

Investigation of the Effect of Surface Roughness on Structural Features of Dental Implants

MSc Neşe Benay Seken
Prof.Dr Nilgün Baydoğan

**Nano Science & Nano Engineering, Istanbul Technical University,
Ayazaga Campus**
**Energy Institute, Istanbul Technical University, Ayazaga Campus,
Maslak, Istanbul**



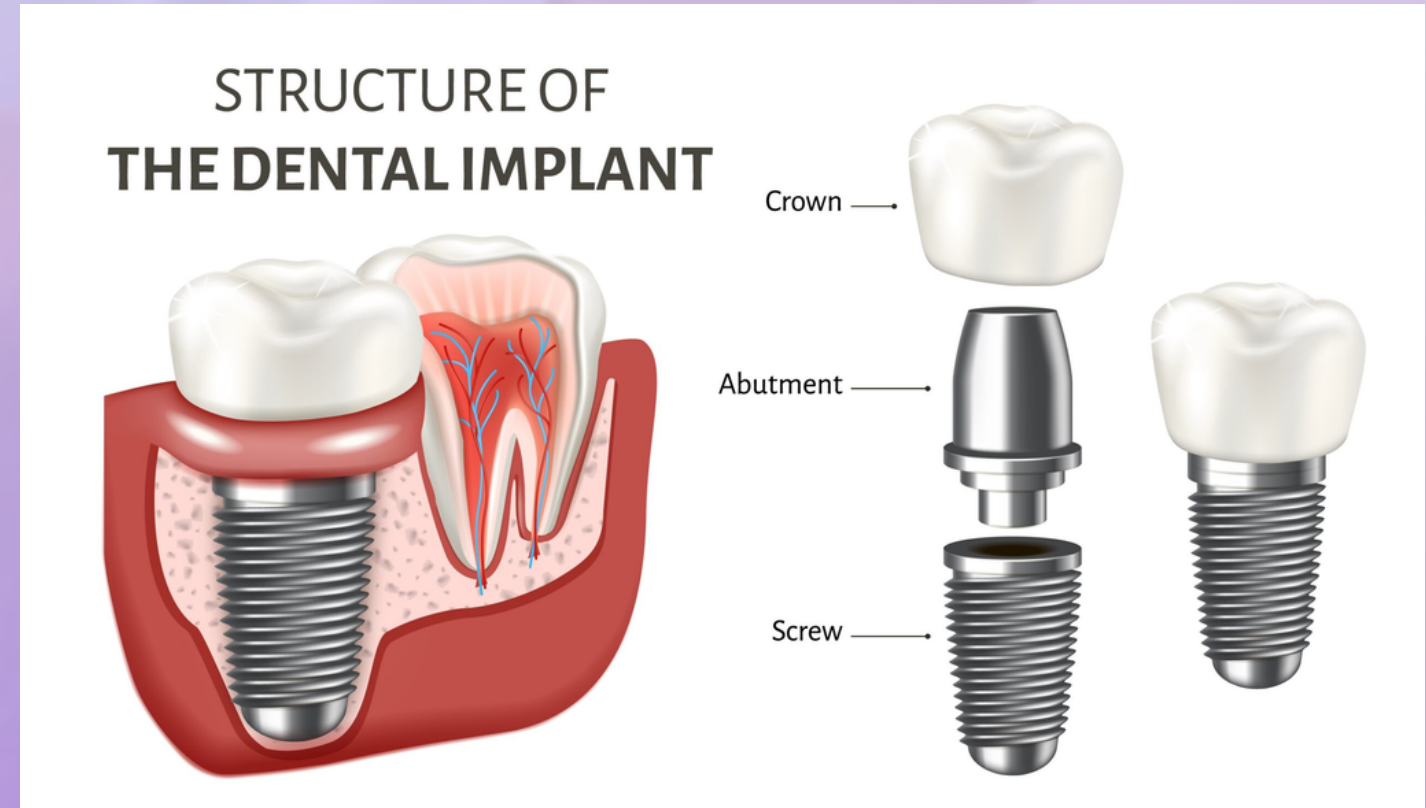
TOOTH LOSS

- Teeth are crucial for the complete start of digestive function, speech and aesthetics and can be lost for various reasons.
- Reasons such as dental caries, (caused by poor oral hygiene, environmental chemicals, smoking or passive smoking, drugs, elemental toxic substances), wrong root canal treatment, injuries, diseases or habits of the patient, and gum diseases may cause tooth loss.



