

Effect of dental implants design on treatment outcome

Ashish Pandey¹, Divya Pandey², Nandlal Pandey³, Anmol Bagaria⁴, Yesh Sharma⁵, Vibhor Azad⁶

¹ Head of the Department of Prosthodontics, Daswani Dental College & Research Centre, Kota, Rajasthan, India.

² Senior lecturer, Conservative dentistry and Endodontics, MGS Dental college. Rajasthan, India.

³ BDS Final Year, JCD Dental College, Sirsa, Haryana, India.

⁴ BDS, Bharati Vidyapeeth Deemed to be University's Dental College & Hospital, Navi Mumbai, India

⁵ MDS, Department of Conservative dentistry and Endodontics, Maharaja Ganga Singh Dental College, Sriganganagar, Rajasthan, India.

⁶ BDS, Awadh Dental college, Associate Dentist, Jamshedpur, Jharkhand, India

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ABSTRACT

Background: Implants design such as thread shape, thread pitch, thread depth and implant neck are considered to be important factor. The present study was conducted to assess effect of dental implants design on treatment outcome.

Materials & Methods: The present retrospective study was conducted on 80 patients who received 150 dental implants. In all cases, implant design such as thread shape, thread pitch, thread depth and implant surface was recorded. Success or failure rate was assessed.

Results: Out of 80 patients, males were 50 and females were 30. Males received 90 and females received 60 dental implants. Out of 150 dental implants, 25 had failures. Maximum implant failure was found in square shaped thread (10) followed by reverse buttress (8) and V- shaped (7). 0.7 mm threaded pitch implant had higher failure than 0.8 mm (9). Maximum failure rate was seen with anodized Surface (9) followed by machined (7), sandblasted surface (5) and acid etched surface (4). The difference was significant ($P < 0.05$).

Conclusion: Authors found maximum dental implant failure with square shaped thread, 0.7 mm threaded pitch implant and implant with anodized surface.

INTRODUCTION

In the early stages of implant dentistry, root implants or endosseous implants were found to be better than many other different types of implants used since they could provide higher success rates and lower patient discomfort. Thereafter, implants are available in various designs such as tapered, cylindrical, and press-fit or a combination of these features.¹ Other features of the implants' design to consider are thread shape, thread pitch, thread depth and implant neck design. Dental

implant's apical design, its diameter, and length in relation to available bone also play an important role.²

The majority of implants currently in use are threaded screws. The original Brånemark-type implant had a machined (ie, minimally rough) surface consisting of parallel machining lines (0.1 μm width/depth).³ This did not allow bone formation by contact osteogenesis, resulting in the need for prolonged healing (via distance osteogenesis) and weak bone-to-implant interfaces after integration. Machined implants worked well in lengths of

* Corresponding author: **Dr. Ashish Pandey**, Head of the Department of Prosthodontics, Daswani Dental College & Research Centre, Kota, Rajasthan, India.

at least 10 mm, but high failure rates (18.5% to 27%) occurred with implants of 7 to 8.5 mm in length.⁴ Further, they performed poorly in low-density bone (ie, type IV), with failure rates of 16% and higher. Thus, machined implants have been largely abandoned for implants with moderately rough surfaces ($Sa \leq 2 \mu m$). Complete abandonment of machined implants may be unfortunate, as they are associated with a lower risk of peri-implantitis than some rougher implants and may benefit some patients (eg, smokers desiring implant-retained mandibular overdentures.⁵ The present study was conducted to assess effect of dental implants design on treatment outcome.

MATERIALS & METHODS

The present retrospective study was conducted in the department of prosthodontics. It comprised of 80 patients who received 150 dental implants in last 10 years of both genders. All patients were informed regarding the study

and written consent was obtained. Ethical clearance was taken from institute ethical committee.

