

Clinical Outcomes of Low-Speed Drilling Without Irrigation for Dental Implant Placement: A Retrospective Study

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Abstract

This retrospective observational study evaluated the clinical and radiographic outcomes of low-speed drilling without irrigation (biological drilling) for dental implant placement, focusing on implant survival and clinical success during short- and medium-term follow-up. A total of 304 implants were placed in 154 patients using drilling at 80 rpm without external irrigation. Patients over 18 years of age with a minimum of 12 months of clinical and radiographic follow-up were included. Variables analyzed included age, sex, implant location, loading protocol, follow-up time, implant survival rate, and clinical success according to the criteria proposed by Lee et al. (2024).

The mean age of the patients was 62.13 years (range: 18–79), with 64.29% being female and 35.71% male. Immediate loading was applied to 39.80% of the implants and delayed loading to 60.20%, with an average follow-up of 31.63 months. Implant survival was 100% during the first 12 months and 99.34% at the end of follow-up, with a clinical success rate of 97.7%. These findings suggest that biological drilling is a safe and effective technique for dental implant placement.

Keywords

Biological drilling; Protocol; Dental implants non-irrigated technique.

Introduction

Currently, implant-supported prostheses represent the best option for oral rehabilitation in the replacement of missing teeth because they effectively restore masticatory function, aesthetics, oral health, and the patient's self-esteem [1]. Several factors during osteotomy preparation can affect implant osseointegration, such as rotation speed, bur geometry, repeated use of burs, pressure applied to the bur, use of intermittent drilling, bone density, type of irrigation, and absence of irrigation [2].

Traditionally, the drilling protocol proposed by Branemark is performed at high speed (800–1300 rpm) with copious irrigation using saline solution to avoid bone overheating, which could compromise the cellular integrity of the bone and, therefore, the implant prognosis [3]. However, recent studies have explored alternatives to the conventional drilling protocol, such as low-speed drilling without irrigation, also known as biological drilling, with the aim of improving the biological quality of the surgical bed [2,4,5,6,7]. This technique, which uses speeds between 50 and 150 rpm without irrigation, allows the collection of autologous bone particulate during osteotomy, which retains its vitality which could be beneficial in cases of dental implant placement with less simultaneous bone regeneration [7]. It has also been proposed that this drilling method reduces thermal damage, preserves the trabecular structure of the bone and stimulates a better biological response, all without compromising surgical precision [8].

Despite promising findings, the scientific literature on this technique remains limited, especially in retrospective contexts with clinically relevant follow-up periods. Therefore, the objective of this study is to retrospectively evaluate the clinical and radiographic outcomes of the low-speed drilling technique without irrigation for dental implant placement, analyzing the short- and medium-term survival and success rates.

Materials and Methods

This study adhered to the STROBE guidelines [9]. An observational, descriptive, and retrospective study was conducted to analyze the clinical outcomes obtained using the low-speed (80 rpm) drilling technique without irrigation for dental implant placement in patients treated between February 2021 and January 2025. Clinical, laboratory, and radiographic data were collected from 154 patient records of those who received a total of 304 dental implants at a private clinic located in Maracaibo, Venezuela. All cases were evaluated using cone-beam computed tomography (CBCT) imaging studies. Panoramic radiographs, and intraoral radiographs were planned virtually using the NemSCAN, R2gate, and Exoplan 3.1 software programs, selected according to market trends at the time. Postoperative follow-up included at least

panoramic radiographs. The anonymity and confidentiality of the data obtained were duly ensured in accordance with standard ethical requirements.

The inclusion criteria were: 1. Patients over 18 years of age; 2. Minimum clinical and radiographic follow-up of 12 months; 3. Complete medical history and adequate pre- and postoperative records. The exclusion criteria were: 1. Implants placed using a mixed or conventional technique; 2. Patients with uncontrolled systemic diseases that could affect healing; 3. Incomplete medical history.