DENTAL IMPLANTS

- Dental implant applications are the first choice in tooth loss.
- These implants, which are usually made of pure titanium or its alloy, are structures that imitate lost tooth roots.



OSSEOINTEGRATION

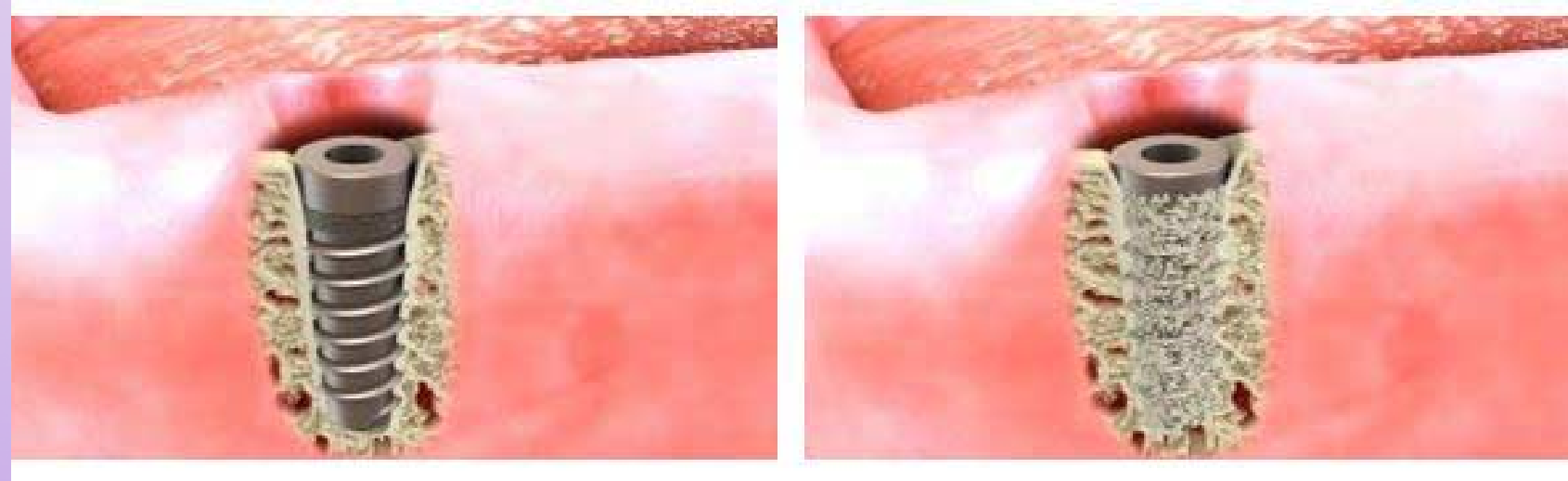


Osseointegration

Osseointegration refers that the implant placed is compatible with the jawbone, accepted and wrapped by the bone tissue.

Factors That Effect Osseointegration

- There are various factors that affect osseointegration. It is believed that the roughness and morphological changes applied on the dental implant surface affect the responses of tissues and cells to the implant.
- With the increase in surface roughness, an increase in primary and mechanical stability occurs. Thus, it is thought that the osseointegration time and recovery time can be shortened, so that failures can be prevented



SURFACE MODIFICATION TECHNIQUES



- There are many surface modification methods available to increase the surface roughness.

