Long-Term Success Rates Of Dental Implants In Prosthodontic Treatment: Systematic Review

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ABSTRACT

Objective and Background: Implant therapy stands as a reliable and secure method for rehabilitating edentulous patients across various clinical contexts. This systematic review aims to delve into the evidence surrounding the long-term success rates and treatment outcomes of dental implants.**Methodology:** Specific keywords such as "dental implants," "successful dental implants," "long-term success," and "dental implants in prosthodontics" were employed to explore databases including PubMed, Cochrane Science, Web of Science, ScienceDirect, and Google Scholar. The search spanned from 2000 to 2020.**Results:** Within the scope of this systematic review, 16 pertinent studies were identified. Findings unveiled predominantly high success rates, often exceeding 80%, and showcased the enduring viability of dental implants over the long period.**Conclusion:** While these studies evidenced commendable long-term success rates, instances of failures and complications were noted as common occurrences. Hence, preserving maintainable natural teeth over the long run should take precedence over an immediate shift to replacing teeth with dental implants.

Keyterms: Implant therapy, edentulous, long-term success, prosthodontics, success rate

INTRODUCTION

In recent years, dental implants have become really popular for replacing missing teeth or edentulous areas.^{1,2,3} People around the world are using them more, and in 2021, the global market for these implants was worth about \$4.12 billion, with over 9 million implants put in. They're considered a very safe and reliable way to help people with missing teeth, and lots of studies show they work well in most cases.^{4,5,6}More and more, dentists are using implants because they're successful and people like them.⁷ In the United States alone, over 5.5 million implants are placed every year. The market for these implants worldwide was about \$4.6 billion in 2019, and it's expected to keep growing by about 9% each year until 2027.⁸Implants have become a key way to help people with missing teeth in dentistr.^{9,10} They're reliable and can last a long time, working for many different dental needs.11These implants are made of three parts: one that goes into the bone another that interacts with the gums and the final part that completes the tooth. Studies show a very high success rate, around 95 to 98%.¹² But the success also

depends on how patients are chosen and how well the treatment is planned and done. Things like smoking, teeth grinding, gum problems, diabetes, bone strength, treatments to strengthen bones, and the design of the implant can all affect how well the implant works.^{13,14}Dental implants come in various sizes, shapes, and materials. They're typically made from metals, ceramics, or polymers.¹⁵ Titanium and its alloys are the most popular choices due to their success rates over time. Titanium has been a go-to in implant dentistry, boasting a 97.2% survival rate for single crowns over five years, 93.1% for fixed dental prostheses, and a 96.8% survival rate over ten years for overdentures in patients without teeth.¹⁶Various studies have outlined criteria to determine the success of dental implants.^{17,18} According to the International Congress of Oral Implantologists (ICOI) Pisa Consensus Conference report, implant survival means the implant stays in place without any mobility, pain during use, or more than half the length of the implant's bone loss.¹⁹ However, survival doesn't indicate the quality of the remaining implant.²⁰To ensure long-term success, it's crucial to explore clearer criteria beyond mere survival. Continuous bone loss can threaten the implant's lasting success, prompting the need for more specific criteria.²¹ The criteria set by Albrektsson and team are commonly seen as the gold standard for implant success. They suggest, among other factors, that the bone loss near the implant should not exceed 1.5 mm in the first year and 0.2 mm each following year.²²The goal of this systematic review is to examine past research on the long-term success rates of dental implants and identify the factors contributing to their success in prosthodontic treatment.

METHODOLOGY

Search strategy :To conduct this systematic review, authors searched various databases like PubMed, Cohran Science, Web of Science, ScienceDirect, and Google Scholar using specific keywords such as "dental implants," "successful dental implants," "long-term success," and "dental implants in prosthodontics." The search spanned from the year 2000 to 2023.

Inclusion criteria: The inclusion criteria for selecting articles involved clinical studies meeting specific conditions: studies focusing on dental implants, those directly comparing different implant materials (including grafted sites), and studies with a long-term follow-up. The eligible study designs included randomized controlled trials, clinical trials, prospective case series, and retrospective case series.

Exclusion criteria: Criteria for exclusion comprised clinical studies with a follow-up period shorter than 3 years. Additionally, animal studies and in vitro research were omitted. Articles not composed in English were also excluded from this systematic review.

Outcome measures :The primary outcome measure focused on dental implant survival, determining their presence or absence during follow-up. Secondary outcomes considered the overall success of dental implants.

Data extraction: Reviewers independently extracted and evaluated the data. Information gathered encompassed authors' names, publication year, patient details, reported outcomes, and duration of follow-up. Recorded outcomes focused on the survival and success of dental implants. In cases of missing data, attempts were made to contact study authors. Reports without a response or with insufficient data were excluded from the analysis.

RESULTS

The search across databases initially resulted in 975 citations. Following the elimination of duplicate titles and abstracts, 491 articles were left for screening. Out of these, 260 were excluded after reviewing their abstracts and 175 removed since they didn't meet the inclusion criteria. The full texts of the remaining 85 articles were evaluated for eligibility. Subsequently, after examining the full text of the remaining 85 citations, 16 were found suitable and thus included. A detailed illustration depicting the flow of literature retrieval is presented in Figure 1.

Study characteristics: In this comprehensive review of 16 studies, the research encompassed diverse study types: 2 prospective cohort studies.^{27, 36} 6 retrospective studies, ^{25, 28, 29, 31, 37, 38} and 8 prospective studies.^{23, 24, 26, 30, 32-35} The studies varied in terms of participant numbers, spanning from 12 to 376 individuals, with a median of 57.5, and implant counts ranging from 52 to 1095, with a median of 180. Subjects' ages ranged from 19 to 90 years across the studies.The research encompassed 6 distinct implant systems: Nobel Biocare, Straumann, Astra Dentsply, ITI, Leone Implant system, and Astra Tech. Follow-up periods spanned from 5 to 20 years. The success rates varied, with the lowest reported at 34.9% and the highest at 100% across the studies.



