

Plasma Activation for Mandibular Overdenture Implants :Preliminary Results of a Randomized Controlled Clinical Trial

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Introduction:

Implant surface characteristics are critical for achieving high bone-to-implant contact. Biological aging during storage reduces surface energy and bioactivity.

Plasma activation rejuvenates implant surfaces by:

- Removing organic contaminants
- Increasing hydrophilicity
- Enhancing early biological response

Aim: To compare clinical and radiographic outcomes of plasma-treated vs. non-treated implants supporting mandibular overdentures.

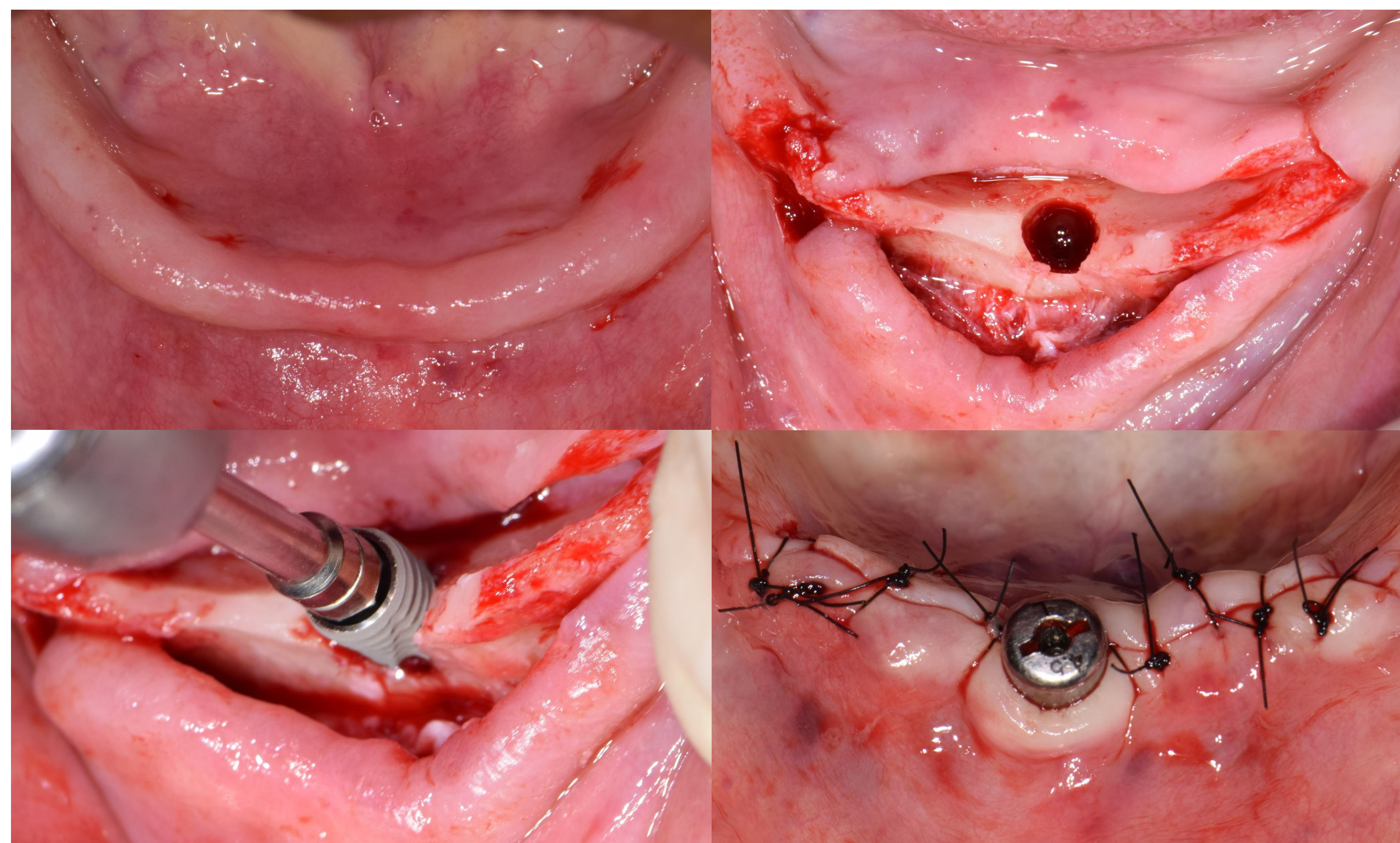


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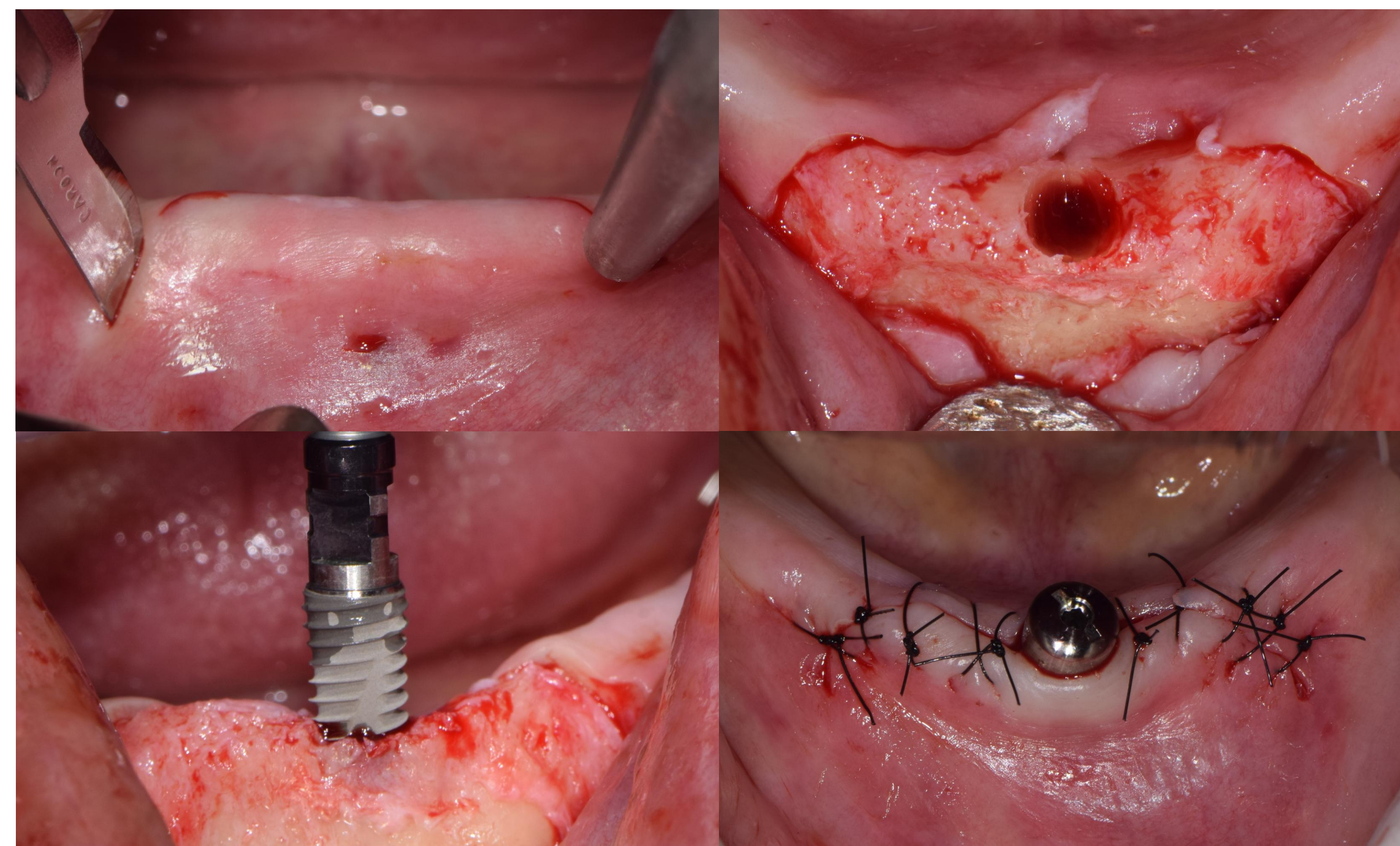
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Method:

