

Bacteriological evaluation for one- and two-piece implant design supporting mandibular overdenture

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ABSTRACT

Background: This study evaluated and compared the bacteriological effect of two-piece implants and one-piece implants in complete overdenture cases on supporting structures. **Materials and Methods:** Ten male completely edentulous patients were selected and randomly divided into two equal groups according to the implant design and surgical technique for this study; Group 1: Patients were rehabilitated with complete mandibular overdenture supported by two-piece implants one on each side of the lower arch following two-stage surgical technique and Group 2: Patients were rehabilitated with complete mandibular overdenture supported by one-piece implants one on each side. Evaluation was made at the time of insertion, 6, 12, and 18 months after overdenture insertion, by measuring bacteriological changes around implants abutments. **Results:** Complete overdenture supported by one-piece implants showed better effect on the bacteriological changes as compared to that supported by two-piece implants. **Conclusion:** Complete overdenture supported by one-piece implants one on each side of the lower arch showed better effect on the bacteriological changes than using the same prosthesis supported by two-piece implants.

Key words: One-piece dental implants, overdentures, two-piece dental implants

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INTRODUCTION

Overdenture is defined as a removable partial or complete denture that covers and rests on one root of natural teeth and/or dental implants. A prosthesis that covers and is partially supported by natural teeth, natural tooth roots and or dental implant is called also overlay denture, overlay prosthesis, and superimposed prosthesis.¹

Overdentures supported by implants were the development of well-researched implant systems, providing a predictable success rate that made such restoration feasible. Recently, new one-piece implant design has been fabricated and consequently the implant surgical technique has been changed into one-stage technique with its benefits for the patients and either immediate or progressive loading protocols were used for prosthetic appliances.²⁻⁵

It is conceivable that implant materials, which are chosen because of their "friendliness" to tissue cells, offer particularly favorable grounds for bacterial adhesion and availability of "cell-friendly" surfaces for microbial colonization. Adhesion-mediated infections developing on implanted biomaterials respond poorly to antimicrobial treatment and often require that the device be removed.⁶

Dental implants, however, can be designed in such a way that the surfaces on which bacterial colonization occurs may be reached from the exterior. Thus, in contrast to internal implants, there is a possibility for control of bacterial colonization on exposed surfaces and a potential

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for treatment of infectious conditions of peri-implant tissues.^{6,7}

In a study, it was found that the microflora associated with stable osseointegrated implants serving successfully as abutments for overdentures was investigated, and 50% of the organisms cultured were facultatively anaerobic cocci, *Staphylococci*, and the rest were facultatively anaerobic rods. Repeated microbiological and clinical data were collected along 5 years after implantation. No significant time trends were noted. Separate samples taken within the same patient from different sites showed a similar composition of the microflora.^{8,9}

The role of microorganisms in the development of peri-implant pathology has also been investigated in animals. Differences in the presence of putative periodontal pathogens on titanium implants and teeth were determined in animals in experimental gingivitis and in peri-implantitis/periodontitis situation. Similar colonization patterns were seen on implants and teeth.^{10,11}

MATERIALS AND METHODS

Ten completely edentulous male patients with age ranged from 50 to 60 years were selected from the outpatient clinic, Prosthodontics Department, Faculty of Dentistry October 6 University. Consent forms were signed by all patients selected for this work before the treatment. The patients after preparation to receive an overdenture were randomly divided into two equal groups according to implant designs; 1st group and the patients in this group received mandibular overdenture supported by two-piece implant system using delayed loading prosthetic technique. The 2nd group and patients in this group received mandibular overdenture supported by one-piece implant system.

Surgical procedures for implant placement

- Surgical stent constructed using transparent acrylic resin on duplicated study cast
- Threaded endosseous implant system (titanium plasma spray) coating root form with 13 mm length and 3.9 mm diameter were used for all patients
- The implant was inserted manually and observing the correct insertion angle [Figure 1]
- 4 months after implant placement, all patients were recalled. For Group 1, the abutments were inserted in place and attached to the fixture using abutment screw, and for Group 2, the patients were ready for prosthetic procedures.

