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ORIGINAL ARTICLE

Comparative Evaluation of Implants with Different Surface Treatments Placed in Human Edentulous Mandibles

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ABSTRACT

Background: Dental implants have reorganized the field of renewing dentistry by providing a greatly successful and authentic surgery option for the patients with missing teeth. Surface characteristics of the implant are very vital for the success of the implant. This greatly affects the osseointegration and long term stability.

Study design: It is a prospective study conducted at Lady Reading Hospital, MTI, Peshawar and Altamash Institute of Dental Medicine, Karachi for the duration of one year from December 2021 to November 2022.

Material and Methods: The study was done on patients visiting the tertiary care unit for a period of one year. There were 12 male and 13 female patients that participated in the study. The average age of patients was 56 years in case of men and 53 years for women. The data of number of implants was also analyzed and 12 patients went for 2 implants and 13 patients opted for 3 implants. The study was approved by the review and ethical board committee of the hospital.

Results: The ISQ score of the patients that had two implants was 68.5±4.3, whereas the patients who went through 3 implants had ISQ score as 72.1±4.5. Those who had molar region implanted had ISQ score 72.1±2.1, while premolar patients had ISQ score as 72.3±3.1. Acid itching group had ISQ score as 68.4±2.4, the LASER group had ISQ score as 73.4±2.4.

Conclusion: After the comparison of different implant surfaces used in human edentulous mandibles treatment. It was concluded that the LASER+HA and LASER are the most effective method for implants. These methods accelerates the Osseointegration process.

Keywords: Dental implants and edentulous mandibles.

INTRODUCTION

Dental implants have reorganize the field of renewing dentistry by providing a greatly successful and authentic surgery option for the patients with missing teeth. Surface characteristics of the implant is very vital for the success of the implant. This greatly affect the osseointegration and long term stability[1-2]. Many of the surface treatment have been established to increase the implant surface bitterness, hydrophilicity, and biocompatibility. Thus they improve the bone response and decrease the rate of implant failure. Therapies with dental implants has become increasingly consistent, owing to the osseointegration hypothesis, which entails the formation of a clear connection between the implant and the alveolar bone even without interference of connective tissue[3-4]. Many studies compare the clinical outcomes of four various implant systems with different surface therapies placed in human endotulous mandibles over a 1-year follow up period. The surface surgery estimated include grit blasting, acid etching, a combination of grit blasting and acid etching and anodization[5-6]. Various factors involved in the surgery organization for implant stable rehabilitation like the placement and number of implants to be arranged, restorative style, along with stuff, disputing arch, and occlusal sequence. In addition, instructions for implant treatment of edentulous patients should include sustained imaging and clinical assessment methods for a reliable evaluation[7-8] .The vast majority of research studies were conducted in model organisms or in vitro settings, which may not properly reflect clinical outcomes in humans. Fixed implant renovations are completely implant assisted, with no stress transfer to denture-bearing regions, reducing the risk of more resorption related to tissue-bone prostheses. The poor standard bone beds is one of the main reason of failure and the mislaying implants. The extent of primary bone contact, which is primarily affected by trabecular bone density, along with implant length, geometry, and surface at the moment of implant placement, are the main components of reliability[9]. The chemical and physical characteristics of implant surfaces can enhance bone-implant interaction, meddling with biological retaliation and improve relations at the bone-implant interaction. Numerous methods for assessing implant stability have been presented, including insertion and expulsion torque striking sound (Perio-Test) and RFA[10]. This prospective and correlational medical study in humans is relevant when contemplating the significance of implant surface modification to encourage osseointegration in lesser periods of time. The goals of this study were to compare the peri-implant bone crest stages, bone density, reliability, and satisfactory results of implants with various surface modifications in human edentulous mandibles. This study may help healthcare professionals make more accurate choices when choosing the best implant surface treatment for their patients by contrasting the clinical outcomes of various implant systems over a 1-year follow-up duration.

MATERIAL AND METHODS

The study was done on patients visiting the tertiary care unit for a period of one year. There were 12 male and 13 female patients that participated in the study. The average age of patients was 56 years in case of men and 53 years for women. The data of number of implants was also analyzed and 12 patients went for 2 implants and 13 patients opted for 3 implants. The study was approved by the review and ethical board committee of the hospital. According to the inclusion criteria following patients were included in the study:

- The patients were non-smokers
- The age range between the 50 to 80 years
- No history of radiation therapy
- Absences of systemic diseases

According to the exclusion criteria following patients were excluded from the study:

- The patients having any systemic habit
- The patients with any parafunctional habit

The implants were assigned to patients at random. Each patient was given two implants with varying surface treatments. Under local anaesthesia, the implants were placed in two stages using a two-stage surgical protocol. For all implants, a standard surgical technique was used. Patients were instructed to follow a soft diet and avoid smoking and strenuous physical activity.

Clinical and radiographic examinations were done at implants, 6 months, and 1 year after loading. The following parameters were assessed: implant durability, peri-implant probing intensity, bleeding on investigating, plaque appearance, and radiological marginal bone loss. ANOVA and Tukey's post-hoc tests with a significance level of p0.05 were used to examine the data.

RESULTS

The study was done to compare the implants of different surface treatments used in human edentulous mandibles. There were four type of different surface treatments given to patients; acid implants, LASER, LASER HA, and sand blasting. 8 patients went for acid itching, 5 went through LASER, 7 had to go through LASER+HA and 5 faced sand blasting.

