

## Original Research

### Evaluation of short dental implants in compromised bone cases: An original research

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#### ABSTRACT:

**Aim:** To assess the survival rate of short dental implants in medically compromised patients. **Methods:** This follow-up study was conducted on 171 medically compromised patients of both genders (290 dental implants). The failure rate of dental implants was assessed. **Results:** There were 71 diabetes mellitus patients with 127 dental implants, 54 patients with hypertension with 95 dental implants, 13 patients with mental disabilities with 20 dental implants, 10 oral cancer patients with 18 dental implants, and 23 osteomyelitis subjects with 30 dental implants. There were 30 (10.5%) short dental implant (SDI) failures of which a maximum of 13 (22.7%) were seen with 4 mm diameter. Maximum failure was seen with osteomyelitis patients 4 (13.3%) followed by diabetes mellitus 16 (12.5%). Out of 135 dental implants in 65 control patients, implant failure was seen in 6 (4.07%). There was a significant ( $p < 0.05$ ) bone loss on follow-up at 6 months, 1 year, and 2 years. **Conclusions:** Medically compromised patients are more prone to dental implant failure as compared to healthy subjects.

**Keywords:** Dental implant, Medically compromised, Short implant.

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#### INTRODUCTION

Dental implants are widely used nowadays. They have been proved to be a boon to dentistry. A careful insertion of dental implants ensures high survival rate for longer duration. Preferably longer dental implants are used depending on the amount of bone available. However, shorter dental implants (SDIs) can be used in resorbed ridges where there is limited bone height. Shorter dental implants have a low success rate as compared to longer dental implants. Dental implants <8 mm are short dental implants<sup>(1)</sup> Despite this, there is limited use as compared to longer dental implants, and there is not much data suggesting success rate based on implant length. Researchers have found similar survival

rate of SDI as with long implants. However, there are instances when SDIs encounter higher mechanical stress as compared to longer implants. Patient can have insufficient bone leading to implant failure.<sup>(2)</sup> To obtain favorable results, careful oral evaluation as well as radiographic exercises is needed. Dental implant planning should be performed before inserting implants in these patients to prevent future complications.<sup>(3)</sup> Procedures such as direct or indirect sinus lift, guided bone regeneration or edentulous ridge expansion are performed in these patients. The limitation of such procedures is that healing time is prolonged. It is found that dental implant insertion in resorbed dental ridges, especially in the maxillary

posterior region, can lead to sinus perforation. Moreover, there are more chances of implant failure. These procedures are quite expensive and have high morbidity. Considering such shortcomings, SDIs may be regarded as substitutes(4) Studies mentioning success and failure rates of SDIs have been conducted, but there is limited data of success rates of SDIs in medically compromised patients. Since there are insufficient studies mentioning the utility of short dental implants in patients with resorbed denture ridges, the present study is an attempt to evaluate their survival rates in medically compromised patients.

## METHODOLOGY

The study consisted of 171 patients of both genders (290 dental implants). We also included 65 normal (control) participants (135 dental implants) of age range 20–50 years. The approval for the study was obtained from the institutional ethics committee before commencement. Informed consent was obtained from all the participants. Inclusion criteria were medically compromised patients in age range 20–50 years such as diabetes mellitus, mental disability, hypertension, oral cancer (without radiotherapy) and patients with osteomyelitis, who were under medication with controlled medical problems. All patients had insufficient residual mandibular or maxillary bone due to mandible atrophy or sinus pneumatization. Exclusion criteria

were pregnant women, drug abusers, smoking habit, and patients with periodontal pathology. The study was carried out by trained investigators. Patient data such as name, age, and gender were recorded. All implants were positioned in 1- or 2-stage procedures at an interval of 6 months. Patients were administered local anesthesia (LA) and dental implants were inserted following standardized surgical protocol. Patients were recalled for follow-up. In all cases, a thorough clinical and radiographic evaluation was performed. Intraoral radiographs and panoramic radiographs were taken to assess treatment outcome. The distance between coronal bone to implant contact to implant shoulder depicted marginal bone loss (MBL).<sup>5</sup> It was calculated on both the mesial and distal sides. First measurements were taken at 6 months, second after 1 year, and third after 2 years during follow-up using intraoral radiographs and panoramic radiographs. All the measurements were taken thrice and the mean of all values was considered. The change in MBL at recall visits was recorded. Excessive marginal bone loss, signs of peri-implantitis, presence of mobility, pain, or discomfort was considered as implant failure. Data were entered in an MS Excel spreadsheet and evaluated with SPSS version 21 (IBM, Chicago, USA) using Kaplan Meier survival analysis. Kruskal Wallis test was applied to assess MBL and failed implants with the level of significance set below 0.05.