MECHANICAL METHODS

Machined Surfaces
Blasting
Polishing
Cutting

CHEMICAL METHODS

Anodizing
Acid Etching
Sandblasting and Acid Etching
Chemical Vapour Deposition
Alkaline Treatment

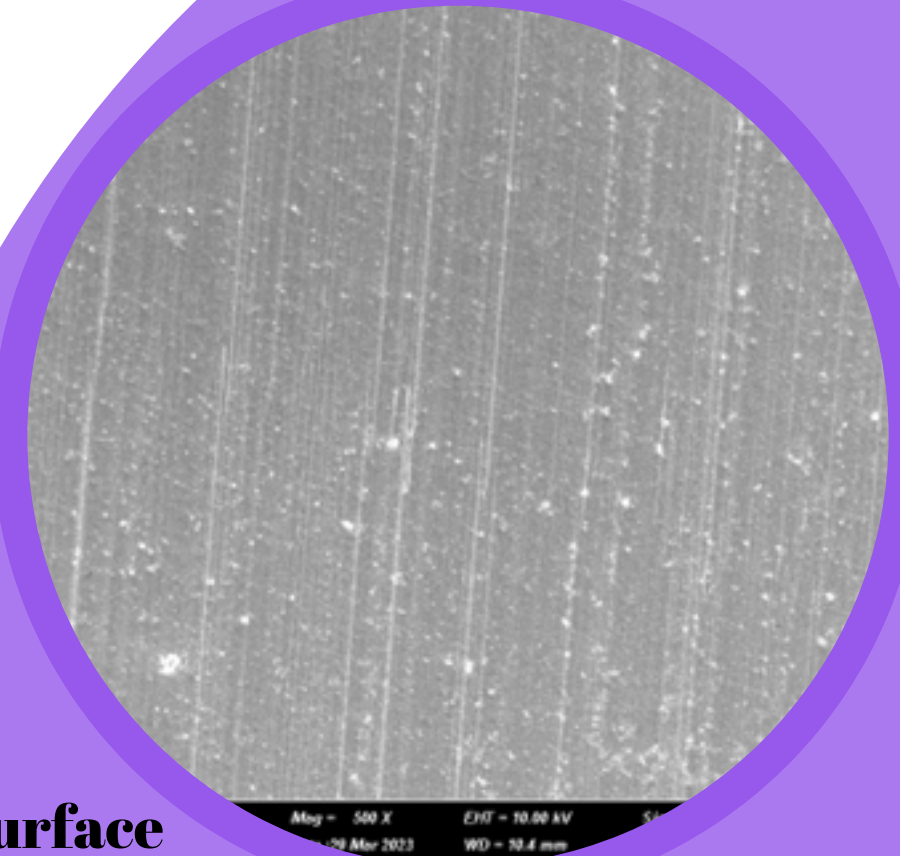
PHYSICAL METHODS

Thermal spray
Physical Vapour Deposition
Ion Implantation and Deposition
Glow Discharge Plasma Treatment