The following variables were recorded: a) Demographics: age, sex; b) Implant location: maxilla or mandible, anterior or posterior; c) Loading type: immediate or delayed; d) Follow-up time (months); e) Survival rate; f) Clinical success rate (based on the criteria of Lee et al, 2024 [10], which consists of: absence of pain, paresthesia, mobility, peri-implant infection and bone loss after initial bone remodeling).

All procedures were performed by the same surgical team using surgical guides to ensure precise implant placement. Megagen brand implants, specifically the Anybody system, were used in all cases, drilled at low speeds (80 rpm) without irrigation. The choice between immediate or delayed loading was based on the primary stability of the implant and the individual clinical context of each case.

Excel database. Quantitative variables were expressed as means, and categorical variables as absolute frequencies and percentages.

Results

Of the 154 patients selected, 99 were women (64.29%) and 55 were men (35.71%), with a mean age of 62.13 years (range: 18–79 years) (**Table 1**). A total of 304 dental implants were placed, distributed anatomically as follows: Anterior maxilla: 89 implants (29.28%), posterior maxilla: 90 implants (29.61%), anterior mandible: 33 implants (10.86%), posterior mandible: 92 implants (30.26%). (**Table 2**)

Variable	Worth
Number of patients	154
Middle age (range)	62.13 years (18–79)
Sex - Female	99 (64.29%)
Sex – Male	55 (35.71%)

Table 1: Demographic characteristics of the sample.

Location	Number of implants (%)
Anterior maxilla	89 (29.28%)
Posterior maxilla	90 (29.61%)
Anterior mandible	33 (10.86%)
Posterior mandible	92 (30.26%)

Table 2: Anatomical distribution of implants.

Type of load	Number of implants (%)
Immediate	121 (39.80%)
Deferred	183 (60.20%)

Table 3: Load Type.

Regarding the loading method: Immediate loading: 121 implants (39.80%), Delayed loading: 183 implants (60.20%) (**Table 3**). The average follow-up time was 31.63 months. The overall implant survival rate was 100% in the first 12 months and 99.34% at the end of follow-up (up to 58 months), with only two implants lost due to osseointegration failure (**Figure 1**). The clinical success rate was 97.7% (**Figure 2**), considering the absence of pain, paresthesia, mobility, peri-implant infection, and bone loss after initial bone remodeling.

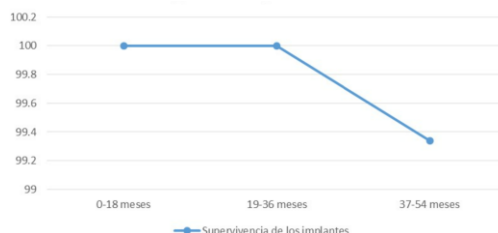


Figure 1: Implant survival.

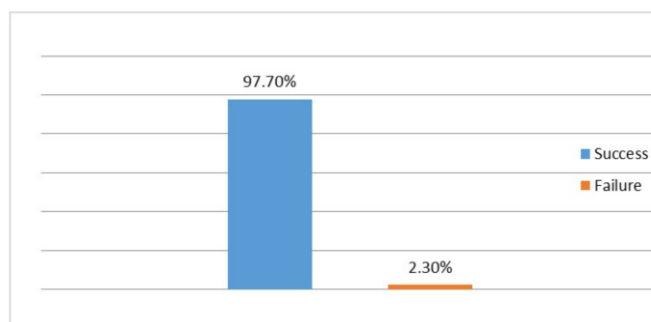


Figure 2: Success/failure rate of implants.

Discussion

The results of this retrospective study support the clinical efficacy of the low-speed drilling technique without irrigation, also known as biological drilling, and compare favorably with those reported for conventional protocols with irrigation.

