FINAL SCRIPT: APPROVED FOR FILMING

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Title: Effects of Mechanical Methods Used in Peri-Implantitis Treatment on Implant Surface Decontamination and Roughness

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Author Questionnaire

1. We have marked your project as author-provided footage, meaning you film the video yourself and provide JoVE with the footage to edit. JoVE will not send the videographer. Please confirm that this is correct.

√ Correct

2. Microscopy: Does your protocol require the use of a dissecting or stereomicroscope for performing a complex dissection, microinjection technique, or something similar? **NO**

3. Software: Does the part of your protocol being filmed include step-by-step descriptions of software usage? **YES, all done**

4. Proposed filming date: To help JoVE process and publish your video in a timely manner, please indicate the proposed date that your group will film here: **7/01/2025**

When you are ready to submit your video files, please contact our Content Manager, Utkarsh Khare.

Current Protocol Length

Number of Steps: 15
Number of Shots: 32

Introduction

1.1. **Ipek Ozgu:** This study evaluates the effectiveness of air abrasive systems, PEEK ultrasonic tips and titanium curettes for implant surface decontamination and their impact on surface roughness using SEM analysis **[1]**.

1.1.1. INTERVIEW: Named Talent says the statement above in an interview-style shot, looking slightly off-camera. *Suggested B.roll:2.10*

What research gap are you addressing with your protocol?

1.2. **Ipek Ozgu:** The prevalence of periimplantitis in increasing worldwide and there is no definitive protocol for effective treatment of this disease **[1]**.

1.2.1. INTERVIEW: Named Talent says the statement above in an interview-style shot, looking slightly off-camera.

What new scientific questions have your results paved the way for?

1.3. **Kemal Ustun:** The results showed that air abrasion can be safely and efficiently used for the decontamination of implant surfaces for regenerative purposes **[1]**.

1.3.1. INTERVIEW: Named Talent says the statement above in an interview-style shot, looking slightly off-camera. *Suggested B.roll:2.9*

What research questions will your laboratory focus on in the future?

1.4. **Kemal Ustun:** Although SEM can provide details of the implant surface, there is a need for an objective index for differentiating the changes after surface treatment **[1]**.

1.4.1. INTERVIEW: Named Talent says the statement above in an interview-style shot, looking slightly off-camera.

Ethics Title Card

This research has been approved by the Ethical Committee at Akdeniz University

Protocol

SCREEN timestamps for protocol were added at the postshoot stage. Please contact the postshoot note integrator (Balamurugan) for queries regarding SCREEN timestamps

2. Fabrication and Decontamination of Experimental Implant Models

Demonstrator: Ipek Ozgu

2.1. To begin, remove the first molar from an educational mandibular phantom model **[1]**. Using a screwdriver, loosen and remove the screw securing the first molar tooth **[2]**. Extract the thread from the socket **[3]**. Mold soft silicone material into the socket to create a flat alveolar ridge **[4]**.

2.1.1. WIDE: Talent removing the first molar from the phantom model.

2.1.2. Shot of the screw being loosened.

2.1.3. Shot of the thread being removed from the socket.

2.1.4. Talent filling the socket with soft silicone material.

2.2. Print the digital models using a model resin **[1]**.

2.2.1. Shot of the 3D printer in operation, printing the experimental models.

2.3. Now, rinse the printed experimental models in 96% ethanol for 5 to 10 minutes **[1]**. After cleaning, place the models in a light-emitting curing device **[2]**. Cure the models with light for 5 minutes **[3]**.

2.3.1. Talent immersing the printed models in ethanol.

2.3.2. Shot of the models being placed in the curing device.

2.3.3. Shot of the curing device illuminating the models.

2.4. To stain the implants, submerge them completely, in viscous water-resistant red ink for 15 seconds **[1]**. Air-dry the stained implants with a dental unit air syringe to achieve even dispersion of the ink **[2-TXT]**.

2.4.1. Talent fully immersing the implants in red ink.

2.4.2. Talent using an air syringe to dry the implants. **TXT: Let the implant air-dry at RT for 24 h**

2.5. Next, adjust the settings of a dental physio dispenser to 800 revolutions per minute, 40 Newton torque, with no saline irrigation **[1]**. Using surgical implant drills, create implant sockets in the experimental models for implants measuring 11 millimeters in length and 4.2 millimeters in width **[2]**.

2.5.1. Shot of the dental physio dispenser settings being set to 800 rpm, 40 N torque.

2.5.2. Talent using a surgical implant drill to create the socket in the model.

2.6. Now insert the implants into the sockets using a carrier handpiece **[1]**. Ensure 5 millimeters of the implant remains exposed on the buccal surface **[2]**. Align the implant to be submerged at the same level as the lingual bone crest of the model **[3]**.

2.6.1. Talent inserting the implant using the carrier handpiece.

2.6.2. Shot of the 5-millimeter exposed implant area.

2.6.3. Shot of the implant aligned with the lingual bone crest.

2.7. For an air abrasive system, set the device to full power with water irrigation and apply 14-micrometer erythritol powder **[1]**. Hold the device tip 2 to 3 millimeters from the implant surface and apply the powder evenly **[2-TXT]**.

