ORIGINAL RESEARCH

Assessment of effect of abutment types and loading protocol on success of dental implant

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ABSTRACT

Background: As people live longer, there are more elderly people who need rehabilitation due to periodontal disease and tooth caries, which makes them edentulous. The present study was conducted to assess effect of abutment types and loading protocol on success of dental implant. **Materials & Methods:** 54 partially edentulous patients of both genders were divided into 2 groups of 27 each. Group I was in which delayed loading and group II was in which immediate loading was done. Probing pocket depth, bleeding on probing, marginal bone loss, and coronal height of soft-tissue were recorded at baseline, 1 year and 2 years. Quantitative PCR was done to detect interleukin-1beta (IL-1β), tumor necrosis factor-alpha (TNF-α), osteocalcin (OC), alkaline phosphatase (ALP), tartrate-resistant acid phosphatase (TRAP). **Results:** The mean marginal bone loss at baseline, 1 year and 2 years at implant level in group I was 1.51, 0.20 and 0.41 and in group II was 1.64, 0.22 and 0.13. At oxidized abutment was 1.07, 0.56 and 0.92 in group I and 1.31, 0.41 and 0.28 in group II. At milled abutment site was 1.07, 0.20 and 0.12 in group I and 0.96, 0.35 and 0.28 in group II. The difference was significant (P< 0.05). At baseline, 1 year and 2 years in group I and II, the mean plaque score was 0.98, 1.12, and 1.60 in group I and 0.97, 1.11, and 1.61 in group II. Probing depth was 1.09, 0.19, and 0.12 in group I and 0.96, 0.42, and 0.28 in group II. Mucosal bleeding was (%) was 28.1, 35.2, and 38.5 in group I and 30.1, 36.2 and 38.0 in group II. Bleeding on probing (buccal) was 10.4, 12.3, and 14.9 in group I and 11.6, 13.2, and 15.8 in group II. Bleeding on probing (proximal) was 10.8, 11.5, and 16.4 in group I and 10.6, 11.3, and 15.9 in group II. Soft-tissue height was 1.9, 2.5, and 2.1 in group I and 1.8, 2.4, and 2.2 in group II. The difference was significant (P< 0.05). The mean TNF-α value at 3 days, 1 month and 3 months was 46.2, 11.6 and 15.9 in group I and 97.2, 11.6, and 15.2 in group II. TRAP was 3.8, 2.1, and 13.2 in group I and 2.7, 1.2, and 1.1 in group II. IL-1β value was 972.4, 432.6, and 575.4 in group I and 11.8, 250.4, and 296.4 in group II. Alkaline phosphatase level was 11.6, 6.2, and 25.9 in group I and 32.7, 11.4, and 4.8 in group II. Osteocalcin level was 1.5, 3.2, and 42.8 in group I and 2.7, 1.2, and 2.9 in group II. The difference was significant (P< 0.05). **Conclusion:** In terms of soft-tissue characteristics, biomarkers in sulcular fluids, and bone loss, both immediate loading and delayed loading implants exhibit comparable outcomes with comparatively few and controllable problems.

Keywords: delayed loading, implants, abutment

INTRODUCTION

As people live longer, there are more elderly people who need rehabilitation due to periodontal disease and tooth caries, which makes them edentulous.[1] Loss of a tooth causes a reduction in general quality of life, nutritional problems, low self-esteem, and reduced appearance, all of which can be improved with rehabilitation. Dental implants are thought to be the best, newest, and most sophisticated method of replacing missing teeth. One potential disadvantage of dental implants is their low cost. Though they may cost more initially, they have higher survival rates than prosthesis supported by teeth.[2]

The use of abutments and loading procedures are two important variables that affect implant success. Debatable topics recently include abutment cost, leakage risk, and cosmetic compromise.[3] Nonetheless, abutments are recommended for better implant conditions and load sharing in the vicinity of the alveolar bone. Additionally, the most frequent abutment-related issue, primarily in a prosthesis with an external connection, is screw loosening.[4] The soft-

tissue levels surrounding immediate/early loaded implants and conventional implants are determined in the same way. Regarding the roughness of the implant surface on the surrounding implant tissue, there are conflicting results. While some research claim improved soft-tissue dimensions with increased roughness, others are unable to support their findings. Implants were initially loaded three to six months after implantation, but more recently, rapid loading has been recommended.[5] Nevertheless, subsequent results from both loading processes have shown the same thing, despite data that has generated controversy. A allowed loss of 2 mm of marginal bone within the first 5 years can also result in implant failure. From prosthesis placement to five years post prosthesis, there is more bone loss observed. Recurrent abutment replacement has little effect on bone loss.[6] The present study was conducted to assess effect of abutment types and loading protocol on success of dental implant.