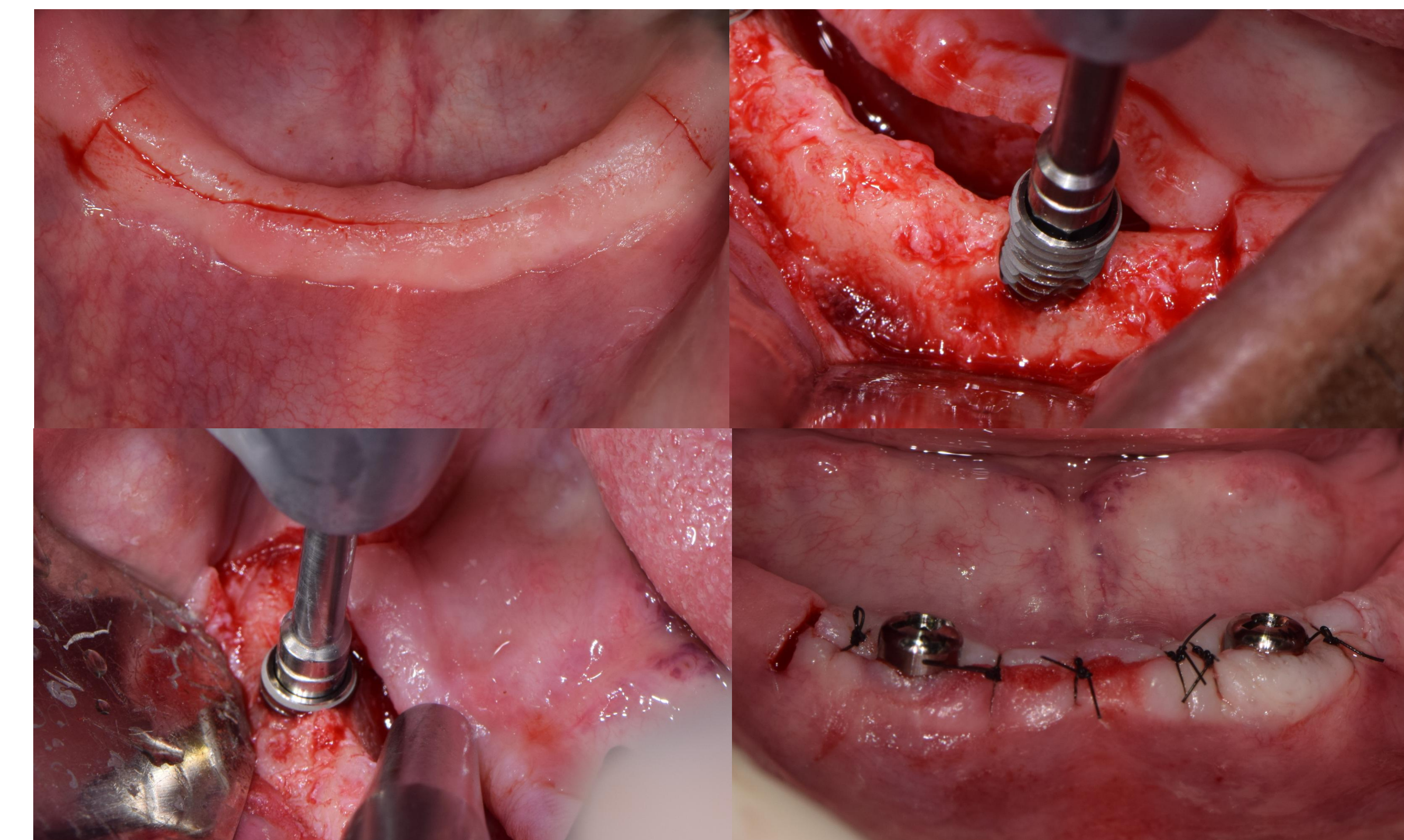
- Prospective, randomized controlled clinical trial
- Fully edentulous patients with healed mandibular ridges



Group 1: One non-plasma-treated implant-retained overdenture (n=10)



Group 2 (Test 1): One plasma-treated implant-retained overdenture (n=10)



Group 3 (Test 2): Two implant-retained overdentures with within group randomization (10 plasma-treated, 10 non-plasma-treated implants)

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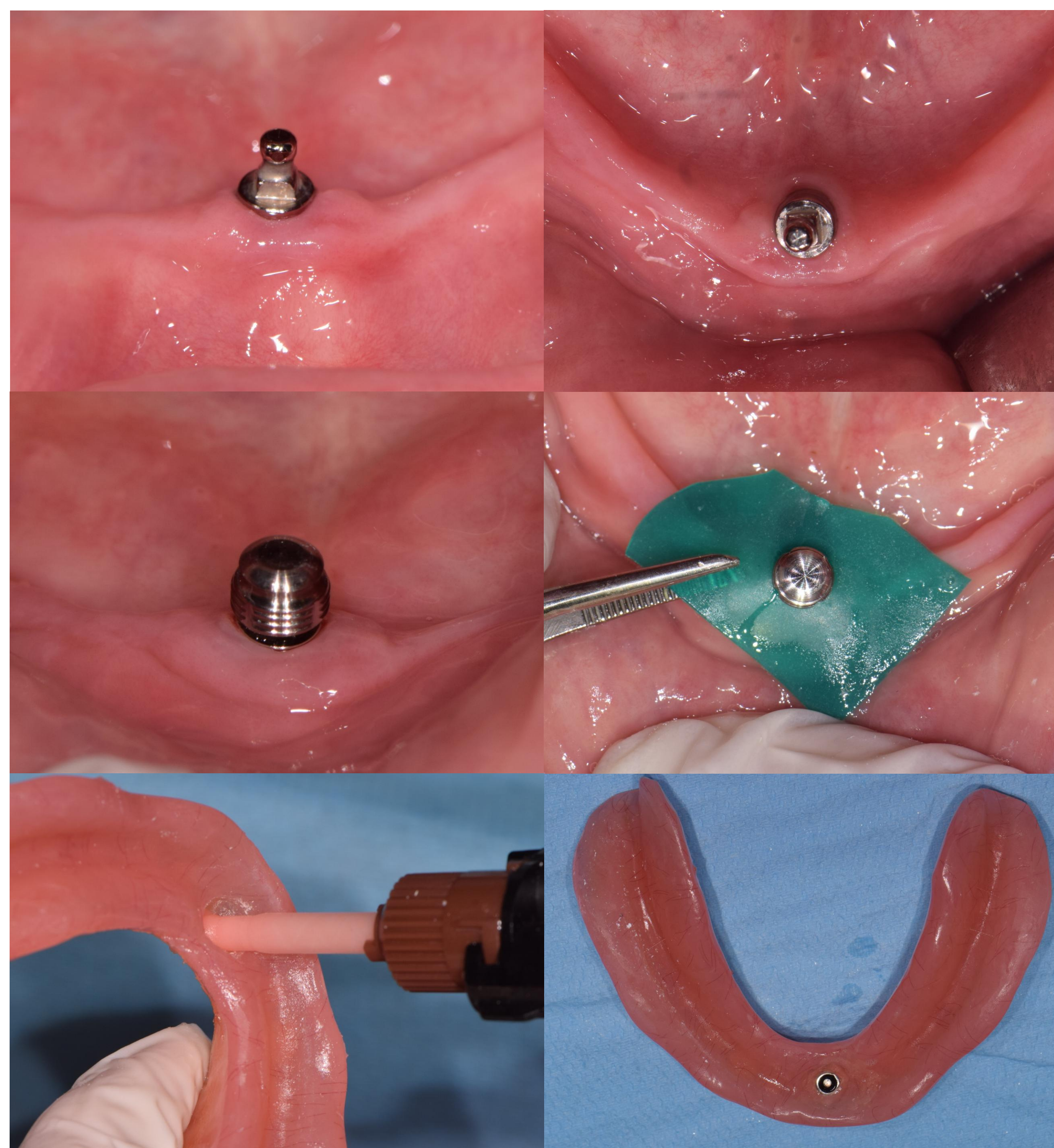
Method:

Implant stability (ISV) :
Baseline, 2, 4, 6, 8, 12 weeks



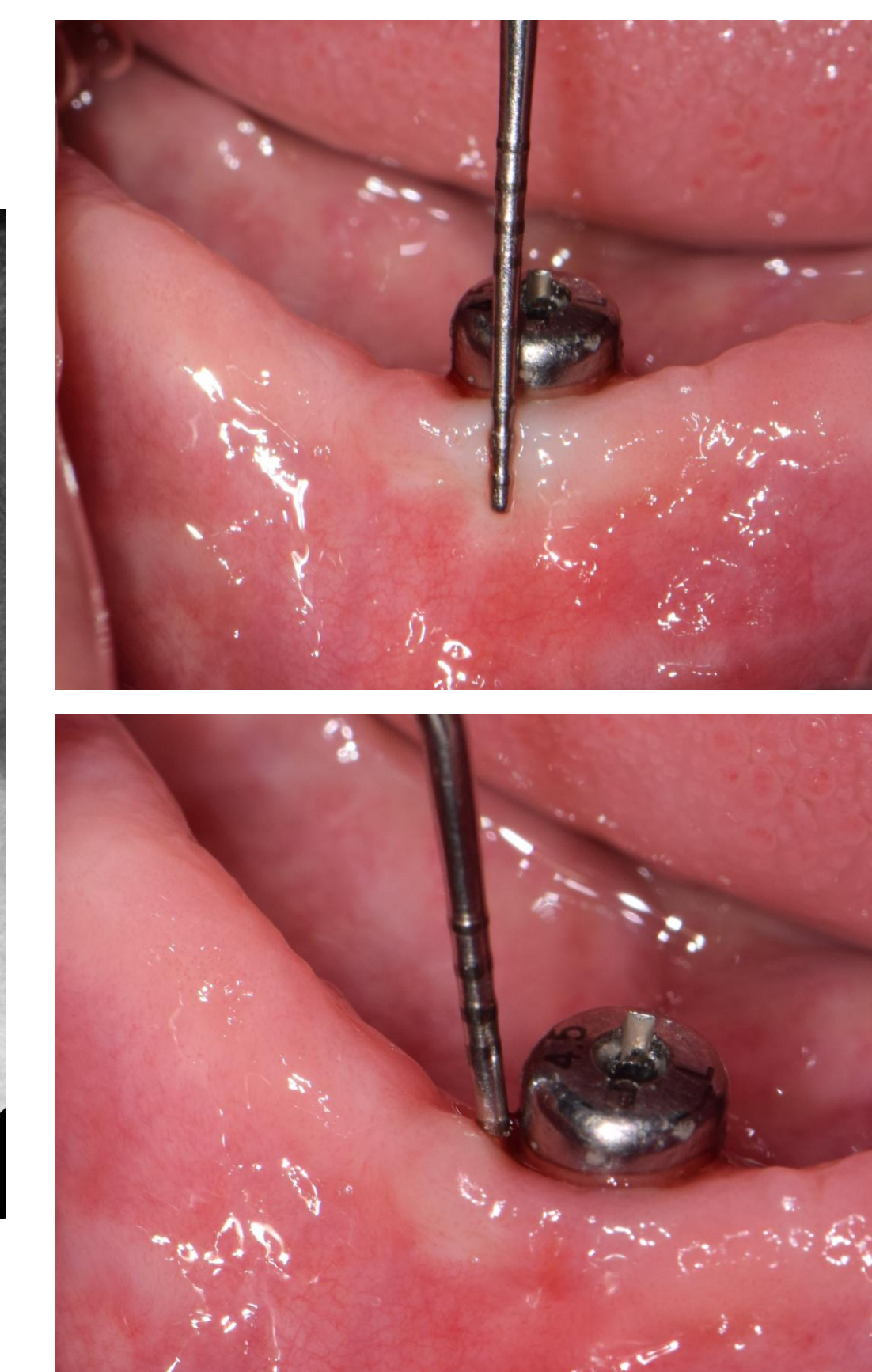
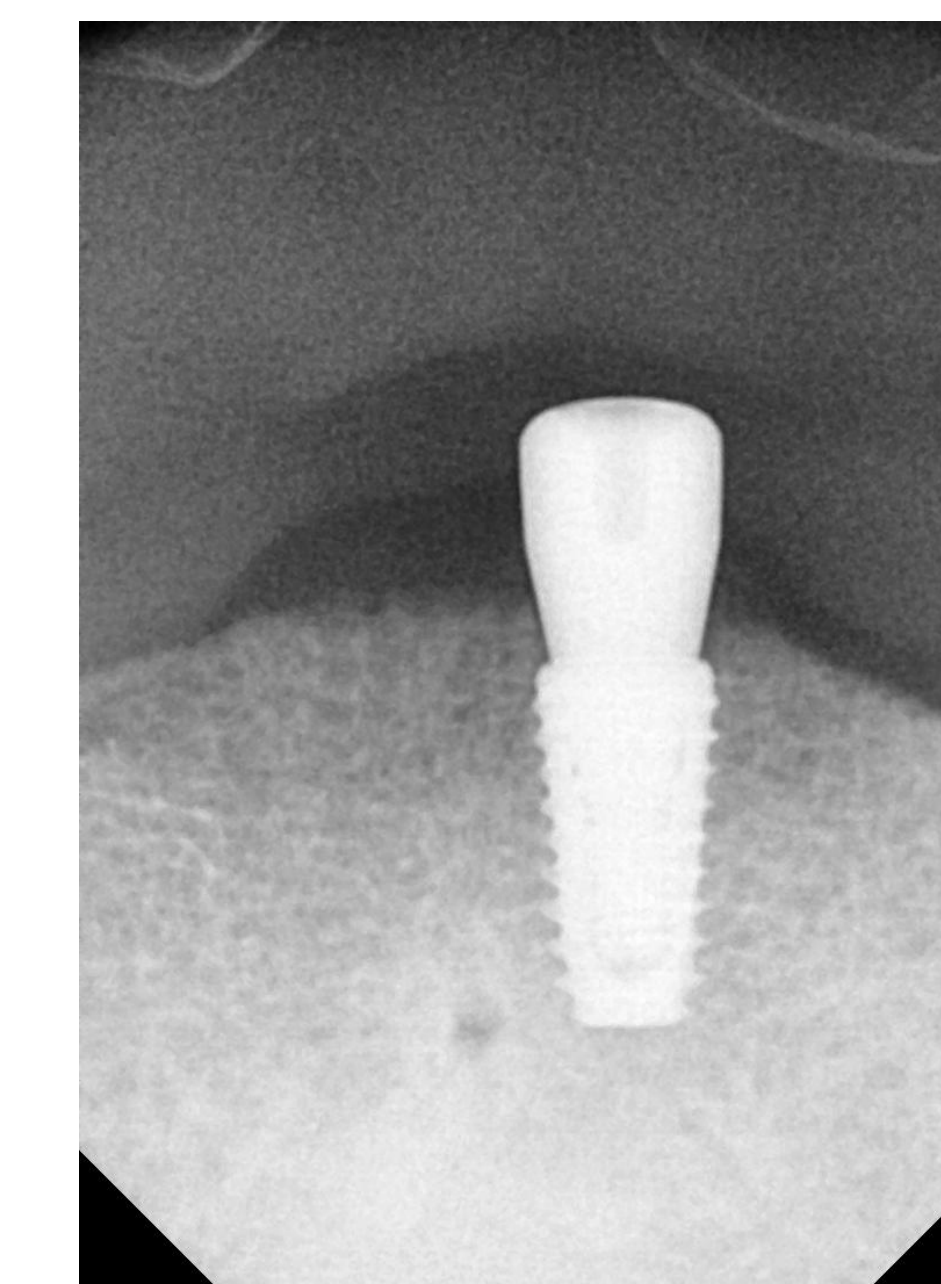
Easy Check Implant Stability Measuring Device

Overdenture delivery: 3 months



Follow-up at 3, 6, 12 months:

- Probing depth
- Bleeding on probing
- Keratinized tissue width
- Crestal bone level
- Patient satisfaction (ongoing)



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Results :

• Groups 1 and 2:

The plasma arm showed numerically higher mean ISV during early healing period between 2-6 weeks. The plasma-treated implants demonstrated a more stable trend over time, whereas control implants showed a slight dip between weeks 4 and 8 before recovering by week 12.

