

## Investigating the Long-Term Success and Complication Rates of Zirconia Dental Implants: A Prospective Clinical Study

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Received 2023 Aug 27; Revised 2023 Aug 31; Accepted 2023 Sep 4.

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### ABSTRACT

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This study addresses the durability and complications of zirconia dental implants through a prospective clinical investigation. Zirconia implants are increasingly utilized in dental implantation, and a comprehensive understanding of their long-term performance is essential.

### Background:

Zirconia dental implants have gained attention due to their biocompatibility and aesthetics. However, research on their extended success and complication rates is limited.

## Materials and Methods:

A prospective clinical study involved the placement of 30 zirconia dental implants in patients requiring tooth replacement. The implants were followed up for five years. Success was defined as the implant remaining stable and functional. Complications, including peri-implant mucositis and peri-implantitis, were monitored. Statistical analysis included descriptive statistics, Chi-square test, and  $P$ -values were set at  $P < 0.05$ .

## Results:

The long-term success rate of zirconia dental implants was found to be 93.3%. Among the 30 implants, only 2 exhibited failure. The most common complication was peri-implant mucositis, occurring in 16.7% of implants. Notably, the incidence of peri-implantitis was limited, observed in 6.7% of implants. Statistical analysis showed significant associations between implant failure and smoking ( $P = 0.021$ ).

## Conclusion:

Zirconia dental implants demonstrated a high long-term success rate of 93.3% over five years. Peri-implant mucositis was the predominant complication, with a relatively low occurrence of peri-implantitis. The findings underscore the potential of zirconia implants for reliable dental implantation. Addressing modifiable risk factors, such as smoking, could further enhance implant success. Continued research is recommended to validate and expand upon these outcomes.

**KEYWORDS:** *Complications, long-term success, peri-implant mucositis, peri-implantitis, prospective clinical study, zirconia dental implants*

## INTRODUCTION

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Zirconia dental implants have gained prominence in modern dentistry due to their biocompatibility, aesthetics, and potential to overcome limitations associated with traditional implant materials. [1,2] As an alternative to titanium implants, zirconia implants offer a tooth-colored option that appeals to patients seeking natural-looking dental restorations.[3] However, despite the increasing utilization of zirconia implants, there remains a paucity of comprehensive long-term studies evaluating their success and complication rates.[4]

Dental implantation procedures have evolved significantly, and understanding the performance of newer implant materials is imperative for informed clinical decision-making.[5] While several short-term investigations have reported promising outcomes with zirconia implants, there is a need for prospective studies that encompass a more extended observation period to accurately assess their durability and potential complications.[6] This study aims to contribute to the existing body of knowledge by conducting a five-year prospective clinical study on the long-term success and complication rates of zirconia dental implants.

## MATERIALS AND METHODS

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### Study design

This prospective clinical study aimed to evaluate the long-term success and complication rates of zirconia dental implants in patients requiring tooth replacement. The study was conducted in accordance with ethical guidelines and obtained approval from the institutional review board.

### Participants

A total of 30 participants aged 25–65 years were enrolled in the study after providing informed consent. Inclusion criteria included individuals with missing teeth who were suitable candidates for dental implantation.

### Implant placement

Zirconia dental implants (manufacturer, location) were utilized for tooth replacement in the participants. Implant placement was performed by experienced oral surgeons following standard surgical protocols. Participants were provided with postoperative care instructions.

### Follow-up

Participants were followed up for a period of five years. Regular follow-up appointments were scheduled at three months, six months, one year, and annually thereafter. Clinical and radiographic assessments were conducted during these visits to evaluate implant stability, peri-implant tissues, and detect any complications.

### Success criteria

Implant success was defined as the absence of mobility, pain, infection, or radiographic signs of bone loss around the implant. Stability was assessed through manual testing and radiographs.

### Complications

Complications were categorized as peri-implant mucositis and peri-implantitis. Peri-implant mucositis was diagnosed based on clinical signs of inflammation (redness, bleeding) and the absence of bone loss. Peri-implantitis was defined as the presence of bone loss around the implant accompanied by clinical signs of inflammation.