MATERIALS & METHODS

The present study consisted of 54 partially edentulous patients of both genders. All gave their written consent to participate in the study.

Data such as name, age, gender etc. was recorded. Patients were divided into 2 groups of 27 each. Group I was in which delayed loading and group II was in which immediate loading was done. In all subjects, titanium implants of Nobel Biocare™ were placed and titanium multiabutments were used. Probing pocket depth, bleeding on probing, marginal bone loss, and coronal height of soft-tissue were recorded at baseline, 1 year and 2 years. For gene expression analysis, crevicular washings were collected. Quantitative PCR was done to detect interleukin-1beta (IL-1β), tumor necrosis factor-alpha (TNF-α), osteocalcin (OC), alkaline phosphatase (ALP), tartrate-resistant acid phosphatase (TRAP). Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I Assessment of marginal bone loss

Parameters	Group I			Group II		
	baseline	1 year	2 years	baseline	1 year	2 years
Implant level	1.51	0.20	0.41	1.64	0.22	0.13
Oxidized	1.07	0.56	0.92	1.31	0.41	0.28
Milled	1.07	0.20	0.12	0.96	0.35	0.28
P value	0.05	0.91	0.02	0.04	0.13	0.84

Table I shows that mean marginal bone loss at baseline, 1 year and 2 years at implant level in group I was 1.51, 0.20 and 0.41 and in group II was 1.64, 0.22 and 0.13. At oxidized abutment was 1.07, 0.56 and 0.92 in group I and 1.31, 0.41 and 0.28 in group II. At milled abutment site was 1.07, 0.20 and 0.12 in group I and 0.96, 0.35 and 0.28 in group II. The difference was significant (P< 0.05).

Table II Assessment of soft-tissue changes

Groups	Group I			Group II			P value
	baseline	1 year	2 years	baseline	1 year	2 years	
Plaque score	0.98	1.12	1.60	0.97	1.11	1.61	0.04
Probing depth	1.09	0.19	0.12	0.96	0.42	0.28	0.02
Mucosal Bleeding (%)	28.1	35.2	38.5	30.1	36.2	38.0	0.05
Bleeding on Probing (buccal)	10.4	12.3	14.9	11.6	13.2	15.8	0.04
Bleeding on Probing (proximal)	10.8	11.5	16.4	10.6	11.3	15.9	0.01
Soft-tissue height	1.9	2.5	2.1	1.8	2.4	2.2	0.03

Table II shows that at baseline, 1 year and 2 years in group I and II, the mean plaque score was 0.98, 1.12, and 1.60 in group I and 0.97, 1.11, and 1.61 in group II. Probing depth was 1.09, 0.19, and 0.12in group I and 0.96, 0.42, and 0.28 in group II. Mucosal bleeding was (%) was 28.1, 35.2, and 38.5 in group I and 3 0.1, 36.2 and 38.0 in group II. Bleeding on probing (buccal) was 10.4, 12.3, and 14.9 in group I and 11.6, 13.2, and 15.8 in group II. Bleeding on probing (proximal) was 10.8, 11.5, and 16.4 in group I and 10.6, 11.3, and 15.9 in group II. Soft-tissue height was 1.9, 2.5, and 2.1 in group I and 1.8, 2.4, and 2.2 in group II. The difference was significant (P< 0.05).