• Group 3 :

Plasma-treated implants maintained **higher ISV values from baseline to week 6**
Indicates **faster early osseointegration**

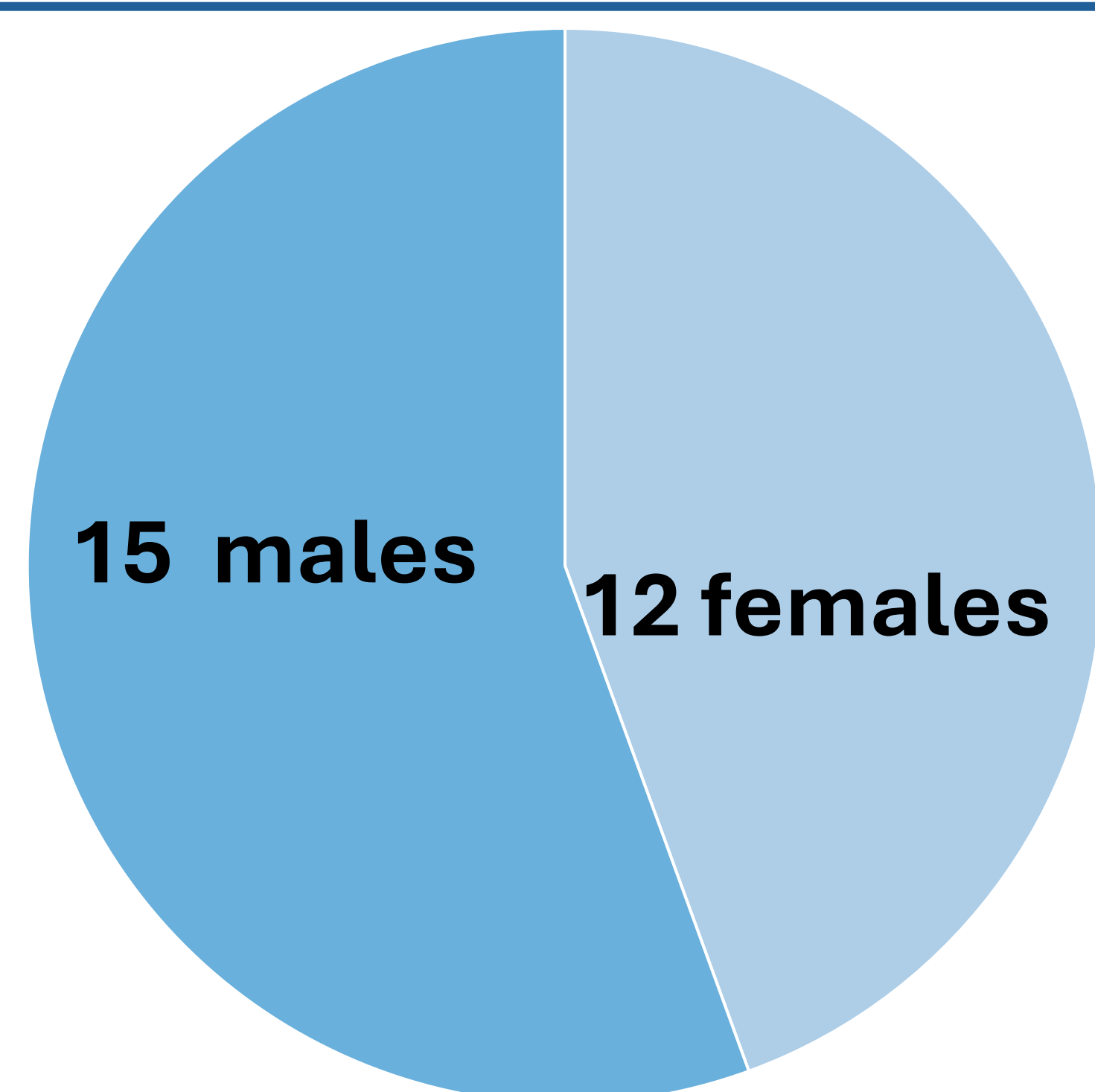


Table 1. Group 1 and Group 2 Baseline Characteristics (surgery visit)

	Total (N=20)	Group 1 (N=10)	Group 2 (N=10)	p-value
ITV	43.95 ± 15.69	40.56 ± 14.46	47.00 ± 16.87	0.383
ISV-B	87.00 ± 4.07	86.60 ± 4.50	87.40 ± 3.29	0.672
ISV-M	88.70 ± 3.85	88.40 ± 4.32	89.00 ± 3.07	0.738
Mean ISV	87.85 ± 3.61	87.50 ± 4.09	88.20 ± 2.79	0.909*