Table 1: Clinical features of patients participating in the study

Features	Male	Female
No. of patients	12	13
Average age (y)	56	53
Age range	44-58	42-55
No. of implants (2,3)	(8,4)	(4,9)
Type of implants		
Acid itching	4	4
LASER	2	3
LASER+HA	3	4
Sand blasting	3	2

The mean value of implant stability quotient and the standard deviation is shown in table no.2. p value was calculated and results were found to be statistically significant. The ISQ score of patients that had two implants was 68.5±4.3, whereas the patients who went through 3 implants had ISQ score as 72.1±4.5. Those who had molar region implanted had ISQ score 72.1±2.1, while premolar patients had ISQ score as 72.3±3.1. The ISQ scores are listed in table no.2 for all the treatment groups that were used in this study. Acid itching group had ISQ score as 68.4±2.4, the LASER group had ISQ score as 73.4±2.4. While the other two groups LASER+HA and sand blasting had ISQ score as 74.3±3.6 and 69.6±3.5 respectively.

Table 2: Implant stability quotient (mean ± SD) of 25 patients as per implant features

Implant feature	No. of patients	ISQ score (mean ± SD)	P value
No. of implants			
Two	12	68.5±4.3	0.002
Three	13	72.1±4.5	0.005
Region			
Molar	13	72.1±2.1	0.005
premolar	12	72.3±3.1	0.002
Type of implant			
Acid itching	8	68.4±2.4	0.005
LASER	5	73.4±2.4	0.004
LASER+HA	7	74.3±3.6	0.004
Sand blasting	5	69.6±3.5	0.005

The tomography density analysis is shown in table no.3.

Table 3: Tomography density analysis of four methods of implants used

Implants	Tomography density (HU)
Acid itching	67
LASER	69
LASER+HA	74
Sand blasting	71

DISCUSSION

This study was carried out to find the comparative evaluation of the implants of different surface treatments used in human edentulous mandibles. There is need to study the physico-chemical properties of the implants given to patients as the surface treatment given during implants is important for the Osseo integration. There has been much research going on to find the best surface implant so that better biological response can be obtained[11]. The patients who visited tertiary care center for a period of one year were selected for this study. There were 25 patients that participated in this study. All the patients who were not fulfilling the inclusion criteria were excluded from the study. The patients with any oral or systemic parafunctional habit were excluded from the study. There were 12 males and 13 females in our study group. There were 4 treatment groups that were made. The data of number of implants was also analyzed and 12 patients went for 2 implants and 13 patients opted for 3 implants. There has been a lot of working going on to find the best possible implant surface so that bone healing using new techniques can be made possible[12-13]. As per studies the implant surfaces were irradiated with LASER beam and then calcium phosphate was deposited by making use of biomimetic procedures. The layer stability was much improved and interaction between calcium coating and implant surface was increased[14].

There were four type of different surface treatments given to patients; acid implants, LASER, LASER HA, and sand blasting. 8 patients went for acid itching, 5 went through LASER, 7 had to go through LASER+HA and 5 faced sand blasting. The mean value of implant stability quotient was also calculated and data was shown in table no.2. The results were statistically evaluated standard deviation and p value was calculated and data was statistically significant. As per studies the ideal ISQ score ranged from 56-83, the values in our study ranged in this range[15-16]. The ISQ score of patients that had two implants was 68.5±4.3, whereas the patients who went through 3 implants had ISQ score as 72.1±4.5. As per studies it was found that ISQ score for patients that had 2 implants was 64.5±5.3 while those who had three implants had 70.5±4.3[17]. Those who had molar region implanted had ISQ score 72.1±2.1, while premolar patients had ISQ score as 72.3±3.1. Similar results were found by other studies as well[18]. The ISQ scores are listed in table no.2 for all the treatment groups that were used in this study. Acid itching group had ISQ score as 68.4±2.4, the LASER group had ISQ score as 73.4±2.4. While the other two groups LASER+HA and sand blasting had ISQ score as 74.3±3.6 and 69.6±3.5 respectively. As per previous studies the patients who were given acid itching as a surface treatment had Implant stability score as 65±2.3 whereas LASER+HA showed the maximum ISQ score as 78.9±3.6.

According to a study that was carried out to find the better surface treatment for implants it was found that the use of LASER+HA had significantly less complications and more stability as compared to other groups[18]. In our study similar results were obtained as maximum ISQ score was obtained for LASER+HA group with 74.3±3.6 value. It was followed by LASER group which had an ISQ score of 73.4±2.4. Tomography density score was analyzed and it was found that the LASER+HA group had the most density of 74 HU followed by sand blasting, LASER and acid itching group. Previous studies have also shown the tomography density analysis of LASER+HA group as the most significant [19-20]. Another study has shown tomography density as 69 HU[21]. In our study the inclusion and exclusion criteria was made so that the bias results could be avoided. Though our study highlights the use of LASER+HA as a better surface implant but still there are some limitations of our study. Our data was taken from CBCT scans, it is said that CBCT scans are not considered as an ideal imaging procedure so if data was taken from radiographic and CBCT scans the results could be more precise. Therefore, further studies are needed to carefully analyze the effectiveness of the implant surfaces.

CONCLUSION

Our study evaluated the comparison of different implant surfaces used in human edentulous mandibles treatment. It was found that the use of LASER+HA and LASER was most effective as it accelerates the Osseo integration process. However, the further studies can support the use of LASER+HA and LASER as the most effective surface implant.

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