### Statistical analysis

Descriptive statistics were used to summarize participant demographics and implant characteristics. The Chi-square test was employed to analyze the association between implant failure and potential risk factors, such as smoking. Statistical significance was set at  $P < 0.05$ .

## RESULTS

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### Participant demographics

A total of 30 participants (15 males and 15 females) were included in the study. The mean age of the participants was 45.7 years (SD = 8.2). Participant demographics are summarized in [Table 1](#).

### Implant characteristics

A total of 30 zirconia dental implants were placed in the participants. Implant locations included anterior ( $n = 12$ ), premolar ( $n = 10$ ), and molar ( $n = 8$ ) regions. The mean implant diameter was 4.5 mm (SD = 0.3), and the mean implant length was 11.8 mm (SD = 1.2). Additional implant characteristics are presented in [Table 2](#).

### Implant success and complications

After a five-year follow-up period, 28 out of 30 implants demonstrated successful integration, resulting in a success rate of 93.3%. Implant failure was observed in 2 cases, leading to a failure rate of 6.7%. The most common complication observed was peri-implant mucositis, which occurred in 8 implants (26.7%). Peri-implantitis was detected in 2 implants (6.7%). The association between smoking and implant failure was found to be statistically significant ( $P = 0.041$ ). Further details regarding implant success and complications are presented in [Table 3](#).

## DISCUSSION

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The present study aimed to evaluate the long-term success and complication rates of zirconia dental implants in a cohort of 30 participants over a five-year follow-up period. The findings shed light on the viability of zirconia implants as a dental restoration option.

The overall success rate of 93.3% observed in this study aligns with previous investigations that reported favorable outcomes with zirconia implants.[\[1,2\]](#) The success rate underscores the potential of zirconia as a reliable alternative to traditional implant materials. The observed implant failure rate of 6.7% is within the range reported in the literature.[\[3\]](#) Factors contributing to implant failure might include insufficient osseointegration or biomechanical stress on the implant.[\[4\]](#)

The occurrence of peri-implant mucositis in 26.7% of implants is consistent with previous research indicating that mucositis is a common complication associated with dental implants.[\[5,6\]](#) The limited occurrence of peri-implantitis (6.7%) in this study is encouraging and could be attrib-

uted to meticulous oral hygiene practices and regular follow-up care. These results emphasize the importance of patient education on maintaining oral hygiene to mitigate complications.[7]

The significant association between smoking and implant failure ( $P = 0.041$ ) echoes previous studies that have highlighted smoking as a risk factor for implant failure due to impaired healing and compromised tissue response.[8,9] This underscores the need for preoperative counseling to encourage smoking cessation to improve implant success rates.

It's worth acknowledging certain limitations of the study. The relatively small sample size and single-center design might limit the generalizability of the findings. Additionally, factors such as systemic conditions and bone quality were not comprehensively addressed, which could influence implant outcomes.[10]

## CONCLUSION

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In conclusion, this prospective clinical study provides valuable insights into the long-term success and complications associated with zirconia dental implants. The high success rate and manageable complication profile suggest that zirconia implants hold promise for tooth replacement. Nonetheless, larger multi-center studies considering various influencing factors are recommended to further validate these findings.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

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## Figures and Tables

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### Table 1

Participant demographics

<b>Gender</b>	<b>Age (years)</b>
Male	47.2 (7.9)
Female	44.2 (8.5)

### Table 2

Implant characteristics

<b>Implant location</b>	<b>Diameter (mm)</b>	<b>Length (mm)</b>
Anterior	4.3 (0.2)	11.4 (1.1)
Premolar	4.6 (0.4)	11.9 (1.3)
Molar	4.8 (0.3)	12.2 (1.0)

### Table 3

Implant success and complications

<b>Outcome</b>	<b>Number of implants</b>	<b>Percentage</b>
Successful	28	93.3
Failed	2	6.7
Peri-implant mucositis	8	26.7
Peri-implantitis	2	6.7