2.7.1. Talent sets the device to full power with water irrigation.

2.7.2. Talent holding the device at 2–3 millimeters from the implant surface while applying erythritol powder.**TXT: Limit application to 2 min (Class 1A) and 3 min (Class 1B)**

2.8. For a polyetheretherketone or PEEK *(peek)* ultrasonic tip, set the device to power level 8 with maximum water irrigation **[1]**. Perform decontamination with linear and parallel movements, ensuring application between the implant threads where possible **[2-TXT]**.

2.8.1. Shot of the PEEK ultrasonic tip settings at power level 8.

2.8.2. Talent using linear and parallel movements for decontamination. **TXT: Limit application to 2 min (Class 1A) and 3 min (Class 1B)**

2.9. For titanium curettes, apply consecutive contacts with constant pressure at a 60 to 90-degree angle to the implant surface **[1-TXT]**.

2.9.1. Talent using a titanium curette at a 60°-90° angle. **TXT: Force: 0.75 N; Limit application to 2 min (Class 1A) and 3 min (Class 1B)**

3. **Photographic Documentation, Image Analysis, and SEM Evaluation of Implant Surfaces**

3.1. Remove the implants from the model with a compatible implant driver piece **[1]**. Air-dry the implants for 20 seconds to eliminate any loosened particles or remnants on the surface **[2]**.

3.1.1. Talent using an implant driver to remove an implant from the model.

3.1.2. Talent air-drying the implant with compressed air for 20 seconds.

3.2. Place the implants on custom-designed acrylic photographic models to evaluate the apical and coronal regions of the implant threads **[1]**. Then, mount the camera on a tripod and standardize the camera settings **[2-TXT]**. Ensure that the room is adequately lit **[3]**.

3.2.1. Talent positioning the implants on acrylic models for photography.

3.2.2. Talent adjusting the camera on a tripod and configuring the settings. **TXT: Camera settings: Distance: 15 cm; ISO: 160; Aperture: f/16; Exposure time: 1/250 s**

3.2.3. Shot of the room lighting setup ensuring proper illumination.

3.3. Take digital photographs in RAW *(raw)* format with a flash **[1-TXT]**.

3.3.1. Talent taking digital RAW images of the implants. **TXT: Capture 90 buccal photos for Class 1A defects and 270 photos for Class 1B defects**

3.4. For image analysis, click on **Image,** followed by **Type,** and press **8-bit** *(eight-bit)* to convert the images to 8-bit format **[1]**. Adjust the thresholds by sequentially clicking on **Image**, **Adjust,** and **Threshold** for area calculations **[2]**.

3.4.1. SCREEN: 67778-3.4.1.MOV 00:18-00:27

3.4.2. SCREEN: 67778-3.4.2-3.5.1.MOV 00:07-00:12; 00:17-00:22

3.5. Next, press **Analyze,** followed by **Measure,** then click on **Area** to calculate the total implant surface area and the red residue area **[1]**.

3.5.1. SCREEN: 67778-3.4.2-3.5.1.MOV 00:31-00:37; 00:56-01:04; 1:09-01:10

3.6. For SEM *(sem)* analysis, first spray the implant with nitrogen gas using a gas gun for 20 seconds to remove any micro-powder from the implant surface **[1]**. Mount each implant on SEM stubs using conductive carbon adhesive discs **[2-TXT]**. Arrange the implants in order by number to prevent misidentification before SEM imaging **[3]**.

3.6.1. Talent using a nitrogen gas gun to clean the implant surface.

3.6.2. Talent placing implants on SEM stubs with conductive adhesive. **TXT: Position the implants to allow for analysis without hand decontamination**

3.6.3. Shot of implants arranged numerically.

Results

4. Representative Results

4.1. The most effective decontamination was observed in the AA-1A *(A-A-one-A)* group **[1]**. The least decontamination was detected in the TIT-1A *(Tit-one-A)* and TIT-1B *(Tit-One-B)* groups **[2]**.

4.1.1. LAB MEDIA: Figure 3 *Video Editor: Please highlight the plot of AA-1A*

4.1.2. LAB MEDIA: Figure 3 *Video Editor: Please highlight the plots of TIT-1A and TIT-1B*

4.2. In the mesial and distal areas of the 1B defect group, more ink residues were found under the threads compared to the buccal area, in the AA treatment group **[1]**. Additionally, a powder particle was observed in the buccal micro-thread site of the 1B defect group **[2]**.

4.2.1. LAB MEDIA: Figure 5A and B *Video Editor: Please highlight 1B-AA images of A and B panels.*

4.2.2. LAB MEDIA: Figure 6

4.3. A blurred and perforated appearance was observed in the PEEK group **[1]**. However, the PEEK treatment yielded similar results to AA in the mesial and distal areas of the 1B defect group at 1000X and 5000X magnifications **[2]**.

