



Marginal bone loss and associated factors in immediate dental implants: A retrospective clinical study

Chele, Dumitru; Rehberger-Bescós, Federico; Salgado-Peralvo, Ángel O.; Chamorro Petronacci, Cintia; Camacho Alonso, Fabio; Peñarrocha Oltra, David; Lado Baleato, Óscar; Pérez-Sayáns, Mario

BACKGROUND

Immediate dental implants (IDIs) have shown survival rates similar to those following other insertion protocols; however, higher rates of marginal bone loss (MBL) have been recorded. The aim of this study was to evaluate the MBL over a follow-up period of up to 36 months in IDIs, as well as the impact of various clinical variables on the MBL

MATERIAL AND METHODS

This retrospective observational study adhered to STROBE guidelines and included patients who agreed to participate and signed the informed consent form. Eligible patients were those treated with IDIs between 2018 and 2021, and did not require simultaneous bone regeneration. Figure 1. Patients selected had baseline and follow-up radiographs, allowing for MBL analysis at intervals: baseline (post-surgery), 2, 6, 12, 24, and 36 months (Figure 2). IDIs were classified based on radiographic analysis of bone levels as bone loss (BL), bone remodeling (BR), or bone overlapping (BO) (Figure 3) [1]. Data on factors such as implant placement depth, implant location (mandibular or maxillary), and abutment design were recorded. MBL was statistically analyzed using generalized additive mixed regression models to identify significant associations and trends over time, with particular emphasis on pre- and post-loading phases

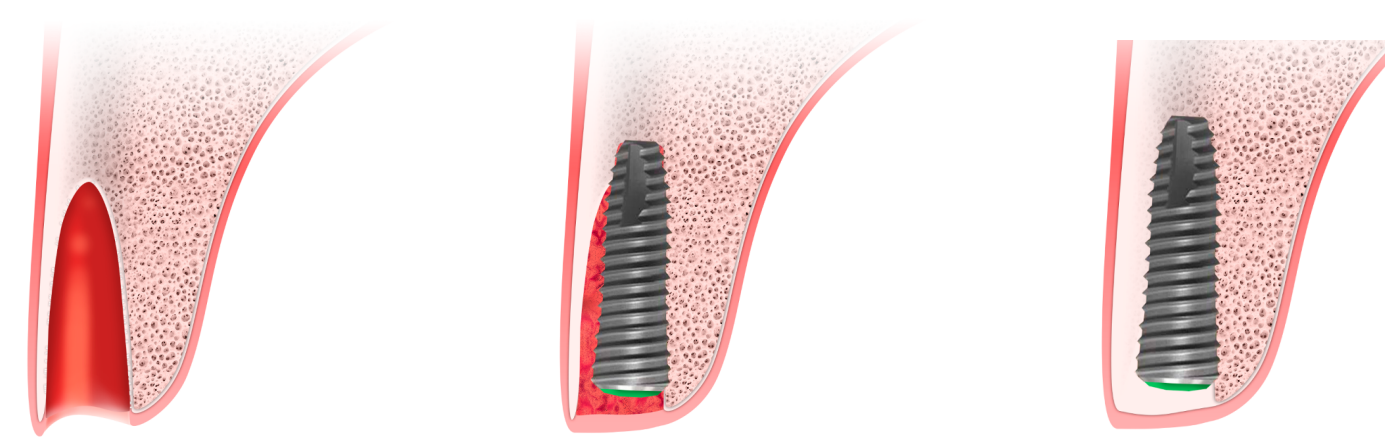


Figure 1. (a) Postextractional socket. (b) Immediate implant placement (c) Stage two was performed after 2 months of healing

