Implant survival rate of patients in Dental Hospital Hasanuddin University: 8 years evaluation

[1]**Bahruddin Thalib**, [1,3]**Rifaat Nurrahma**, [2]**Asmawati**, [2]**Nurlindah Hamrun**, [4]**Alqarama Mahardika**, [5]**Ian Afifah Sudarman**, [5]**Rezky Wahyuni Syamsuddin**
[1]Department of Prosthodontics, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia
[2]Department of Oral Biology, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia
[3]Department of Oral and Maxillofacial Surgery/Oral Pathology, VU University Medical Center/Academic Center for Dentistry Amsterdam (ACTA), Amsterdam, The Netherlands
[4]Department of Dental Material, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia
[5]Prosthodontic Specialist Educational Program, Faculty of Dentistry, Hasanuddin University,
Corresponding author: **Rifaat Nurrahma**, e-mail: **rifaat.nurrahma@gmail.com/r.nurrahma@amsterdamumc.nl**

ABSTRACT
Data on dental implant treatment's success and survival rate are still limited. Meanwhile, the data on the success and survival after implant placement and restoration can be used to evaluate materials, improve the dental implant treatment, and enhance the service quality at Hasanuddin University Dental Hospital. The purpose of this study is to analyze the dental implant survival rate, the contributing factors that enhance the survival rate, and the factors causing the failure of the dental implants at the Prosthodontic Clinic of Dental and Oral Hospital, Hasanuddin University. The final study group consisted of 11 patients with 20 implants. Implant failure was categorized based on implant loss, mobility, or removal due to severe peri-implant infection or implant fracture. Implant survival rates were grouped based on sex, age, smoking habit, placement location, diameter, length, and placement time. The value of implant survival rate was assessed based on the presentation of successful implants. Of all 20 cases, five implants failed, indicating a cumulative implant survival rate of 75%. Based on the failure period, there are initial failure cases before loading and late failure cases after loading. One implant failed within the first six months, and two implants failed 2 years after insertion of the superstructure. The leading cause of implant failure before loading is osseointegration failure. In the case of implants that failed after installing the superstructure, peri-implantitis occurs continuously. It was concluded that the implant survival rate for patients at the Hasanuddin University Dental Hospital is 75%. Dental implant survival rates include gender, age, implant placement location, smoking habits, implant diameter, length, and immediate or delayed implant placement. The factors causing the failure of the implant in this study were osseointegration failure and peri-implantitis
Keywords: dental implant, implant survival rate, implant failure

INTRODUCTION

Dental implants are a reliable treatment option in the rehabilitation of partial or complete tooth loss.[1,2] Dental implants are one of the methods to provide retention and support for strength in using dentures, which function to restore chewing, aesthetic, and speech functions.[3] The use of dental implants provides a better quality of life than conventional denture treatment.[4]

The success rate and survival rate based on previous research are high. Some studies have shown success after 5 years of follow-up. When evaluating implant success and failure rates, one should consider the type of load or restoration to be used. The implant success scale is assessed by its durability and is declared a failure if it must or has been removed.

Dental implant treatment in academic institutions is expected to have a high success rate, so it can be one of the choices for implant treatment. However, data on the success and survival of implants that have been placed are still limited. Meanwhile, data on success and survival after implant placement and restoration can be used for evalua-

tion materials that improve service quality and assess the success rate of implant treatment. Therefore, a long-term retrospective study is useful in objectively assessing the relationship between various factors that affect implant survival rates.[5-7]

The of dental implants has been carried out at the Prosthodontic Clinic, Teaching Dental and Oral Hospital, and Hasanuddin University since 2010. Ongoing evaluation using a retrospective study method on the success and survival rate of implants was firstly carried out; the researchers were interested in examining the *implant survival rate* in patients in Hasanuddin University Oral and Dental Hospital. This study aimed to analyze the *implant survival rate* of patients at the Prosthodontics clinic at the Dental Hospital, Hasanuddin University, the supporting factors that can make the implant *survive* in the mouth, and the factors that cause implant failure.

METHODS

An 8-year follow-up study involved patients sequentially treated with dental implants at the Prosthodontic Clinic of Hasanuddin University, Makas-

sar, Indonesia, between 2013 and 2021. Registered patients were recalled for examination from June 2021 to November 2021. The study group consisted of 21 patients with a total of 33 implants.