Fig: 1. search strategy for related articles

Author	Study Design	patients	Age	No.of Implants	Implant material/Impla	Bone	Follow-	Success Rate/ Criteria of success
	Design			Implants	nt System	1055	duration	Criteria or success
Carlsson	Prospectiv	60	33-64	348	NobelBiocare	0.7 mm	15 years	99%/
et al.	e	(16	years					Albrektsson et al.
$(2000)^{23}$		males						(1986)
		44						
		females)						
Tinsley	Prospectiv	48		181	21	1.5 mm	6 years	83% for both the
et al.	e				patients=fixed			fixed and
$(2001)^{24}$					prostheses			removable groups.
					27 patients=			Spiekermann
					overdenture			et al. (1995)
Van	Retrospect	158	32-82	316	NobelBiocare	2.67 mm	12 years	97.2 %
Steenber	ive	(114	years					Albrektsson et al.
ghe et al.		males						(1986)
$(2001)^{25}$		44						
		females)						
Karoussi	Prospectiv	89	19-79	179	ITI	0.98 mm	12 years	85.5 %
s et al.	e	(34	years					Karoussis et al.
$(2004)^{26}$		males						(2003)
		and 55						
		females)						
Rasmuss	Prospectiv	36	59-82	199	Straumann	1.27 mm	10 years	survival rate of

 Table.1: Characteristics of Included studies.

on et al. (2005) ²⁷	e Cohort Study	(23 males and 13 females)	years					96.6% in the maxilla and 97.2% in the mandible
Telleman et al. (2006) ²⁸	Retrospect ive	38 (8 males and 30 females)	46-90 years	115	ITI	2.2 mm	10 years	92.2 % Albrektsson et al. (1986)
Jemt and Johansso n (2006) ²⁹	Retrospect ive	76 (48 males and 28 females)	32–76 years	450	NobelBiocare	2.1 mm	15 years	86.8 Albrektsson et al. (1986)
Thierer et al. (2008) ³⁰	Prospectiv e	120		88	highly crystalline HA MP-1-coated implants	2 mm	5 years	97% Albrektsson et al. (1986)
Simonis et al. (2010) ³¹	Retrospect ive	55 (21 male and 34 females)	29–88 years	131	ITI	2.25 mm	16 years	51.9 % Simonis et al. (2010)
Mertens et al. (2012) ³²	Prospectiv e	14 (3 male and 11female s)	37–71 years	52	Astra Tech	0.3 mm	10 years	100 % Albrektsson et al. (1986)
Degidi et al. (2012) ³³	Prospectiv e	48 (21males and 27 females)	Mean age = 49.9 years	158	NobelBiocare	1.95 mm	10 years	34.9 % Misch et al. (2008)
Deporter et al. (2014) ³⁴	Prospectiv e	52 (17 males and 35 females)	Mean age = 55.3	156	Sybron Implants Solution	0.67 mm	20 years	73.4 % Albrektsson et al. (1986)
Mangano et al. (2014) ³⁵	Prospectiv e	194 (104 male and 90 females)	24-74 years	215	Leone Implant System	0.62 mm	10 years	95.9 % Zarb and Albrektsson (1998)
Zhang et al. (2016) ³⁶	Prospectiv e Cohort Study	12 (4 males, 8 females)	40-73 years	91	Dentsply (Astra)	1.01 ± 0.85	10 years	97.6%
Kandasa my et al. (2018) ³⁷	Retrospect	200 (88 males, 112 females)	20-70 years	650	fixed single or multiple crowns, both screw- retained and cemented- retained, were Performed		8-15 years	88% Schnitman and Shulman (1979)

					followed by removable overdentures.		
Adler et al. (2019) ³⁸	Retrospect ive	376 (207 males and 169 females)	20-81 years	1095	Astra Tech/NobelBioc are/Straumann	11 years	

DISCUSSION

The long-term performance of dental implants is commonly assessed using survival and success rates. Survival rate typically refers to implants that show no symptoms and remain functional,^{20,39} but it doesn't consider how well the bone is attached to the implant.³⁹ This definition overlooks potential bone loss around the implant, which can be critical for long-term success.²⁰Success rates, on the other hand, rely on clearer clinical and X-ray criteria, considering factors like the amount and timing of bone loss around the implant. However, comparing long-term success among implants is complicated because there's no agreed-upon standard set of criteria for what makes an implant successful.⁴⁰Different researchers have talked about how well implants work in their studies. For example, one study found a 96% success rate after six years,⁴¹ while another reported 83%.⁴² These differences could be because of how long they followed the patients and how the patients' bodies reacted. In the study of Kandasamy et al. an 88% success rate was found.⁴³Another study compared implants in people who lost teeth because of gum problems versus other reasons. They noticed that over 10 years, those with gum problems had fewer successful implants than those who lost teeth for other reasons.⁴⁴ Another research compared implants in people with gum issues against those without and saw lower success rates in people with gum problems and bone loss around the implant.⁴⁵Chrcanovic et al. (2016) found that zygomatic implants had a survival rate of 95.2% over up to 12 years.⁴⁶ Sola Perez et al. (2022) reported survival rates of 98.5% in the first year, 97.5% between 1 and 3 years, 96.8% at 3-5 years, and 96.1% beyond 5 years.⁴⁷

CONCLUSION

In conclusion, picking the right patients is important for implant success. This study showed that even one risk factor can affect how well the implant works, but having multiple risk factors can greatly increase the chances of the implant not working properly. **REFERENCES**

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