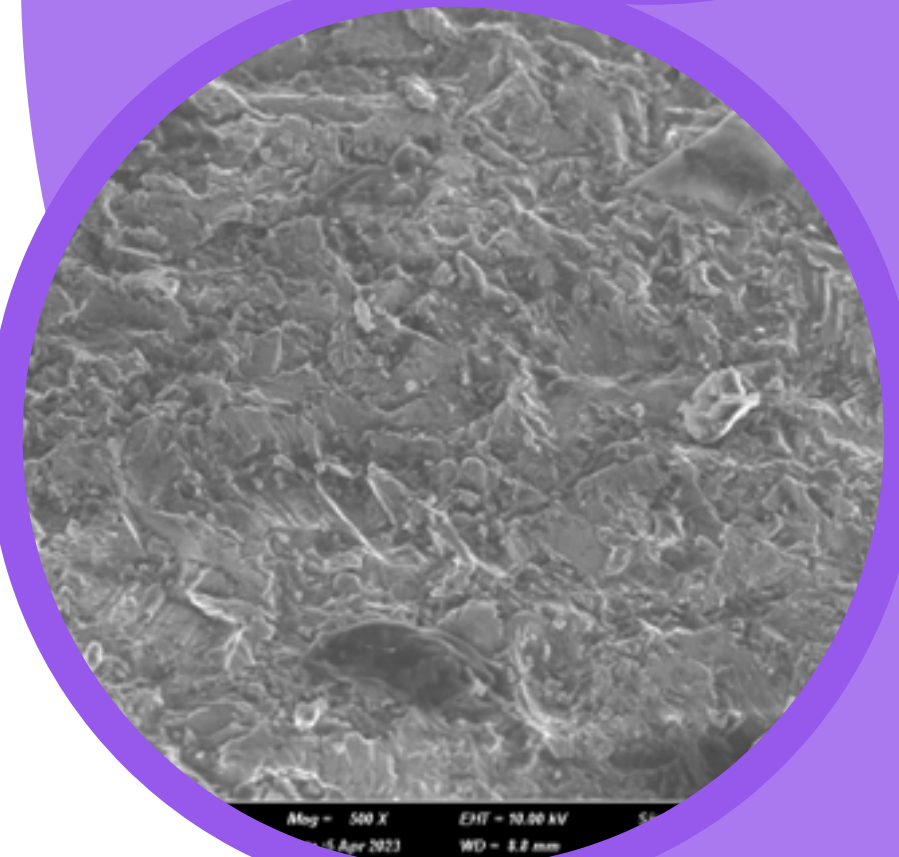


SLA METHOD

- In the SLA method, which is one of the surface modification methods, the surface is roughened by etching with acid and sandblasting.
- SLA surface treatment method creates micro and macro level roughened surfaces. The SLA treated surface results in increased bone-to-implant contact and thus significant role in the process of osseointegration. SLA technique can accelerate and improve the osseointegration process.
- Despite the advantages of this method, it has been observed that it leaves acidic waste residue and damages the surface during the sandblasting process.