All data were taken retrospectively from dental records of patients who had dental implants inserted, including informations on age, sex, general health, time of treatment, implant manufacturer, position, and a number of implants. Patients were recalled for control in this study. This research was approved based on the recommendation of the Health Research Ethics Commission, Faculty of Dentistry, Hasanuddin University (0180/PL.09/ KEPK FKG-RSGM Unhas/2021)

Result measurement

Implant failure was assessed based on implant loss, mobility, or removal due to severe peri-implant infection or implant fracture. The following criteria evaluated implant survival rate: (a) absence of clinically detectable implant mobility, (b) absence of subjective pain and discomfort, (c) absence of peri-implant infection, and (d) absence of persistent radiolucency continuously around the implant (e), the gingival sulcus depth is not more than 2-6 mm (f) the *bleeding on probing value is* between 0-1, (g) peri-implant marginal bone loss that is more than half the implant length is categorized as a failure. Periapical radiographs obtained at the time of control were analyzed based on the condition of the marginal bone. The distance between the implant reference point (fixture-abutment junction) and the level of the marginal bone on both mesial and distal sides of the implant was record-

ed by two blind examiners (BT and RN). Conventional descriptive statistics (number and percentage values) were used for the study materials presented, including *implant survival rate.*

RESULTS

The study group consisted of 21 patients and 33 implants. However, eight patients with nine implants were excluded because they refused to attend the examination and lost contact with two patients. Therefore, the final study group consisted of 11 patients and 20 implants. There were six male patients and five female patients. There were 12 implants in the male and 8 in the female (Table 1), The patients were aged 24-34 years at the study time. Information regarding systemic disease was obtained from patient records. All patients had no systemic disease, and two patients have a history of smoking.

Among 11 patients, 12 implants were placed in 5 male patients. Of these, five implants failed, and the *implant survival rate* was 58.3%. Eight implants were placed in 6 female patients. Of these, no implants were reported to fail, so the *implant survival rate* was 100%.

Based on smoking habits, seven implants were placed in patients who smoked, and five implants failed, so the *implant survival rate* was 28.5%. While the number of implants placed in patients who did not smoke was 13, none of the implants failed, so the *implant survival rate* was 100%.

For implant placement in this study, namely maxillary anterior and mandibular posterior. Four implants were placed in the anterior maxillary re-

Table 1 Characteristics of implant survival rate

Variable	Number of Implants	Distribution (%)	Implant Failed (n)	CSR (%)
Gender				
Man	12	45.4	5	58.3
Woman	8	54.5	-	100
Smoking Prevalence				
Yes	7	35	5	28.5
No	13	65	-	100
Location				
Anterior maxilla	4	20	1	75
Posterior Mandible	16	80	4	75
Implant Diameter				
3.0-3.5	6	30	-	100
3.6-4.0	12	60	5	58.3
4.1-4.5	2	10	-	100
Implant Length				
<10 mm	3	17	85	100
10 mm			5	70.5
Implantation time				
Delayed	16	80	-	100
immediate	4	20	4	0

Table 2 Implant failure analysis

Gender	Age	Location	Implant Diameter	Implant Length	Restoration Type	Failure Time	Cause of Failure	Failure Type
L	24	12	3.8 mm	12 mm	Single Implant	6 months	Osseoint.Failure	Early Failure
L	33	36	4 mm	10 mm	Single Implant	2 years	Peri-implantitis	Late Failure
L	33	46	4 mm	11 mm	Single Implant	2 years	Peri-implantitis	Late Failure
L	33	37	4 mm	10 mm	Single Implant	2 years	Peri-implantitis	Late Failure
L	33	47	4 mm	10 mm	Single Implant	2 years	Peri-implantitis	Late Failure
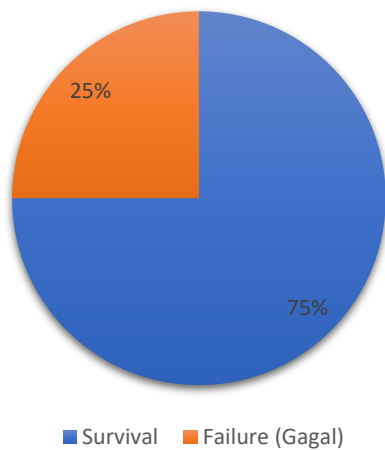
Figure 1 Implant survival rate presentation

region. One implant failed, so the *implant survival rate* was 75%. Furthermore, 16 implants were placed in the posterior mandibular region, and four failed, so the *implant survival rate* was 75%.

Assessment based on the implant diameter, 6 implants were installed with a diameter of 3.0-3.5 mm. None of the implants failed, so the *implant survival rate* was 100%. Twelve implants were placed with a 3.6-4.0 mm diameter, and five implants failed, so the *implant survival rate* was 58.3%. Furthermore, two implants with a diameter of 4.1-4.5 mm, none of the implants failed in this group, so the *implant survival rate* was 100%.