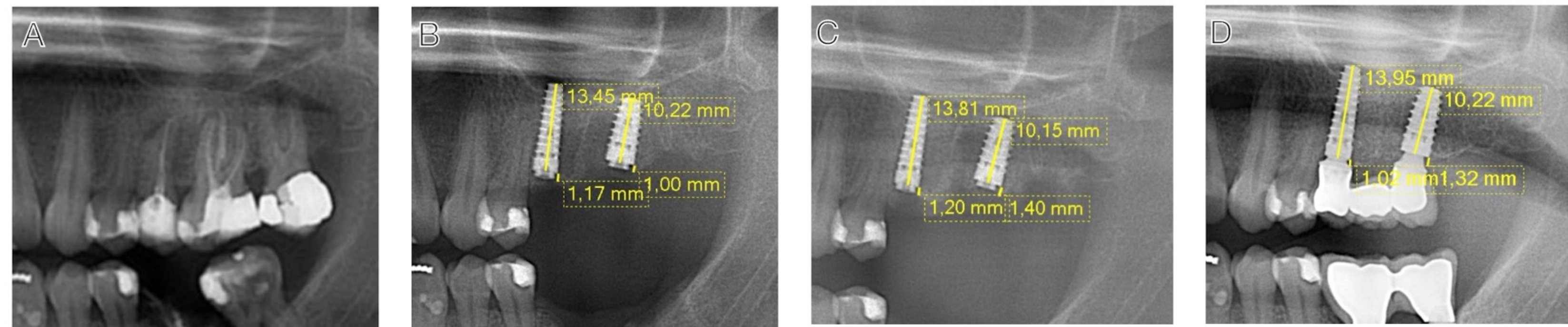


Figure 2. Measurements for the calculation of the MBL performed: A) Preoperative evaluation. B) Immediate postoperative measurements. C) 2 months after implant placement. D) 36-months follow-up





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RESULTS

A total of 1,040 immediate dental implants were inserted in 344 patients, on average 1.6 ± 1.1 mm subcrestally, with a successful osseointegration rate of 98.9%.

The average MBL from B0 was 2m: -0.2 ± 1.0 , 6m: -1.1 ± 1.8 , 12m: -1.3 ± 1.8 , 24m: -1.7 ± 2.0 , 36m: -1.3 ± 2.3 and from B1 2m: -0.3 ± 1.0 , 6m: -1.1 ± 1.8 , 12m: -1.4 ± 1.8 , 24m: -1.7 ± 1.9 , 36m: -1.3 ± 2.3 respectively (Figure 5).

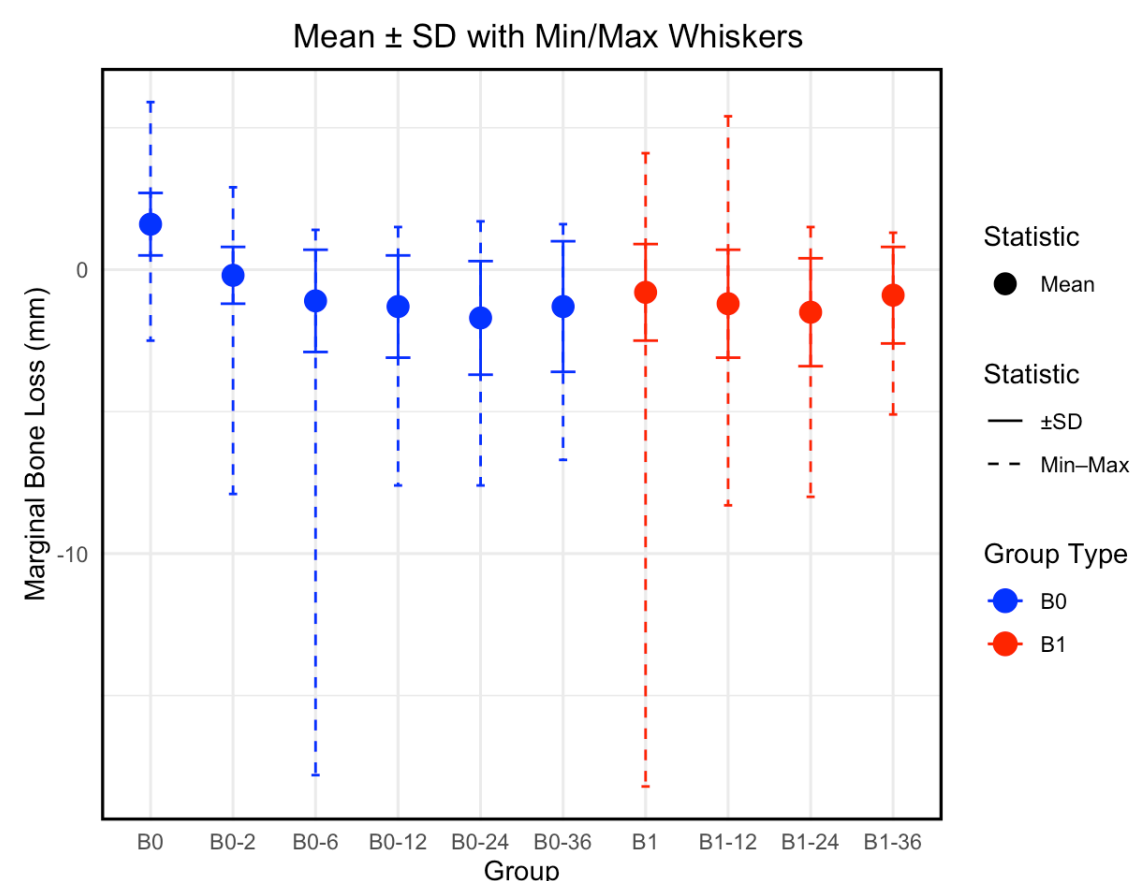
In the B0-12-month period, 17.5% of the IDIs presented BL, 9% BR, and 73.5% B0. For the B1-12-month period, 19.8% presented BL, 10.7% BR, and 69.5% BO (Figure 6).