Untreated Surface

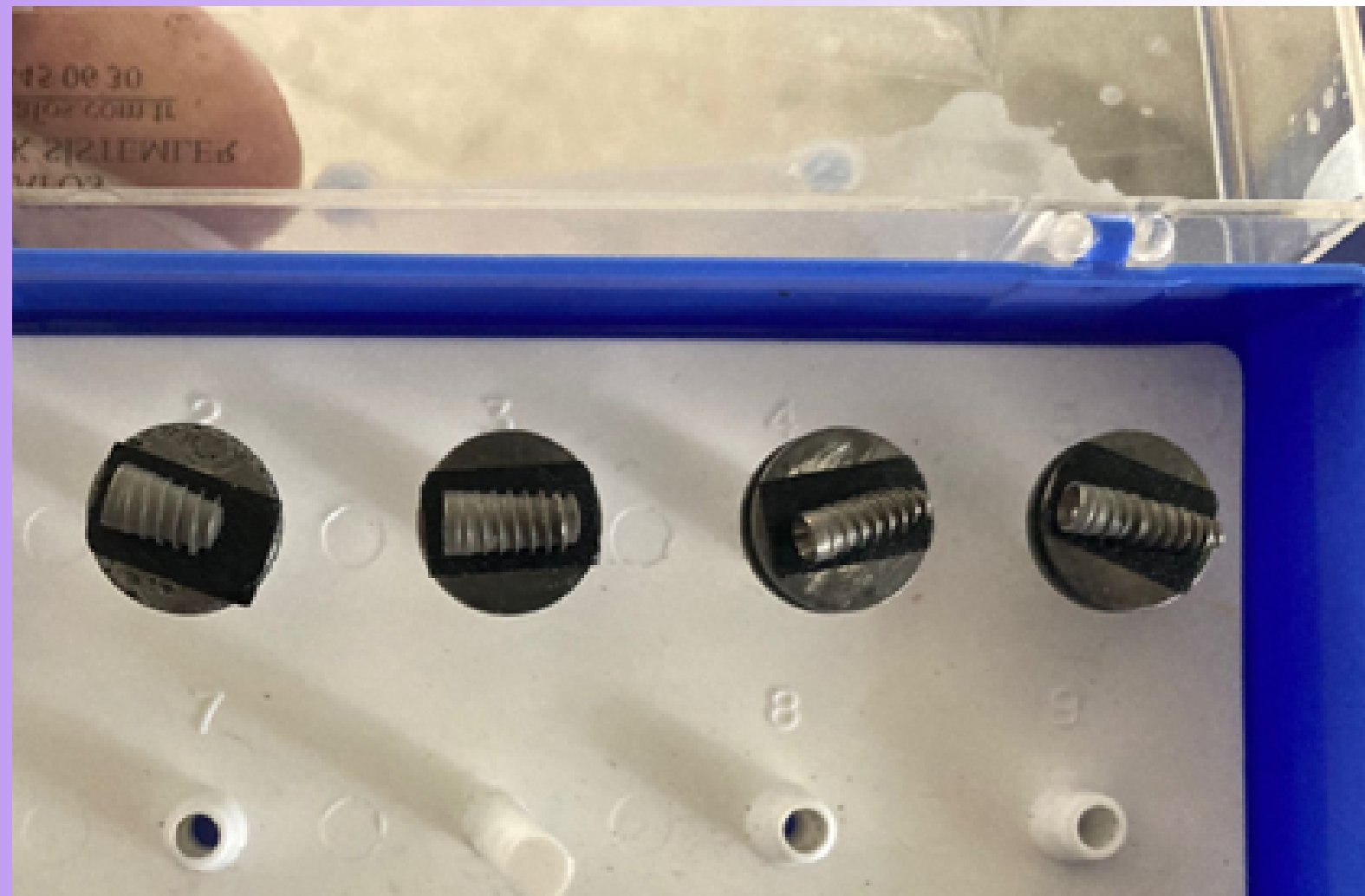


Sandblasting and acid etching (SLA) treated surface

MATERIAL AND METHOD

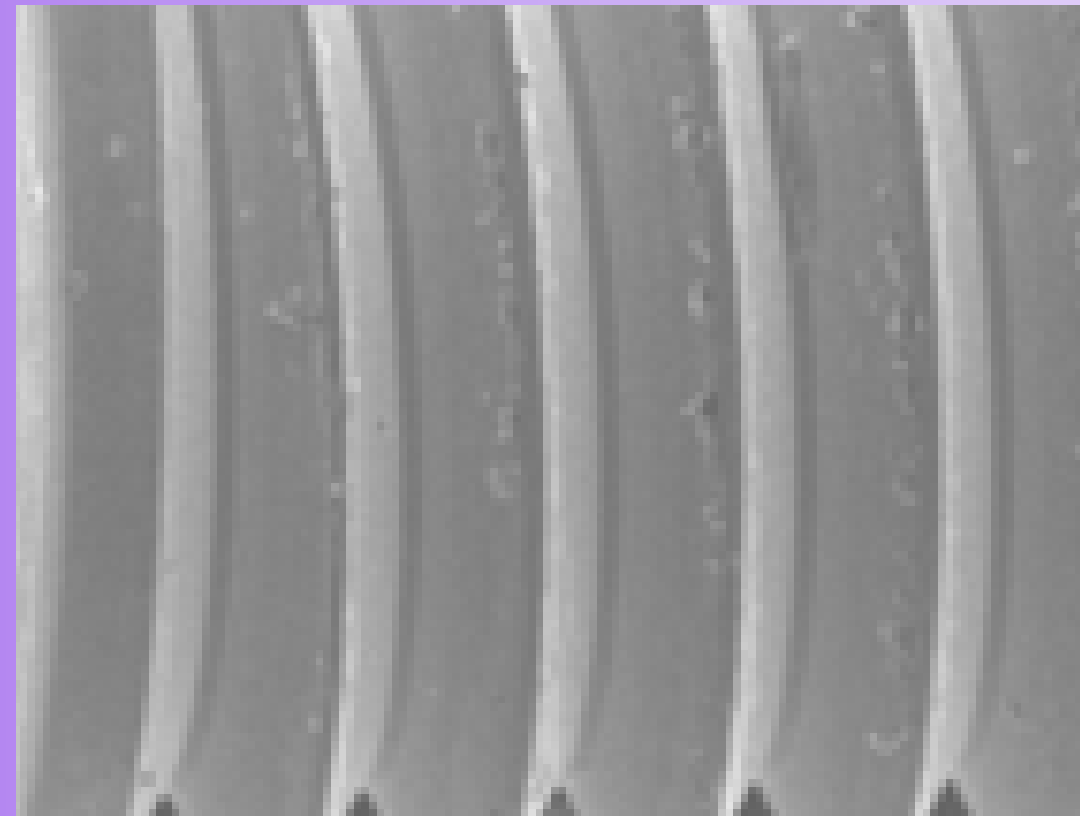
- **In this study, it was compared to 4 sandblasted and acid-etched failed implants with 4 unroughened and untreated implant surfaces. The radiography examination method was performed to detect defects both inside and on the surface of the implants. The effect of the surface modification on the physical properties was evaluated considering the implant's roughness as the result of the comparison with SLA surface modification and untreated implant surfaces.**