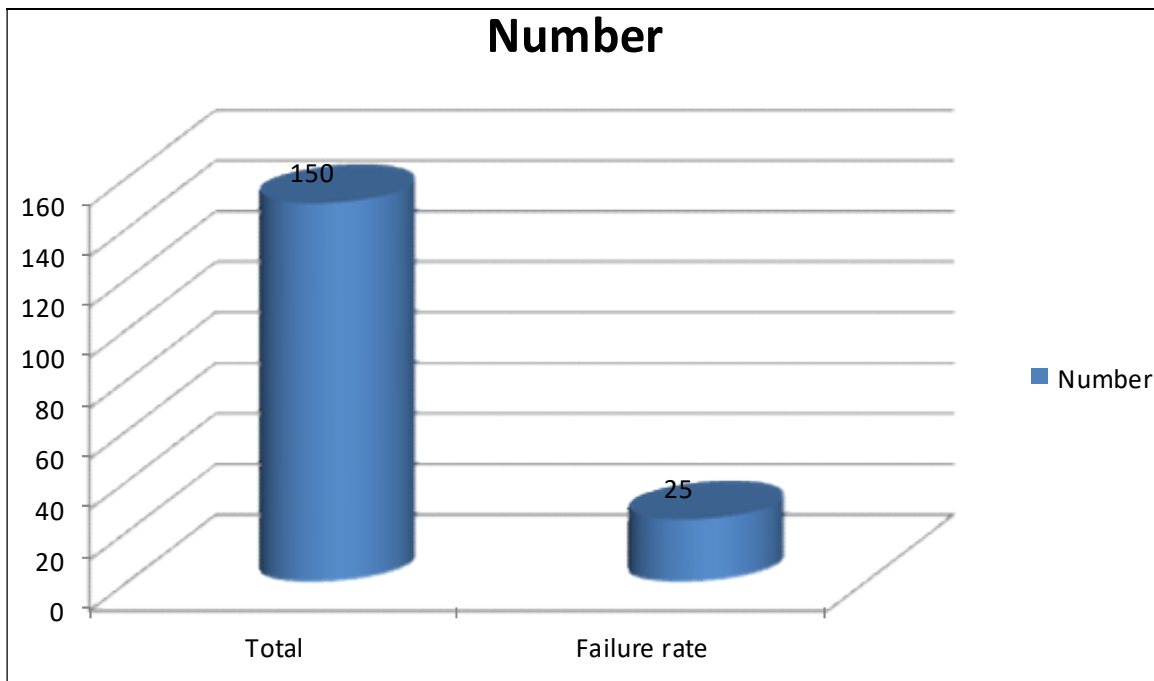
Data such as name, age, gender etc. was recorded. In all cases, implant design such as thread shape, thread pitch, thread depth and implant surface was recorded. Success or failure rate was assessed. Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Table I: Distribution of patients

Gender	Male	Female
Number	50	30
Implants	90	60

Table I shows that out of 80 patients, males were 50 and females were 30. Males received 90 and females received 60 dental implants.



Graph I: Failure rate of dental implants

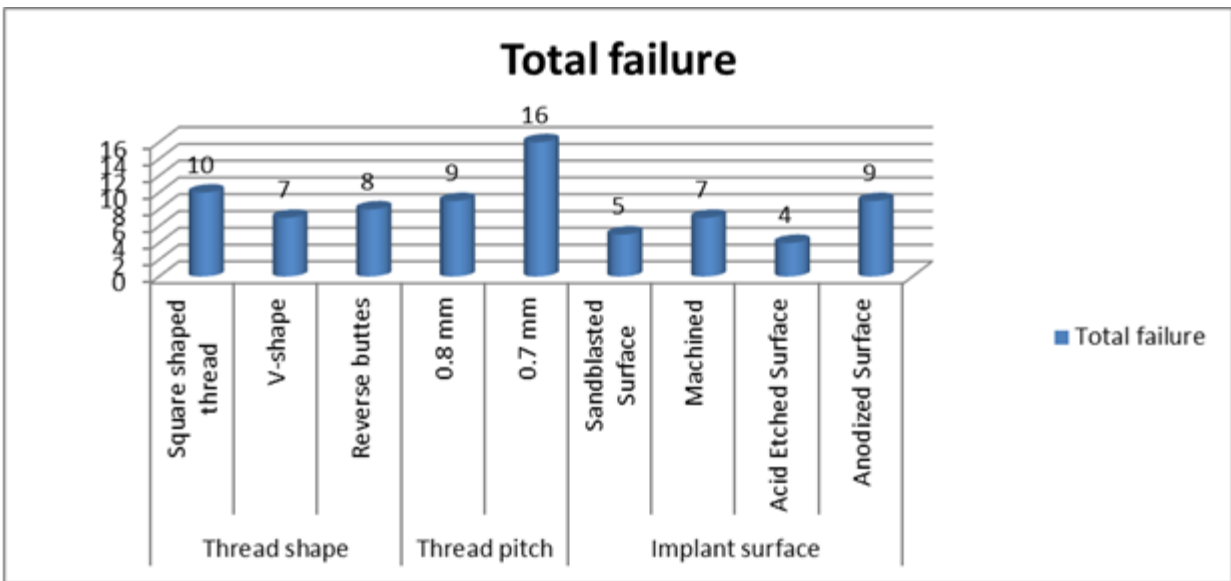
Graph I shows that out of 150 dental implants, 25 had failures.

