the clip anchorage fracture of the prosthesis or its parts, etc.) can occur, but the literature still reports years of success. [1,4,29,30]

Using 2 implants and retentive anchors for the retention of a mandibular complete denture is, in terms of immediate costs, one of the most affordable implant procedures. With ideal placement of the implant, the

stability of the prosthesis is excellent and the lingual dimensions of the denture can in some cases be reduced to the level of mylohyoid line, providing more space for the tongue and greater comfort than with conventional complete dentures. However, if the labial musculature is tense or the amount of attached gingiva is limited, the implants should not be placed too deep or too labially, which might prevent gingival growth over the abutments. In those cases, ball anchor abutments with elevated shoulders can be used to improve implant anatomy.

IV. Conclusion:

A multidisciplinary approach such as surgical and prosthodontic intervention provided a better outcome of the prosthesis with better stability, comfort, long term success of prosthesis in a patient with severe atrophied ridges. The overdenture has become a preferred treatment modality, particularly for elderly and maladaptive patients with resorbed ridges. Patients with implant-supported overdentures are highly satisfied with their dentures. They show increased efficiency in mastication. Denture retention, stability, and support are also greatly increased.

References

- [1]. Abu-Hussein M. , Abdulgani A., Bajali M., Chlorokostas G ; The Mandibular Two-Implant Overdenture. *Journal of Dental and Allied Sciences* , 2014 , Vol 3,1; 58-62
- [2]. The glossary of prosthodontic terms. *J Prosthet Dent* 2005, 94:10-92.
- [3]. Kibrick M, Munir ZA, Lash H, Fox SS. The development of a materials system for an endosteal tooth implant: I. Critical assessment of previous designs. *Oral Implantol* 1975;6:172-92.
- [4]. Abu-Hussein M. , Abdulgani A. ; MANDIBULAR IMPLANT OVERDENTURE RETAINED WITH O-RING BALL, *Int J Dent Health Sci* 2014; 1(6):984-991
- [5]. Brånemark PI, Adell R, Breine U, Hansson BO, Lindström J, Ohlsson A. Intra-osseous anchorage of dental prostheses. I. Experimental studies. *Scand J Plast Reconstr Surg* 1969;3:81-100.
- [6]. Adell R, Lekholm U, Rockler B, Brånemark PI. A 15-year study of osseointegrated implants in the treatment of the edentulous jaw. *Int J Oral Surg* 1981;10:387-416.
- [7]. Marco F, Milena F, Gianluca G, Vittoria O. Peri-implant osteogenesis in health and osteoporosis. *Micron* 2005;36:630-44.
- [8]. Soballe K, Hansen ES, HBR, Jorgensen PH, Bunger C. Tissue ingrowth into titanium and hydroxyapatite-coated implants during stable and unstable mechanical conditions. *J Orthop Res* 1992;10:285-99.
- [9]. Sevimay M, Turhan F, Kiliçarslan MA, Eskitascioglu G. Three-dimensional finite element analysis of the effect of different bone quality on stress distribution in an implant-supported crown. *J Prosthet Dent* 2005;93:227-34.
- [10]. Büchter A, Kleinheinz J, Joos U, Meyer U. Primary implant stability with different bone surgery techniques. An in vitro study of the mandible of the minipig. *Mund Kiefer Gesichtschir* 2003;7:351-5.
- [11]. Wright C, Swartz W, Godwin W. Mandibular denture stability: a new concept. *Overbeck*;1961. Pound E. Esthetic dentures and their phonetic values. *J Prosthet Dent*. 1951;1:98-111.
- [12]. Cune M, Kampen F V, Bilt AV D, Bosman F. Patient satisfaction and preference with magnet, bar-clip, and ball-socket retained mandibular implant overdentures: a cross-over clinical trial. *NT J Prosthodont*:2005;18,99-100.
- [13]. Author Preiskal W. *Overdentures Made Easy A Guide To Implant and Root Supported Prosthesis*. Quintessence, 1996, 189.
- [14]. Author Hobkirk JA, Watson RM, Searson LJJ. *Introducing Dental Implants* Churchill Livingstone, 2003, 64-67.
- [15]. Misch, C.E., 2005, *Contemporary implant dentistry*. 2nd ed., Mosby Co., St. Louis, Chicago, London, Toronto, 1999, C.E.: Dental implant prosthetics, Mosby Co., St. Louis, Chicago, London, Toronto.
- [16]. Jaafar Abduo, *DclinDent*. Occlusal Schemes for Complete Dentures, A Systematic Review. *Int J Prosthodont* 2013; 26:26-33.
- [17]. Sadowsky SJ. Mandibular implant-retained overdentures: a literature review. *J Prosthet Dent*. 2001 Nov;86(5):468-473.
- [18]. Batenburg RHK, Raghoebar GM, Van Oort RP, Heijdenrijk K, Boering G. Mandibular overdentures supported by two or four endosteal implants. A prospective, comparative study. *Int J Oral Maxillofac Surgery*. 1998b;27:435-439.
- [19]. Wismeijer D, Van Waas MAJ, Mulder J, Vermeeren JI, Kalk W. Clinical and radiographical results of patients treated with three treatment modalities for overdentures on implants of ITI dental implant system. A randomized controlled clinical trial. *Clin Oral Implants Res*. 1999;10:297-306.
- [20]. Tawse-Smith A, Payne AGT, Kumara R, Thomson WM. Early loading of unsplinted implants supporting mandibular overdentures using a one-stage operative procedure with two different implant systems: A 2-year report. *Clin Implant Dent Relat Res*. 2002;4:33-42.
- [21]. Kawai Y, Taylor JA. Effect of loading time on the success of complete mandibular titanium implant retained overdentures: a systematic review. *Clin Oral Impl Res*. 2007;18:399-408.
- [22]. Von Wowern N, Gotfredsen K. Implant-supported overdentures, a prevention of bone loss in edentulous mandibles? A 5-year follow-up study. *Clin Oral Implants Res*. 2001;12:19-25.
- [23]. Brånemark PI. Osseointegration and its experimental background. *The Journal of Prosthetic Dentistry*. 1983 Sep;50:399-410.
- [24]. Jemt T, Carlsson L, Boss A, Jorneus L. In vivo load measurements on osseointegrated implants supporting fixed or removable prostheses: a comparative pilot study. *International Journal of Oral & Maxillofacial Implants*. 1991;6(4):413-417.
- [25]. Tokuhisa M, Matsushita Y, Koyano K. In vitro study of a mandibular implant overdenture retained with ball, magnet, or bar attachments: Comparison of load transfer and denture stability. *Int J Prosthodont*. 2003;16:128-134.
- [26]. Federick DR, Caputo AA. Effects of overdenture retention designs and implant orientations on load transfer characteristics. *J Prosthet Dent*. 1996;76:624-632
- [27]. Gotfredsen K, Holm B. Implant-supported mandibular overdentures retained with a ball or bar attachments: a randomized prospective 5-year study. *Int J Prosthodont*. 2000;13:125-130.
- [28]. Murphy WM. Clinical and experimental bone changes after intraosseous implantation. *J Prosthet Dent*. 1995;73:31-35
- [29]. Van der Bilt A, Burgers M, van Kampen FM, Cune MS. Mandibular implant-supported overdentures and oral function. *Clin Oral Implants Res*. 2010;21:1209-1213.