Based on the length of the implants, three implants were installed with a length of <10 mm, no implants failed, so the *implant survival rate* was 100%. Furthermore, 17 implants were installed with a length of 10 mm, and 5 implants failed, so the *implant survival rate* was 70.5%.

The evaluation was based on the time of implant placement. Sixteen implants were installed six months after tooth extraction, and none of the implants failed, so the *implant survival rate* was 100%. Furthermore, four implants were placed immediately, but the four implants failed. Out of all 20 cases, five implants failed in this study, showing a cumulative implant survival rate of 75% (Figure 1). Based on the failure period, there were cases of early failure before loading and late failure cases after installation of the superstructure. Of these, one implant failed within the first six months; two implants failed between 2 years after insertion of the superstructure. The leading cause of implant failure before loading is osseointegration failure. In the case of failed implants after insertion of the superstructure due to persistent peri-implantitis (Table 2).

DISCUSSION

In this study, a clinical examination was carried out to see the implant survival rate in patients treated at the Prosthodontic Clinic, Hasanuddin University Dental and Oral Hospital. Several factors affect the implant survival rate: age, gender, smoking habits, implant placement location, and implant installation time.

According to a study conducted by Maris Victoria et al., no association was found with patient age,[5] as reported by several studies; although Noguerol et al., reported higher failure rates in patients between 41 and 60 years of age than in those older than 60 years. It can be concluded that advanced age is not a disadvantage in implant treatment.[7] This is in line with the results of this study, which found five failed implants from 2 young male patients, namely 24 and 33 years. However, several factors influence the failure of this patient's implant, such as smoking habits, systemic disease, and immediate implants.

As many as 7 of the 12 implants placed in male patients showed successful treatment, whereas, in 8 implants in female patients, the implants were still well placed in the oral cavity. The results of this study found that gender did not affect the success of dental implant treatment. This is in line with the research conducted by Jang et al which stated that there was no significant difference between male and female gender in the success of dental implants. In addition, a study states that from the results of periapical radiographic examination, the success of dental implant placement in men is better than in women due to the anatomy of the maxillary sinus in women.[8,9] However, in this study, there were five implants from two male patients who experienced failure, due to patient's smoking habit.

Smokers must anticipate complications after implant placement that require surgical intervention. Smokers have a higher incidence of complications,

especially with screw implants. However, most complications will not lead to failure. While the association between implant complications and smoking, smoking duration, implant type, and implantation time was significant, it cannot be assumed that they were the only or the most significant factors. Implant patients should be noticed that smoking can have harmful effects on dental implants. Limiting or reducing smoking will reduce the complications of endosseous dental implants.[10]

Another factor that can affect the success of a dental implant is the location of the implant. Of the four implants placed in the maxillary anterior region, 1 implant failed to survive. In line with the previous article (zone 1), this region often has a history of bone infection and trauma to the alveolar ridge. There were 4 failures out of 12 implants in the posterior mandible in the posterior area. This area is tricky due to vertical bone deficiency, proximity to the inferior alveolar canal, and insufficient blood flow causing poor healing of the implant area.[11]

In line with research on the relationship between success and implant placement, Alsaadi et al.'s study concluded that the anterior mandibular region experienced less bone loss than the mandibular posterior region and the maxillary region. Jacob's study supports it, that bone loss was more in the maxilla than in the mandible because the cortical bone in the maxilla was thinner, and the trabecular bone was less dense. When compared to the anterior (incisor) and posterior (molar) regions, the chewing load and the force during clenching were, on average, three times greater in the posterior region. In contrast to the study conducted by Lang et al. who found no statistically significant difference regarding the success of implants placed in the maxilla and mandible.[12,13]

Immediate implants require higher primary stability, and their attachment to tissues (soft and hard) is more susceptible to bacteria and poor micro repair during the healing process, leading to an increased risk of implant failure.[14] It has been reported that the risk of implant failure in an infected post-extraction socket is three times greater than in an infection-free post-extraction socket.[15] However, the placement of an immediate implant has the following advantages: maintaining the shaping network soft and hard. Therefore, research on immediate implant placement continues.