Table II: Dental implant design and failure rate

Parameters	Shape	Total failure	P value
Thread shape	Square shaped thread	10	0.05
	V-shape	7	
	Reverse buttes	8	
Thread pitch	0.8 mm	9	0.01
	0.7 mm	16	

Implant surface	Sandblasted Surface	5	0.92
	Machined	7	
	Acid Etched Surface	4	
	Anodized Surface	9	

Table III shows that maximum implant failure was found in square shaped thread (10) followed by reverse buttress (8) and V- shaped (7). 0.7 mm thread pitch implant had higher failure than 0.8 mm (9). Maximum failure rate was seen with anodized Surface (9) followed by machined (7), sandblasted surface (5) and acid etched surface (4). The difference was significant ($P < 0.05$).



Graph II: Dental implant design and failure rate

DISCUSSION

Although dental implants have become a predictable aspect of tooth replacement in prosthodontic treatment failures of up to 10% are still encountered. Furthermore these failures have been more associated with “soft” bone quality such as encountered in the maxillary

posterior area. Friberg et al reported an implant failure rate of 32% for those implants which showed inadequate initial stability.⁶ Major contributors to initial implant stability have been suggested to be implant length, diameter, surface texture, and thread configuration. Primary implant stability in dense mandibular bone,

measured with resonance frequency analysis, was similar to the implant stability measured after 3-4 months. However, initial stability can be significantly less in bones of low density increasing the risk of failure. Although bone density and quantity are local factors and cannot be controlled, the implant design and surgical technique may be adapted to the specific bone situation to improve the initial implant stability.⁷ The present study was conducted to assess effect of dental implants design on treatment outcome.

In present study, out of 80 patients, males were 50 and females were 30. Males received 90 and females received 60 dental implants. Out of 150 dental implants, 25 had failures. Threads have been incorporated into implants to improve initial stability, enlarge implant surface area, and distribute stress favorably. Palmer et al⁸ demonstrated the presence of a bone-bridge from the depth of one thread to another, when the implants were laterally loaded. They concluded that the strain is more concentrated in the area where bone contacts the crest of the thread and the strain decreased from the crest to the root of the thread. It has been proposed that threads, due to their uneven contour will generate a heterogeneous stress field, which will match the 'physiologic overload zone', thus prompting new bone formation which may support the 'cuplike bone formation' at the crest of the implant thread.

We found that maximum implant failure was found in square shaped thread (10) followed by reverse buttress (8) and V- shaped (7). 0.7 mm threaded pitch implant had higher failure than 0.8 mm (9). Maximum failure rate was seen with anodized Surface (9) followed by machined (7), sandblasted surface (5) and acid etched surface (4).

An alternate design concept is the press-fit (ie, nonthreaded) implant. Rather than being screwed into

bone, press-fit implants are seated with a mallet and derive initial stability by tight contact within precisely sized osteotomies. The operator has less control over depth of seating and cannot employ immediate placement (into fresh extraction sockets) or immediate loading. The original press-fit design was a parallel-sided cylinder that integrated via plasma-sprayed (ie, truly rough) surfaces. However, this design was withdrawn because of problems with late implant failures; these likely resulted from high stresses and microfractures in crestal bone⁷⁶ with subsequent peri-implantitis.⁹ Schrotenboer et al¹⁰ found micro-threaded implants increase bone stress at the crestal portion when compared with smooth neck implants. Maintenance of marginal bone levels with an implant that had retentive elements at the neck. They found increased BIC at 10 months in implants with micro-threads in the coronal portion (81.8%) when compared with control non-micro-threaded implants (72.8%).

CONCLUSION

Authors found maximum dental implant failure with square shaped thread, 0.7 mm threaded pitch implant and implant with anodized surface.

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