**Table1: Survival rate of short dental implants**

Diameter (mm)	Total	Survival	Failure	p value
5	160	152(95.3%)	8(4.6%)	0.05
4.5	75	65(86.7%)	10(13.3%)	
4	55	42(77.2%)	13(22.7%)	
Total	290	259(89.6%)	31(10.3%)	

**Table 2: Marginal bone loss on the mesial and distal aspects of dental implants (in mm)**

Time	Mesial (mean)	Distal (mean)	p value
6Month	0.34	0.56	0.01
1 year	0.52	0.68	0.04
2 year	0.61	0.72	0.05
P value	0.01	0.51	

## RESULTS

Dental implant failures of which a maximum of 13 (22.7%) were seen with 4 mm diameter followed by 10 (13.3%) with 4.5 mm diameter and 8 (4.6%) with 5 mm diameter dental implants which was found to be significant ( $p < 0.05$ ). We found that out of 270 dental implants in 130 control patients, implant failure was seen in 11 (4.07%). Table 4 and study showed that at 6 months, there was 0.34 mm mesial bone loss and 0.56 mm distal bone loss, at 1 year 0.52 mm mesial and 0.68 mm distal bone loss, and at 2 years 0.61 mm mesial and 0.72 mm distal bone loss was recorded. The difference was significant ( $p < 0.05$ ).

## DISCUSSION

Dental implant in medically compromised patients is challenge for dental practitioners(5) General health plays an important role in ensuring the success of dental implant treatment. There have been certain absolute contraindications for dental implant insertion in medically compromised patients. It has been observed that medical conditions may increase the risk of treatment failure(6) Conditions like myocardial infarction (MI), stroke, transplantation of organs, immunosuppressant, bleeding and clotting disorders, patients with malignancy, valvular prosthesis surgery, alcohol and drug abusers, psychiatric illness, osteoporosis, and intravenous bisphosphonate therapy are relative contraindications(7) Conditions like myocardial infarction (MI), stroke, transplantation of

organs, immunosuppressant, bleeding and clotting disorders, patients with malignancy, valvular prosthesis surgery, alcohol and drug abusers, psychiatric illness, osteoporosis, and intravenous bisphosphonate therapy are relative contraindications(8) Conditions like diabetes mellitus, hypertension, osteomyelitis, oral cancer, and mental disability pose challenges as the general health of patients is compromised(9)The present study was an attempt to evaluate the survival rates of SDIs in medically compromised patients. The present study was carried out on 171 patients with 290 dental implants. In our study, we included 71 diabetes mellitus patients with 127 dental implants, 54 hypertension participants with 95 dental implants, 15 mental disabilities with 20 dental implants, 10 oral cancer patients with 18 dental implants, and 23 osteomyelitis subjects with 30 dental implants. There are very few studies of assessment of shorter dental implant outcome in medically compromised patients. It is established that diabetes mellitus is a state of hyperglycemia because of either defect in insulin production or its secretion. Insulin affects the regeneration of bone matrix. Diabetic patients have poor clot quality, reduced level of osteoblastic activity, diminished bone formation with increased osteoclastic function, and higher susceptibility to periodontitis. Cardiovascular diseases such as hypertension can lead to poor blood supply leading to limited oxygen or nutrients in the osseous tissue. They can also have xerostomia. They have high osseointegration failure rates. Cancer patients usually undergo radiotherapy or chemotherapy which alters osseointegration process. Radiotherapy impairs vascular and cellular processes of healing. There is a possibility of osteoradionecrosis. Patients with mental disability cannot maintain good oral hygiene. Moreover, most of the patients are on selective serotonin reuptake inhibitors (SSRI), which tend to affect bone formation. Osteomyelitis is an inflammatory condition that can lead to dental implant failure. Oral tissues healing and implant success rate are affected in systemic conditions generally due to increase of susceptibility to other diseases or by interference with healing(10-13) Nguyen et al. conducted a study in which SDIs (7 mm-long dental implants) were assessed in 33 patients with 47 implants in the over four years. Patients with diabetes mellitus, mental disability, hypertension, oral cancer and osteoradionecrosis were assessed. They used 38 dental implants with 4 mm diameter, 8 with 4.5 mm diameter, and 1 with 5.0 mm diameter. There was 95.74% survival rate of implants as recorded during follow-ups. Survival rates were independent of implant diameter. The authors found higher mean MBL recorded at 1 year as compared to 3 months. However, when MBL was compared at 1 and 2 years, the difference was non-significant ( $p > 0.05$ ). We found that there were 60 (10.5%) dental implant failures of which a maximum of 25 (22.7%) were seen