The loading factor is also very influential on the stability of the immediate dental implant.[16] Menchini et al., suggested that the placement of an immediate dental implant with a single restoration can be an option in missing one tooth.[17] It has been proven either on short or long research period (approach 100%) and bone damage marginal (0.42-2.69 mm).[17] Immediate implant placement requires adequate osseointegration to enhance a direct functional and structural relationship between the bone and the implant surface. This osseointegration process does not occur immediately but occurs gradually over time. Several factors play a role in the success of osseointegration, including a good adaptation between the implant material and stable surrounding bone. Comparison of post-retraction immediate implant placement techniques is also a consideration.[18] In addition, patients who experience implant failure have been reported to have a smoking habit. This is also a predisposing factor for immediate implant failure. Non-immediate implant placement increases implant success. *Early implant failure* is generally linked with a healing wound that is not suitable and hinders or prevents osseointegration. Other influencing factors including variation in surgical technique, the inadequate quality of bone, post-operation infection and inflammation, and excess occlusal. *Late failure implant* was often caused by a damage on osseointegration, the burden functional from prosthesis which supported implant. Late failure implants are generally linked with excess occlusal (biomechanics) or peri-implantitis.[18]

It is concluded that the implant survival rate for patients at the Hasanuddin University Dental Hospital is 75%. Dental implant survival rates include gender, age, implant placement location, smoking habits, implant diameter, length, and immediate or delayed implant placement. The factors causing the failure of the implant in this study were osseointegration failure and periimplantitis.

Acknowledgments

REFERENCES

1. Tetelepta R, Machmud E. Effect of addition of bioactive materials on dental implants based on the histology examination. J Dentomaxillofac Sci 2015;4:135-42
2. Tjikman AP, Lpsodqw G, Wkhuh W. Straightforward case of dental implants in general dentistry. J Dent Indonesia 2011;18(3):1-5.
3. Moy PK, Medina D, Shetty V, Aghaloo TL. Dental implant failure rates and associated risk factors. Int J Oral Maxillofac Implant 2005; 20(4).

4. Misch CE, Perel ML, Wang HL, Sammartino G, Galindo-Moreno P, Trisi P, et al. Implant success, survival, and failure: the International Congress of Oral Implantologists (ICOI) pisa consensus conference. Implant Dent 2008;17(1):5-15

5. Maris VO, Francisco JM. Risk factors associated with early implant failure: a 5-year retrospective clinical study. J Prosthet Dent 2015;1–5.

6. Jang HW, Kang JK, Lee K, Lee YS, Park PK. A retrospective study on related factors affecting the survival rate of dental implants. J Adv Prosthodont 2011;3(4):204–15.

7. Noguerol B, Muñoz R, Mesa F, de Dios Luna J, O'Valle F. Early implant failure. Prognostic capacity of Perio-test®: retrospective study of a large sample. Clin Oral Implant Res 2006;17(4):459-64.

8. Chrcanovic BR, Albrektsson T, Wennerberg A. Dental implants inserted in male versus female patients: A systematic review and meta-analysis. J Oral Rehabil 2015;42(9):709-22.

9. Gender BJ, Implant P. Radiographic evaluation of alveolar bone loss around dental implants after 1 functional year. 1979.

10. Singh, dr. Padam, et al. Evaluation of dental implants failures in smokers and healthy subjects. Eur J Molec Clin Med 2020; 7(11)

11. Lang LA, Hansen SE, Olvera N, Teich S. A comparison of implant complications and failures between the maxilla and the mandible. J Prosthet Dent [Internet] 2019;121(4):611-7. Available from: https://doi.org/10.1016/j.prosdent. 2018.08.002

12. Meijer HJA, Raghoebar GM. Immediate implant placement in molar extraction sites: A 1-year prospective case series pilot study. Int J Implant Dent 2020;6:1–7.

13. Huang F, He JH Ouyang Y. Risk factors for dental implant failure with the anterior teeth. J Prev Treat Stomatol Dis 2018;26:250–3.

14. Ji TJ, Kan JYK, Rungcharassaeng K, et al. Immediate loading of maxillary and mandibular implant-supported fixed complete dentures: A 1-to 10-year retrospective study. J Oral Implantol 2012;38(S1):469–77.

15. Menchini-Fabris GB, Toti P, Crespi G, Covani U, Furlotti L, Crespi R. Effect of different timings of implant insertion on the bone remodeling volume around patients' maxillary single implants: a 2-3 years follow-Up. Int J Environ Res Publ Health 2020;17(18):6790.

16. Yang Y, Hu H, Zeng M. The survival rates and risk factors of implants in the early stage: a retrospective study. BMC Oral Health 2021; 21: 293. https://doi.org/10.1186/s12903-021-01651-8

17. Velasco-Ortega E, Jiménez-Guerra A, Ortiz-Garcia I. Immediate loading of implants placed by guided surgery in geriatric edentulous mandible patients. Int J Environ Res Public Health 2021;18(8):4125.

18. Manor Y, Oubaid S, Mardinger O, Chaushu G, Nissan J. Characteristics of early versus late implant failure: a retrospective study. J Oral Maxillofac Surg 2009;67:2649-52.