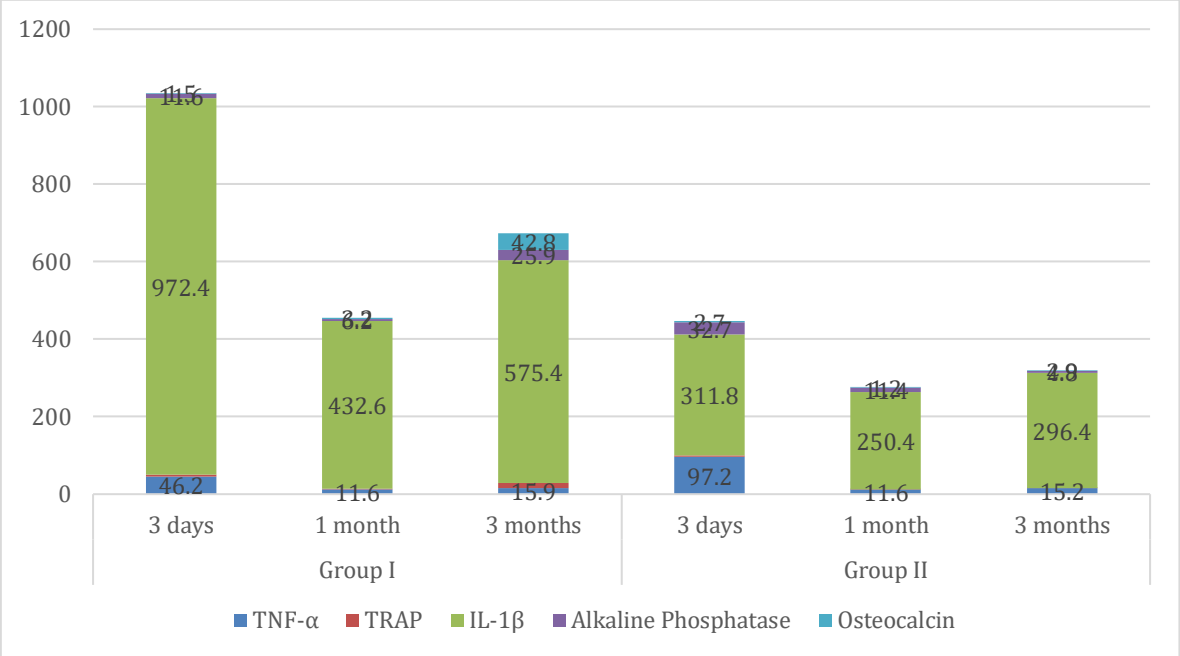
Table III Assessment of biomarkers

Groups	Group I			Group II			P value
	3 days	1 month	3 months	3 days	1 month	3 months	
TNF-α	46.2	11.6	15.9	97.2	11.6	15.2	0.05
TRAP	3.8	2.1	13.2	2.7	1.2	1.1	0.03
IL-1β	972.4	432.6	575.4	311.8	250.4	296.4	0.01
Alkaline Phosphatase	11.6	6.2	25.9	32.7	11.4	4.8	0.04

Osteocalcin	1.5	3.2	42.8	2.7	1.2	2.9	0.02

Table III, graph I shows that mean TNF-α value at 3 days, 1 month and 3 months was 46.2, 11.6 and 15.9 in group I and 97.2, 11.6, and 15.2 in group II. TRAP was 3.8, 2.1, and 13.2 in group I and 2.7, 1.2, and 1.1 in group II. IL-1β value was 972.4, 432.6, and 575.4 in group I and 11.8, 250.4, and 296.4 in group II. Alkaline phosphatase level was 11.6, 6.2, and 25.9 in group I and 32.7, 11.4, and 4.8 in group II. Osteocalcin level was 1.5, 3.2, and 42.8 in group I and 2.7, 1.2, and 2.9 in group II. The difference was significant (P< 0.05).

Graph I Assessment of biomarkers



DISCUSSION

For individuals who are partially or completely edentulous, dental implant-supported prostheses are a well-recognized therapeutic option for their functional and aesthetic recovery. Preserving the peri-implant bone is one of the most important needs for good treatment results.[7,8] Early peri-implant crestal bone loss has been widely seen, has been regarded as a complex multifactorial process, and occurs during the time of most therapeutic interventions. Inflammatory responses linked to microbial leakage at the implant-abutment interface have the potential to compromise the stability of the peri-implant crestal bone.[9] A significant obstacle in the design of two-piece implant systems is the prevention of microbiological leakage at the implant-abutment contact. Modifications to the implant-abutment complex design resulted in a decrease in the amount of microbiological leakage and/or the implant-abutment interface's separation from the osseous surface. However, it is still unclear if microbial leakage at the implant-abutment interface plays a role beyond the initial crestal bone remodeling, namely on the development of peri-implantitis.[10] The present study was conducted to assess effect of abutment types and loading protocol on success of dental implant.