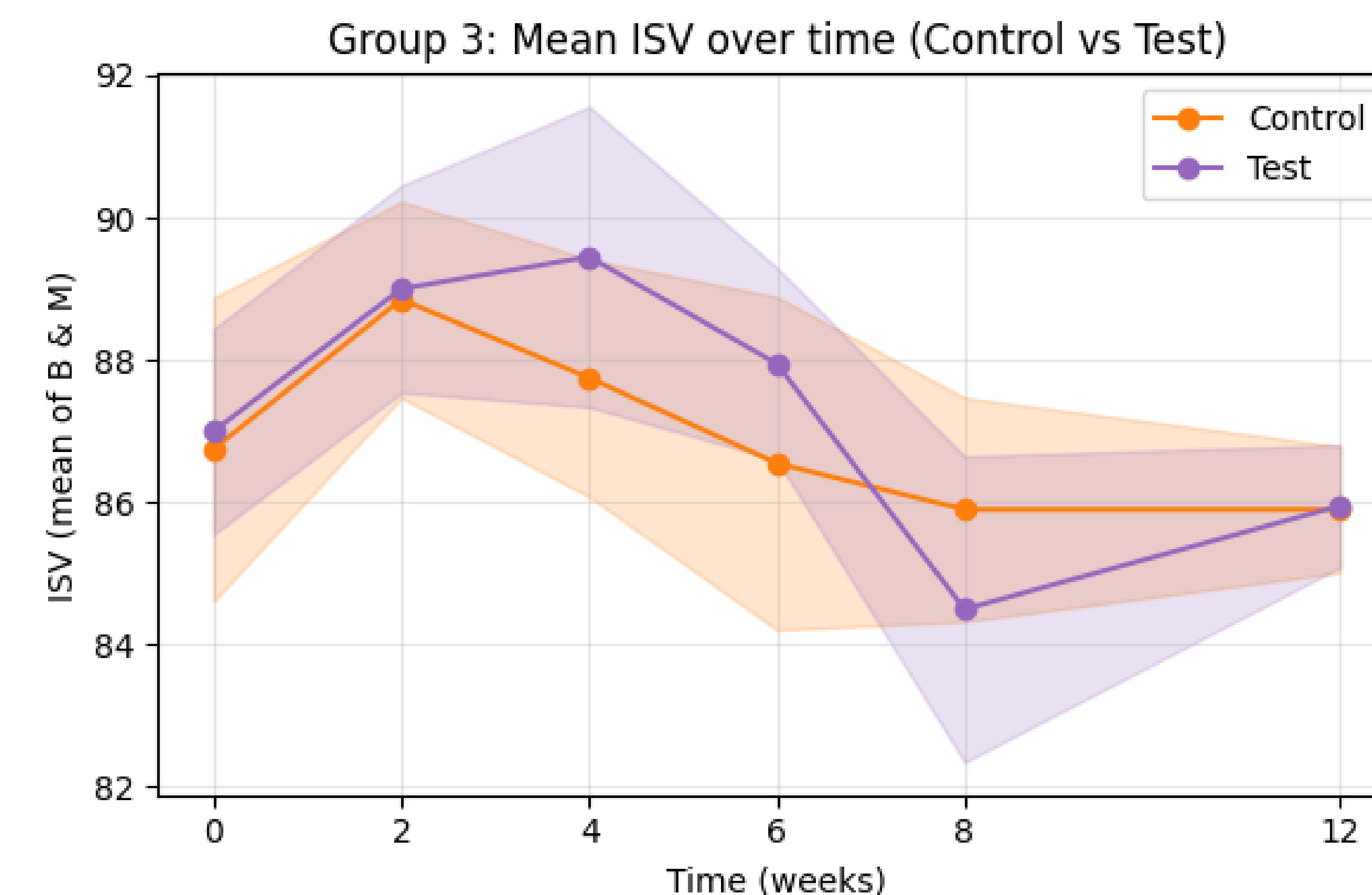
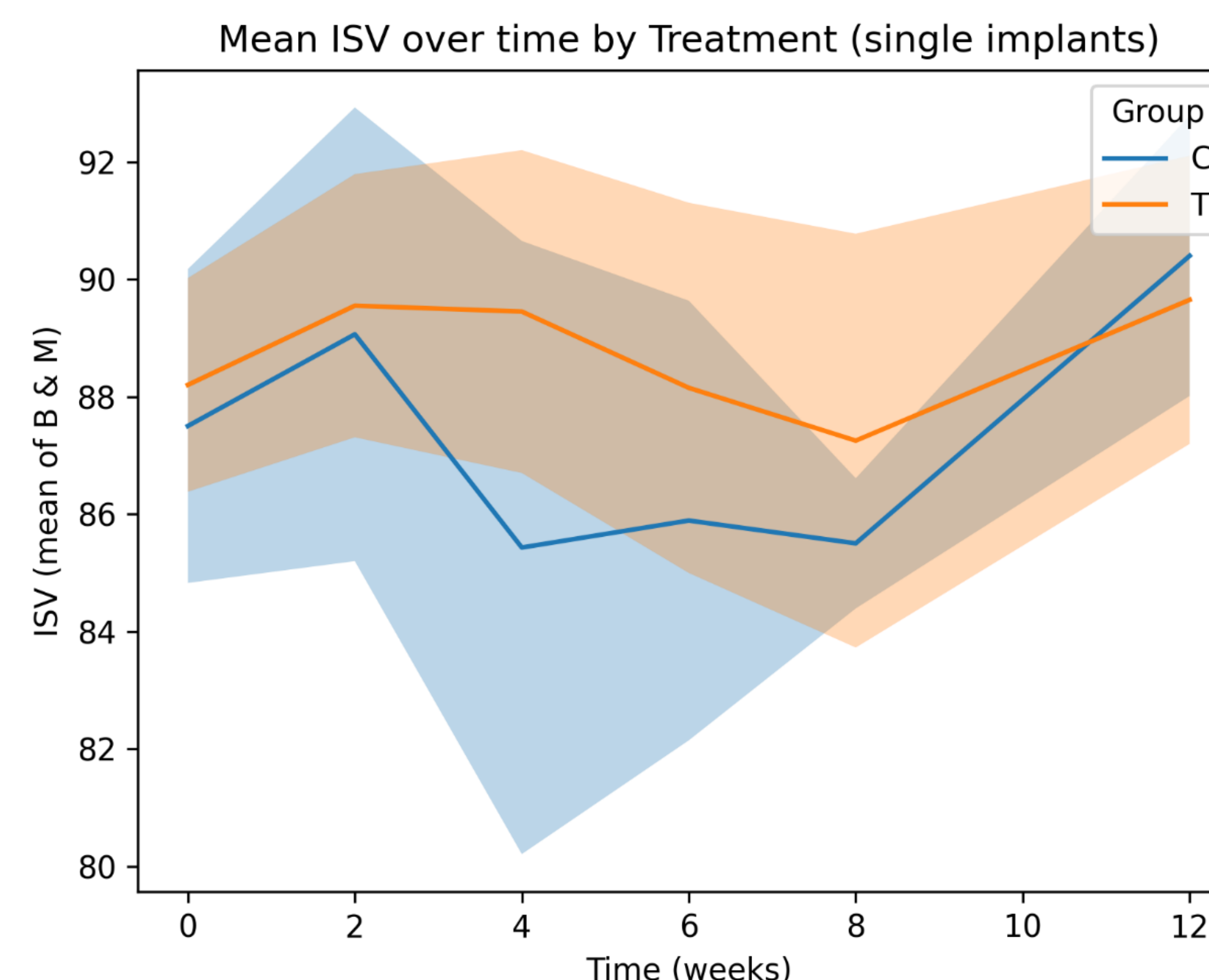
*If non-parametric test used