with 4 mm diameter followed by 20 (13.3%) with 4.5 mm diameter and 15 (4.6%) with 5 mm diameter dental implants. It is established that diabetes mellitus is a state of hyperglycemia because of either defect in insulin production or its secretion. Insulin affects the regeneration of bone matrix. Diabetic patients have poor clot quality, reduced level of osteoblastic activity, diminished bone formation with increased osteoclastic function, and higher susceptibility to periodontitis. Cardiovascular diseases such as hypertension can lead to poor blood supply leading to limited oxygen or nutrients in the osseous tissue. They can also have xerostomia. They have high osseointegration failure rates. Cancer patients usually undergo radiotherapy or chemotherapy which alters osseointegration process. Radiotherapy impairs vascular and cellular processes of healing. There is a possibility of osteoradionecrosis. Patients with mental disability cannot maintain good oral hygiene. Moreover, most of the patients are on selective serotonin reuptake inhibitors (SSRI), which tend to affect bone formation. Osteomyelitis is an inflammatory condition that can lead to dental implant failure. Oral tissues healing and implant success(14) Patients with diabetes mellitus, mental disability, hypertension, oral cancer and osteoradionecrosis were assessed. They used 38 dental implants with 4 mm diameter, 8 with 4.5 mm diameter, and 1 with 5.0 mm diameter. There was 95.74% survival rate of implants as recorded during follow-ups. Survival rates were independent of implant diameter. The authors found higher mean MBL recorded at 1 year as compared to 3 months. However, when MBL was compared at 1 and 2 years, the difference was non-significant ( $p > 0.05$ ). We found that there were 60 (10.5%) dental implant failures of which a maximum of 25 (22.7%) were seen with 4 mm diameter followed by 20 (13.3%) with 4.5 mm diameter and 15 (4.6%) with 5 mm diameter dental implants. Verma et al. conducted a study of 25 medically compromised patients and 25 normal healthy patients. The number of failed dental implants in the study group was 3 and 1 in the control group. Extraction of dental implants was carried out for 5 teeth in the study group and 6 implants in the control group. On comparing, the results were statistically significant for failed dental implants(15) We observed that there were 0.34 mm mesial bone loss and 0.56 mm distal bone loss at 6 months, 0.52 mm mesial and 0.68 mm distal bone loss at 1 year, and 0.61 mm mesial and 0.72 distal bone loss at 2 years. Maximum failure was seen with osteomyelitis patients (8, 13.3%) followed by diabetes mellitus (32, 12.5%), oral cancer patients (4, 11.1%), patients with mental disability (4, 10%), and hypertensives (12, 6.3%). We observed that out of 270 dental implants in 130 control patients, implant failure was seen in 11 (4.07%). It has been suggested that diabetes mellitus and other medical conditions reduce the immunity of patients. The healing capacity of body decreases especially in diabetic patients. Hence

special consideration should be given to these patients.(16) Villa et al. evaluated the survival rate of 323 short implants and concluded that short parallel implants can support different prosthesis in the case of limited bone height.(17) Calvo-Guirado et al. evaluated the implant stability and bone resorption with different short implants placed in a dog's maxilla and concluded that the amount of crestal bone loss after remodeling over a period of 12 weeks was less in the extra-short implant, compared to that of wide extra-short implants.(18) Anitua et al. on evaluation of short implants for a period of 10–12 years found that SDIs are alternative to existing longer dental implants.(19) The limitation of the study is its small sample size. A longterm follow-up was not done. Evaluation of medical condition of the patient before placement of dental implant and careful case selection helps in increasing the success rate in the practice of primary care procedure. Further long-term studies are required to assess the success of short dental implants in patients with other medical conditions.

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