We found that mean marginal bone loss at baseline, 1 year and 2 years at implant level in group I was 1.51, 0.20 and 0.41 and in group II was 1.64, 0.22 and 0.13. At oxidized abutment was 1.07, 0.56 and 0.92 in group I and 1.31, 0.41 and 0.28 in group II. At milled abutment site was 1.07, 0.20 and 0.12 in group I and 0.96, 0.35 and 0.28 in group II. Mayuri et al[11] assessed marginal bone loss and implant failure in immediate and delayed loading implants. The 44 subjects were randomly divided into two groups with immediate loading and delayed loading protocols. Various soft-tissue parameters were seen clinically. Quantitative PCR was done to detect biomarkers. Concerning marginal bone loss, it was seen that for delayed loading, the bone loss at the implant level was 1.52 ± 0.14, 0.19 ± 0.11, and 0.40 ± 0.12, respectively, at placement, 1 and 2 years. Plaque and mucosal bleeding scores were low at the time of placement with respective values of 0.96 ± 0.12 and 28.42 ± 3.15 for the delayed loading group and 0.98 ± 0.11 and 30.24 ± 3.15 for the immediate loading group. Tartrate-resistant acid phosphatase (TRAP) showing remodeling was high at 3 months in delayed loading (13.3 ± 8.5). Alkaline Phosphatase (ALP) was highest in delayed loading at 3 months (25.2 ± 7.7) and immediate loading at 2 days (32.6 ± 13).

We found that at baseline, 1 year and 2 years in group I and II, the mean plaque score was 0.98, 1.12, and 1.60 in group I and 0.97, 1.11, and 1.61 in group II. Probing depth was 1.09, 0.19, and 0.12 in group I and 0.96, 0.42, and 0.28 in group II. Mucosal bleeding was (%) was 28.1, 35.2, and 38.5 in group I and 30.1,

36.2 and 38.0 in group II. Bleeding on probing (buccal) was 10.4, 12.3, and 14.9 in group I and 11.6, 13.2, and 15.8 in group II. Bleeding on probing (proximal) was 10.8, 11.5, and 16.4 in group I and 10.6, 11.3, and 15.9 in group II. Soft-tissue height was 1.9, 2.5, and 2.1 in group I and 1.8, 2.4, and 2.2 in group II. We found that mean TNF-α value at 3 days, 1 month and 3 months was 46.2, 11.6 and 15.9 in group I and 97.2, 11.6, and 15.2 in group II. TRAP was 3.8, 2.1, and 13.2 in group I and 2.7, 1.2, and 1.1 in group II. IL-1β value was 972.4, 432.6, and 575.4 in group I and 11.8, 250.4, and 296.4 in group II. Alkaline phosphatase level was 11.6, 6.2, and 25.9 in group I and 32.7, 11.4, and 4.8 in group II. Osteocalcin level was 1.5, 3.2, and 42.8 in group I and 2.7, 1.2, and 2.9 in group II. M. Sampaio Fernandes, et al[12] conducted a study in 58 edentulous Caucasian patients rehabilitated with implant overdentures. A total of 229 implants were included in the study. Anamnestic, clinical, and implant-related parameters were collected and recorded in a single database. The performed prediction model included the following variables: mean probing depth, metal exposure, IL1B_allele2, maxillary edentulousness, and Fusobacterium nucleatum. The F. nucleatum showed significant association with the outcome. Introducing a negative coefficient appeared to prevent complications or even boost the biological defense when associated with other factors.

The limitation of the study is the small sample size.

CONCLUSION

Authors found that in terms of soft-tissue characteristics, biomarkers in sulcular fluids, and bone loss, both immediate loading and delayed loading implants exhibit comparable outcomes with comparatively few and controllable problems.

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