Generalized additive mixed regression models showed significant marginal bone loss (MBL) over time pre-loading ($p < 0.0001$), stabilizing at 8.5 months from implantation. (Figure 7, 8)

Immediate mandibular implants had lower MBL ($p = 0.0365$). Post-loading, MBL was lower in the mandible ($p = 0.0095$) and positively influenced by abutment height and rotational abutments. (Figure 9)

CONCLUSIONS

The present study supports the clinical efficacy of the immediate DI placement protocol with high survival rates and acceptable MBL. It is recommended to place bone level DIs slightly below the crest to ensure the platform remains at an optimal depth during the initial bone remodeling phase post-implantation



	MBL from B0	MBL from B1
2mo	-0.2 ± 1.0	-0.3 ± 1.0
6mo	-1.1 ± 1.8	-1.1 ± 1.8
12mo	-1.3 ± 1.8	-1.4 ± 1.8
24mo	-1.7 ± 2.0	-1.7 ± 1.9
36mo	-1.3 ± 2.3	-1.3 ± 2.3

Figure 5. Marginal bone loss (MBL) over time measured from implant placement (B0) and from prosthetic loading (B1)

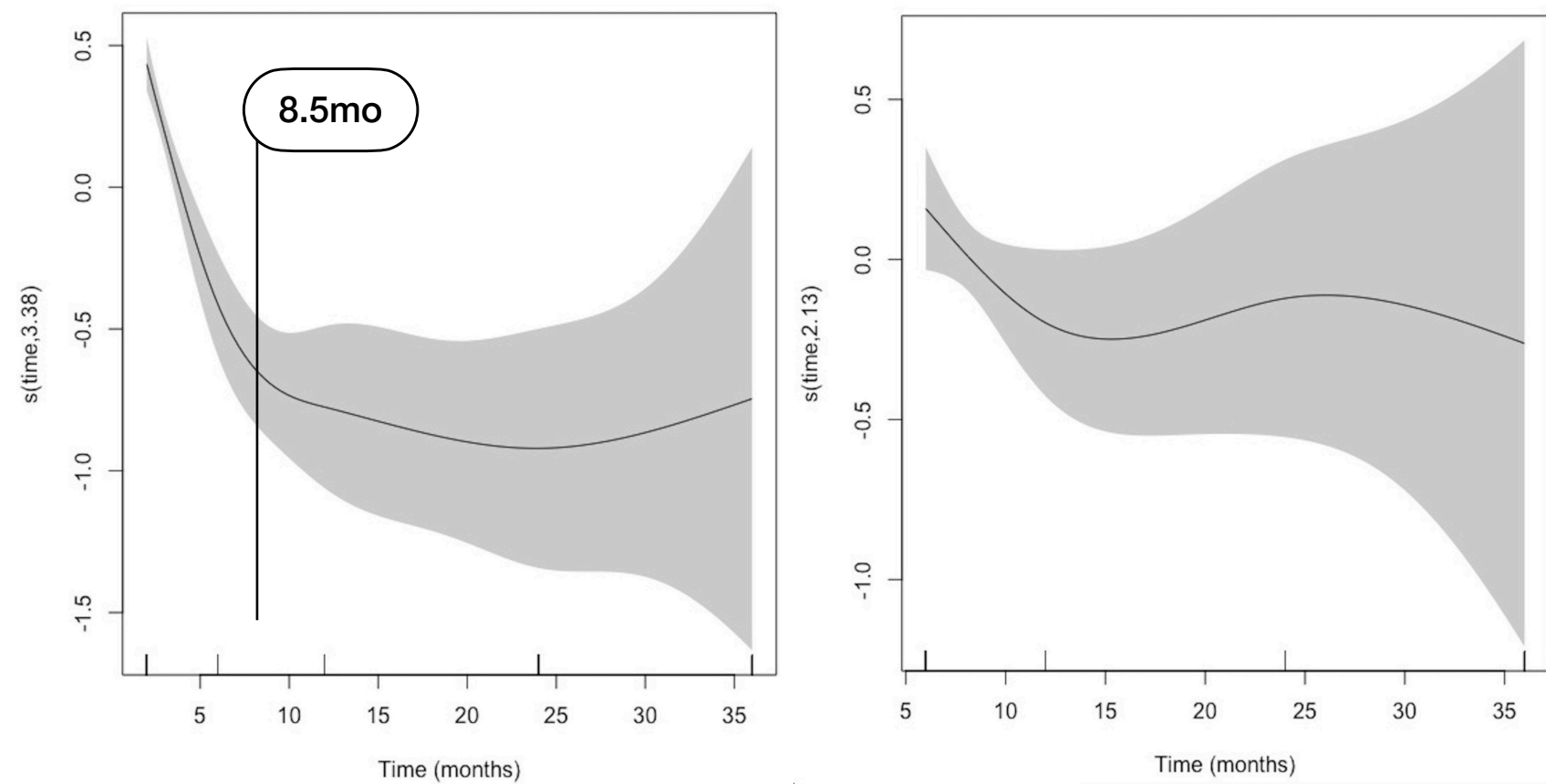


Figure 7. Time effect on marginal bone loss after implant placement

Figure 8. Time effect on marginal bone loss after loading

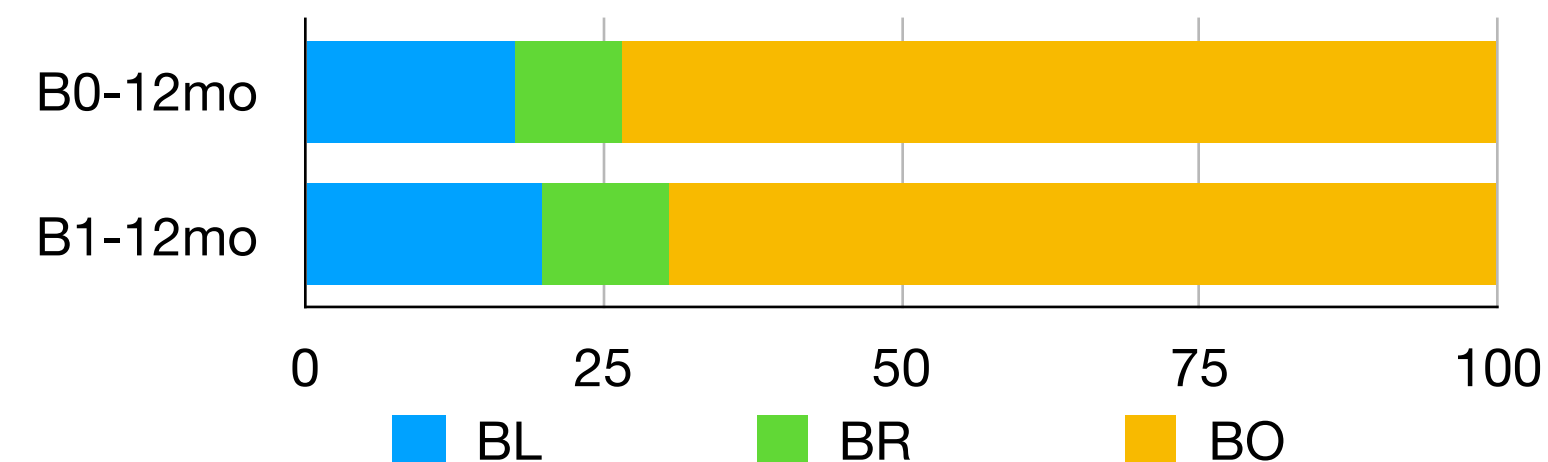