Prosthetic procedures

- Upper and lower primary impressions were made for all patients followed by a secondary impression that was made for the lower arch in the preconstructed special tray after proper border molding

- Centric occluding relation following the interocclusal wax wafer technique was made and a try in stage was made successfully
- The denture was processed, laboratory remounted, finished, polished, and delivered to the patient in the usual manner after clinical remounting [Figure 2].

The insertion appointment (considered as zero readings), 6, 12, and 18 months of postinsertion successively considered as follow-up periods.

A swap sample was taken from area around the implants by means of sterile swap, transferred and immersed in reduced transport media; all samples were carefully homogenized without aeration into 1 mm of saline and centrifuged for 30 s.

- One plate from each media was aerobically incubated at 37°C.
- Films were prepared from various colonies, stained with Gram's stain, and examined
- Certain organisms required special tests as *Staphylococcus aureus*, which was further identified by coagulase test done through the tube method
- Catalase production to differentiate between *Staphylococci* and *Streptococci*.¹²

Visible colonies of each organism were counted in every plate, and the number of colonies-plate was multiplied by the corresponding dilution factor and by 10 to determine the total colony forming units per ml of suspension.

RESULTS

Comparison between Group 1 (two-piece implants) and Group 2 (one-piece implants) regarding Staphylococcal bacteria:

Staphylococci

At 6, 12, and 18 months, the mean values of staphylococcus count around the implants revealed significant difference revealed between the two studied groups [Graph 1].



Figure 1: Manual insertion of implant



Figure 2: Final denture in patient mouth

DISCUSSION

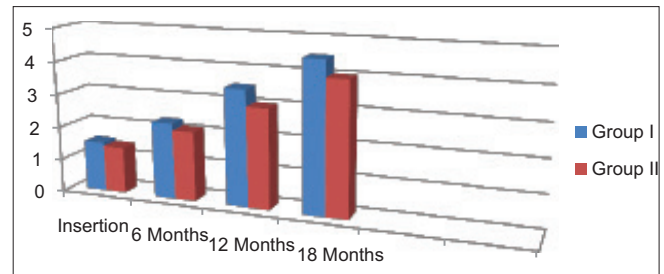
Using the sterile swap in taking specimen from the area around the implant abutment would help in direct spreading the specimens on the culture plates, and the biochemical reactions were carried out to differentiate the microscopically resembled microorganisms. Films were stained with gram stain to see the morphology of the organism and its reaction to Gram's stain. Coagulase test was carried out through the tube method to identify *S. aureus*. Catalase production to differentiate between *Staphylococci* and *Streptococci*.¹²

Regarding Group 1, the microgap, which is the most effective factor for bacterial colonization at this critical area around implant, provides a good media for inflammation around implant neck and subsequently leads to bone resorption, and regarding Group 2 (one-piece implant), the design eliminates the microgap and that decrease the possibility for bacterial colonization.¹³

Despite strict oral hygiene measures and patient instructions about proper cleansing of the prosthesis and implant neck area along the 18 months follow-up period, there is tiny unreachable areas, especially in the microgap area at fixture-abutment connection, regarding Group 1 that area cannot be reached by the patient especially the subgingival portion of implant neck; that subsequently increase the possibility for bacterial colonization and that may explain significant difference in bacterial count around the implants between the two groups as regarding the four main types of bacteria that had been examined in the study (*Staphylococci*, *Streptococci*, *L. bacilli*, anaerobes).^{14,15}

CONCLUSION

Within the limitation of the results of this study, it could be concluded that the complete mandibular overdentures supported by two osseointegrated one-piece implant



Graph 1: *Staphylococcus* count changes in the two groups

design showed better effect on bacteriological changes around the implants abutments when compared with two-piece implant design.

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Conflicts of interest

There are no conflicts of interest.

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