Previous studies have suggested that this technique, by avoiding the use of irrigation and allowing the harvesting of vital autologous bone, promotes local bone regeneration and reduces the risk of thermal necrosis [3,4,6]. Kim et al. (2010) [8] used pig ribs to obtain cortical bone of similar quality to the human mandible, evaluating heat production using three implant drilling systems (two conventional and one low-speed without irrigation) by measuring bone temperature using infrared thermography. No implant drilling system produced heat above 47 °C, which is the critical temperature for bone necrosis during low-speed drilling, demonstrating that drilling at 80 rpm does not generate harmful thermal increases, thus corroborating its safety. Similarly [11] conducted a retrospective, observational, multicenter study of 95 patients and 165 implants placed using low-speed surgical site preparation instruments without irrigation, reporting a 98% survival rate at 12 months. Our study differs from this one in the traditional conical shape of implants used, in contrast to the triovate conical implants described by [11]. in their technique. It also

differs in that it included a larger sample (304 implants) and a longer clinical follow-up. However, the survival rate reported by them is similar to the results of this study, providing relevant clinical evidence for the safe use of this technique [12]. Suggested low-speed drilling without irrigation as an alternative to the conventional procedure, focusing on obtaining autologous bone during surgical site preparation and eliminating the need to harvest bone from a second surgical site. They studied the tissue obtained from the drill bits and the surgical bed in 10 patients, demonstrating through optical microscopy and ultrastructural analysis that the tissue was vital and biologically active. Therefore, drilling in this manner improves its quality, allowing its use as an autograft. In the present study, the tissue obtained from the drill bits (**Figure 3**) was used as an autologous graft according to the anatomical requirements of the surgical implantation site for each patient.

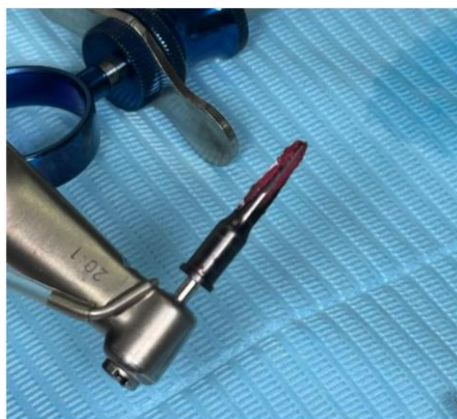


Figure 3: Bone tissue removed after low-speed milling.

In this retrospective study, the low-speed drilling technique without irrigation achieved a survival rate of 99.34% and a clinical success rate of 97.7%. These results are consistent with the findings of [13]. Who, in a randomized, controlled clinical trial, compared conventional high-speed drilling with irrigation versus low-speed drilling without irrigation in 30 implants placed in 25 patients. At 12 months of follow-up, he reported a 100% success rate in the low-speed, non-irrigated group, compared to 93.3% in the conventional group, and less mean marginal bone loss in the experimental group (0.62 ± 0.70 mm) compared to the control group (0.83 ± 0.73 mm). Although Pellicer Chower 's study had a smaller sample size and a shorter follow-up period, its results demonstrate that biological drilling is not only safe but can also be associated with less peri-implant bone loss and higher short-term success rates, consistent with our mid-term findings. Despite the shorter follow-up period and sample size, the level of methodological control inherent in a randomized clinical trial provides strong evidence for the use of this technique compared to conventional methods.

Limitations of this study include its retrospective nature, the absence of a control group, and the anatomical variability of the cases. However, the consistency of the results reinforces the potential of biological drilling as an effective and predictable alternative for dental implant placement.

Conclusion

The low-speed drilling technique without irrigation has proven to be safe, effective, and clinically viable for dental implant placement, achieving a high success rate and short- and medium-term survival. Its ability to preserve

Bone vitality and the ability to generate autologous bone represent an additional advantage in local regeneration procedures. Further clinical studies, especially prospective and comparative ones, are recommended to further validate these results.

Declaration of conflict of interest

It is certified that there is no commercial or other association that could represent a conflict of interest in relation to this research.

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