



EFFECT OF PLASMA SURFACE TREATMENT ON PRIMARY STABILITY OF DENTAL IMPLANTS

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Introduction

Achieving predictable and stable osseointegration is essential for the long-term success of dental implants. Surface modification strategies aim to enhance the biological interaction at the bone–implant interface, particularly during the early healing phase. Plasma surface treatment increases surface energy and hydrophilicity, potentially accelerating early bone healing and improving primary and early secondary stability.

Aim: To evaluate the effect of plasma surface treatment on primary and early implant stability using Implant Stability Test (IST) values measured with the AnyCheck device.



(a) Actilink Reborn vacuum plasma surface treatment system; b) AnyCheck implant stability measurement device

Materials & Methods

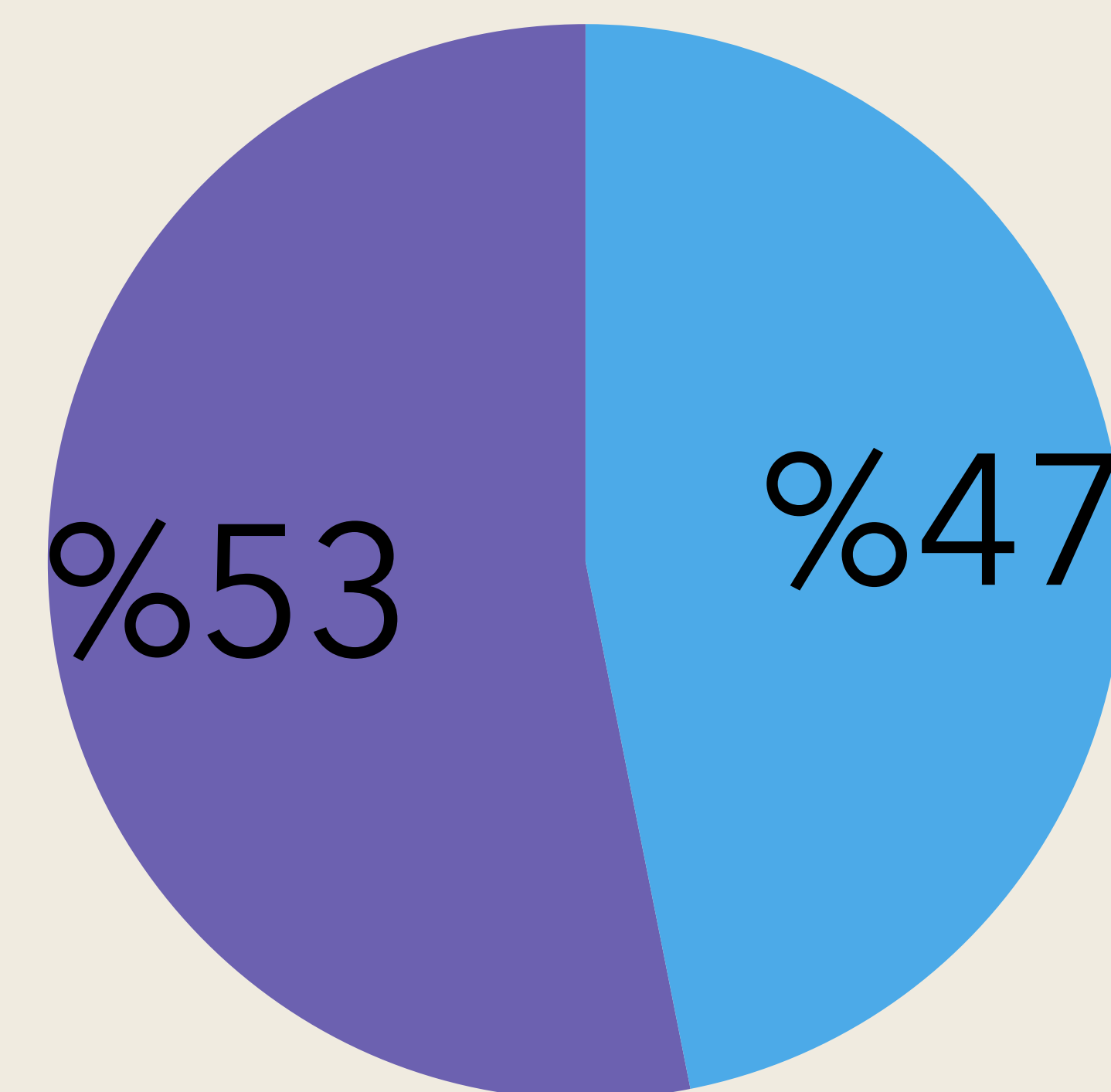
- **Participants:** 30 systemically healthy patients
- **Implants:** 64 dental implants (Neobiotech, Ø3.5 mm × 10 mm)

Groups

- **Test group:** Plasma-treated implants (Actilink plasma device) (n = 30)
- **Control group:** Untreated implants (n = 34)

Surgical & Measurement Protocol

- All implants placed following standard surgical procedures
- 4 mm healing abutments connected immediately after placement
- Implant stability measured using AnyCheck (IST values) at:
 - Day 0 (immediately after placement)
 - 1 week postoperatively
 - 4 weeks postoperatively



● Plasma-treated

● Untreated



Results

- **Day 0:** IST values were comparable between test and control groups, indicating similar primary stability at insertion.
- **Week 1 & Week 4:** Plasma-treated implants demonstrated consistently higher IST values compared to controls.
- **Week 4 peak values:**
 - Plasma group: IST max = 84
 - Control group: IST max = 77

These findings indicate an enhanced early stability pattern in plasma-treated implants.

Clinical Relevance

- Simple chair-side surface modification
- No change in surgical workflow
- Potential benefit for early loading protocols

Discussion

Plasma surface activation appears to positively influence early implant stability without altering the surgical protocol. The improved IST values observed during the first four weeks suggest accelerated early osseointegration, which may be clinically advantageous, particularly in protocols requiring early loading.

Conclusion

Plasma surface treatment prior to implant placement may enhance early implant stability, as reflected by higher IST values over time. Plasma activation represents a promising adjunctive approach to improve early osseointegration. Further longitudinal studies with larger sample sizes are warranted to confirm long-term clinical outcomes.

References:

1. Stacchi C, Rapani A, Montanari M, Martini R, Lombardi T. Effect of Vacuum Plasma Activation on Early Implant Stability: a Single-Blind Split-Mouth Randomized Clinical Trial. *J Oral Maxillofac Res.* 2025;16(2):e4. Published 2025 Jun 30. doi:10.5037/jomr.2025.16205
2. Tallarico M, Meloni SM, Troia M, et al. The Use of Vacuum Plasma Surface Treatment to Improve the Hydrophilicity and Wettability of Bone Graft Substitutes and Resorbable Membranes: An In Vitro Study. *Dent J (Basel).* 2025;13(4):141. Published 2025 Mar 25. doi:10.3390/dj13040141
3. Okuhama Y, Nagata K, Kim H, Tsuruoka H, Atsumi M, Kawana H. Validation of an implant stability measurement device using the percussion response: a clinical research study. *BMC Oral Health.* 2022;22(1):286. Published 2022 Jul 14. doi:10.1186/s12903-022-02320-0
4. Kim YK, Choi H, Kim HG, Sohn DS. Impact of Plasma Surface Treatment on Implant Stability and Early Osseointegration: A Retrospective Cohort Study. *Materials (Basel).* 2025;18(19):4568. Published 2025 Sep 30. doi:10.3390/ma18194568