Figure 6 Bone condition distribution at 12 months – Pre- vs. Post-loading” Consistent patterns with a strong correlation ($r = 0.492$, $p < 0.001$)





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✓ Protective Associations

- Mandibular implants showed significantly lower MBL than maxilla ($p = 0.0365$ pre-loading; $p = 0.0095$ post-loading)
- Rotational abutments (multi-unit) reduced MBL vs. anti-rotational abutments (single-unit) ($p = 0.001$)
- Higher abutments (2.5–3 mm) had lower MBL vs. shorter ones ($p = 0.015$ at 6m; $p = 0.04$ at 12m)
- No effect of implant diameter or length

⚠ Risk Indicator

- Women had higher MBL at 2 months ($p = 0.015$) and were more likely to present with BL at 12 months ($p = 0.027$)
- Smokers had higher early MBL vs. non-smokers ($p = 0.009$)
- Older patients had greater MBL at 36 months ($r = 0.714$; $p = 0.002$); $+0.098$ mm/year ($p = 0.001$)
- Strong correlation between MBL at 6 and 24 months ($r = 0.853$; $p < 0.0001$)

Figure 9: Summary of key findings

REFERENCES

1. Bernabeu-Mira, J. C., Peñarrocha-Diago, M., Viña-Almunia, J., Romero-Gavilán, F., Pérez-Sayans, M., & Peñarrocha-Oltra, D. (2023). Influence of abutment shape on peri-implant tissue conditions: A randomized clinical trial. *Clinical Oral Implants Research*, 34, 1015–1024. <https://doi.org/10.1111/clr.14130>