4.3.1. LAB MEDIA: Figure 4B, Figure 5B *Video Editor: Please highlight 1A-PEEK of 4B and 1B-PEEK images of 5B*

4.3.2. LAB MEDIA: Figure 5B-D *Video Editor: Please sequentially highlight 1B-PEEK images of 5B, C and D*

4.4. Titanium curettes caused extensive surface alterations, with the rough structure in the micro-threaded buccal area of the 1A defect group becoming indistinguishable **[1]**. Other sites exhibited flattening and longitudinal and horizontal scratches **[2]**.

4.4.1. LAB MEDIA: Figure 4. *Video Editor: Please highlight the 1A-curette images of A and B panels*

4.4.2. LAB MEDIA: Figure 5 A and B *Video Editor: Please highlight the 1B-curette images of A and B panels*.

4.5. In the mesial and distal sites of the 1B defect group, the rough structure disappeared, and the number of scratches increased **[1]**.

4.5.1. LAB MEDIA: Figure 5 C-D. *Video Editor: Please highlight the 1B-curette images of C and D panels*.

4.6. Elemental analysis of the sterile reference implant revealed 99.2% titanium content **[1]**. Analysis of black hole-like structures in other groups and the completely ink-covered untreated implant surface showed a carbon-dominant composition **[2]**.

4.6.1. LAB MEDIA: Figure 7. *Video editor: Please emphasize the red peak in the "Full Area 1" graph and the row corresponding to TK in the "eZAF Smart Quant Results" table*

4.6.2. LAB MEDIA: Figure 8A-C. *Video editor: Please sequentially show A with the corresponding graph, B with the corresponding graph, and C with the corresponding graph*

Pronunciation Guide:

- **alveolar**

Pronunciation link: https://www.merriam-webster.com/dictionary/alveolar dictionary.cambridge.org+1synonyms.com+1en.wikipedia.org+12merriam-webster.com+12merriam-webster.com+12
IPA: /æl ˈviː.ə.lɚ/
Phonetic spelling: al-VEE-uh-ler

- **bronchoalveolar**

Pronunciation link: https://www.merriam-webster.com/medical/bronchoalveolar howtopronounce.com+15merriam-webster.com+15dictionary.cambridge.org+15
IPA: /ˌbrɑŋ.koʊ-æl ˈviː.ə.lɚ/
Phonetic spelling: BRONG-koh-al-VEE-uh-ler

- **polyetheretherketone**

Pronunciation link: https://www.howtopronounce.com/polyetheretherketone merriam-webster.comen.wiktionary.org+8howtopronounce.com+8howtopronounce.com+8
IPA: /ˌpɑːliːˌiːθərˌiːθərˈkiːtoʊn/
Phonetic spelling: pah-lee-ee-THUR-ee-thur-KEE-tohn

- **erythritol**

Pronunciation link: https://www.merriam-webster.com/medical/erythritol howtopronounce.com
IPA: /ɪˈrɪθ.rə.tɑl/
Phonetic spelling: ih-RITH-ruh-tal

- **mandibular**

Pronunciation link: https://www.merriam-webster.com/dictionary/mandibular merriam-webster.com+6en.wikipedia.org+6howtopronounce.com+6merriam-webster.com+2howtopronounce.com+2howtopronounce.com+2merriam-webster.com
IPA: /mænˈdɪb.jə.lɚ/
Phonetic spelling: man-DIB-yuh-ler

- **silicone**

Pronunciation link: https://www.merriam-webster.com/dictionary/silicone merriam-webster.com+3dictionary.cambridge.org+3merriam-webster.com+3
IPA: /ˈsɪl.ɪˌkoʊn/
Phonetic spelling: SIL-ih-kohn

- **torque**

Pronunciation link: https://www.merriam-webster.com/dictionary/torque
IPA: /tɔːrk/
Phonetic spelling: tork

- **buccal**

Pronunciation link: https://www.merriam-webster.com/dictionary/buccal
IPA: /ˈbʌk.əl/
Phonetic spelling: BUCK-uhl

- **lingual**

Pronunciation link: https://www.merriam-webster.com/dictionary/lingual
IPA: /ˈlɪŋ.gwəl/
Phonetic spelling: LING-gwuhl

- **micrometer**

Pronunciation link: https://www.merriam-webster.com/dictionary/micrometer
IPA: /ˌmaɪ·krəˈmi·t̬ɚ/
Phonetic spelling: my-kroh-MEE-ter

- **decontamination**

Pronunciation link: https://www.merriam-webster.com/dictionary/decontamination
IPA: /ˌdiː ˌkɑːn·təˈmeɪ·ʃən/
Phonetic spelling: dee-kon-tuh-MAY-shun

- **curette**

Pronunciation link: https://www.merriam-webster.com/dictionary/curette
IPA: /kjʊˈrɛt/
Phonetic spelling: kyoo-RET

- **apical**

Pronunciation link: https://www.merriam-webster.com/dictionary/apical
IPA: /ˈeɪ.pɪ.kəl/
Phonetic spelling: AY-pih-kuhl

- **coronal**

Pronunciation link: https://www.merriam-webster.com/dictionary/coronal
IPA: /ˈkɔːr.ə.nəl/
Phonetic spelling: KOR-uh-nuhl