Bone Condensation Improves Implant Stability of Different Diameter Implants In-Vitro

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INTRODUCTION

The primary stability of dental implants can be influenced by bone quality, implant thread design, and surgical technique.

OBJECTIVE

This study aimed to evaluate the primary stability of dental implants with a hybrid design inserted in soft polyurethane blocks in implant beds prepared with different methods.

METHODS

Implants with hybrid design (Implant Swiss™, cylindrical neck design with tapered design apically) were split into two groups (Group A: 3.3mm x 10mm implants, Group B: 3.7mm x 10mm implants). Each group of implants was placed in artificial bone blocks simulating soft type 4 bone.

Two placement techniques were utilized: conventional osteotomy or bone condensation using cylindrical osteotomes after pilot drilling. Fifteen implants were placed with each technique. Primary stability was evaluated by insertion torque (IT) and implant stability quotient (ISQ) values. Paired t-Test was conducted for statistical comparisons.

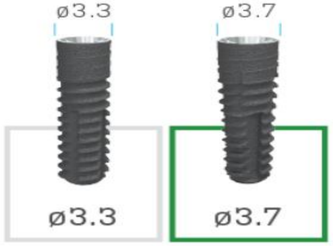

Figure 1. Implant Swiss™, cylindrical neck design with tapered design apically. 3.3mm implant (Left), 3.7mm implant (right)

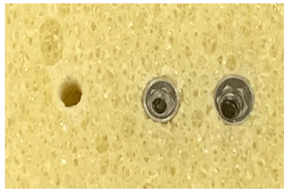

Figure 2. Bone condensed osteotomy (Left), 3.3mm x 10mm implant placement (Middle), 3.7mm x 10mm implant placement (Right)

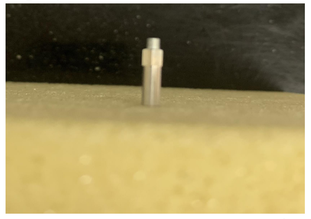

Figure 3. 3.3 mm x 10mm implant with SmartPeg insert placed for stability measurement

Figure 4. Osstell resonance frequency analysis device

RESULTS

Mean and standard deviations for IT and ISQ values were as follows for conventional technique, Group A: 10Ncm, 58.17 ±1.6 ISQ; Group B: 10Ncm, 61.10±3.0 ISQ. For osteotome technique, Group A: 15.3 ± 1.3Ncm, 63.8 ±2.0 ISQ; Group B: 19.3Ncm ±1.8, 68.4 ±0.9 ISQ. IT and ISQ values were significantly higher with the osteotome technique for both implant diameters compared to the traditional osteotomy method ($p<0.0001$).

Conventional Osteotomy Mean Values (±SD)		
	Group A	**Group B**
IT (Ncm)	10 (± 0) Ncm	10 (± 0) Ncm
RFA (ISQ)	58.17 (± 1.6) ISQ	61.10 (± 3.0) ISQ

Bone Condensation Osteotomy Mean Values (±SD)		
	Group A	**Group B**
IT (Ncm)	15.3 (± 1.3) Ncm	19.3 (± 1.8) Ncm
RFA (ISQ)	63.8 (±2.0) ISQ	68.4 (± 0.9) ISQ

CONCLUSION

Condensation techniques with cylindrical osteotomes increase significantly implant stability in artificial polyurethane soft bone.

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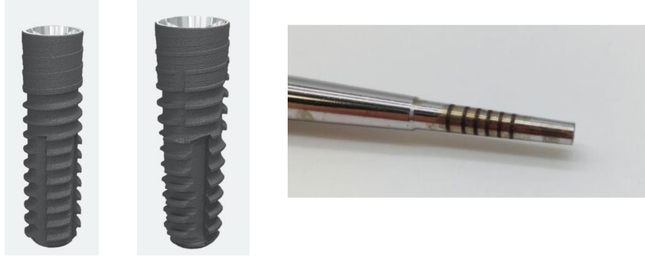

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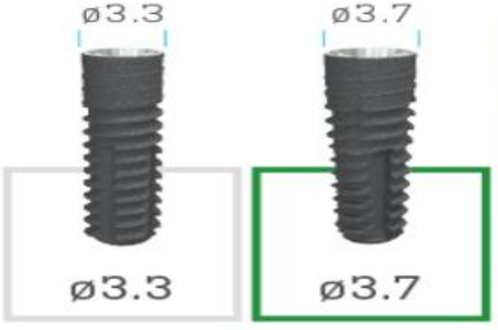

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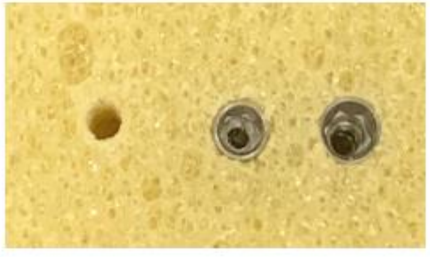

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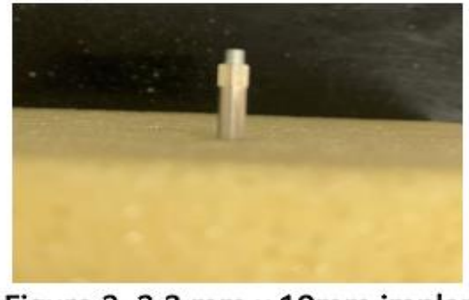

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