Table 2. Group 3 Baseline Characteristics (surgery visit)

	Total (N=20)	Control (N=10)	Test (N=10)	p-value
ITV	44.50 ± 14.59	43.0 ± 14.35	46.0 ± 13.93	0.723*
ISV-B	86.40 ± 3.60	85.60 ± 4.76	87.20 ± 0.87	0.608*
ISV-M	87.35 ± 3.42	87.90 ± 2.12	86.80 ± 4.14	0.593*
Mean ISV	86.88 ± 2.86	86.75 ± 3.27	87.00 ± 2.21	0.822

*If non-parametric test used

At surgery, mean ISV did not differ between single-implant arms (p = 0.909) nor within the two-implant arm (p = 0.822)



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Conclusion:

- Plasma-treated implants show:
 - ✓ More stable healing trajectory
 - ✓ Higher early ISV values
 - ✓ Faster osseointegration patterns
- Preliminary findings support plasma activation as a **potentially valuable adjunct** in implant dentistry.
- Follow-up and full data analysis will clarify the **clinical relevance** of plasma surface activation in implant dentistry, as well as the **differences between one and two-implant retained mandibular overdentures** in terms of retention and patient satisfaction.

References :

- Makary, C.; Menhall, A.; Lahoud, P.; Yang, K.R.; Park, K.B.; Razukevicius, D.; Traini, T. Bone-to-Implant Contact in Implants with Plasma-Treated Nanostructured Calcium-Incorporated Surface (XPEEDActive) Compared to Non-Plasma-Treated Implants (XPEED): A Human Histologic Study at 4 Weeks. *Materials* **2024**, *17*, 2331.
- Kim, Y.-K.; Choi, H.; Kim, H.-G.; Sohn, D.-S. Impact of Plasma Surface Treatment on Implant Stability and Early Osseointegration: A Retrospective Cohort Study. *Materials* **2025**, *18*, 4568.