MATERIAL AND METHOD

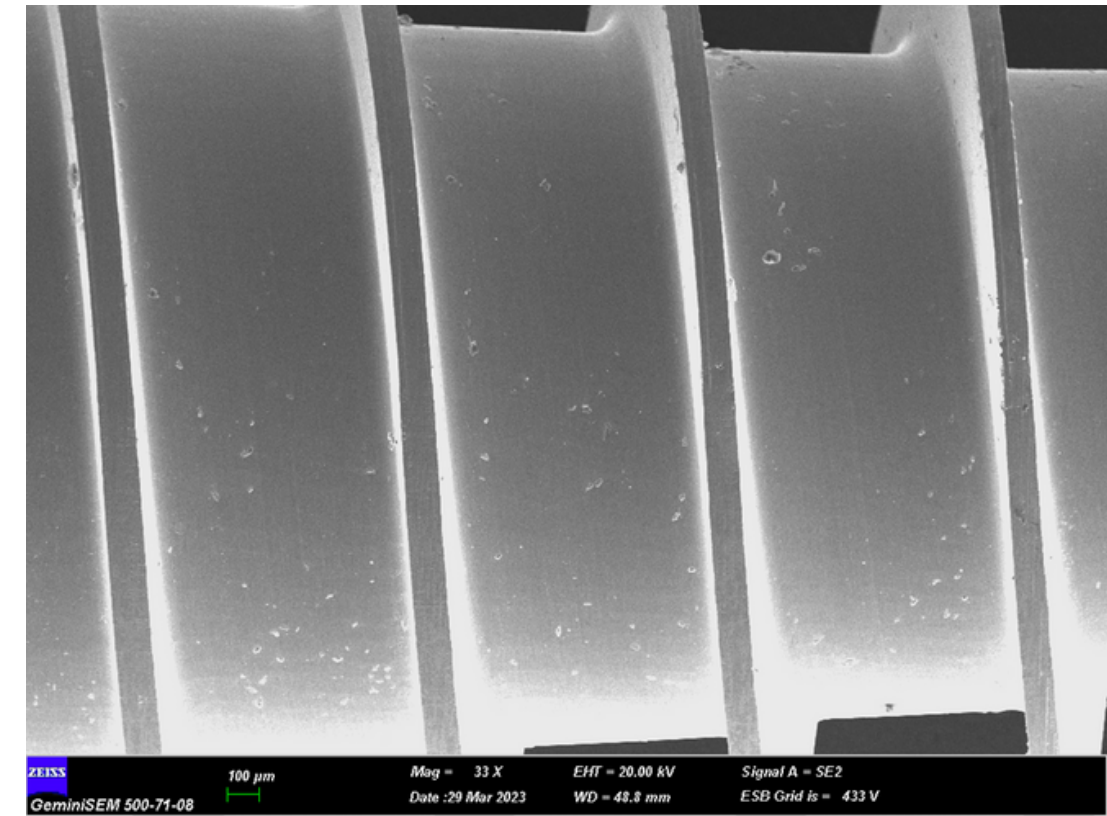


- **Image of 4 sandblasted and acid-etched failed implants**

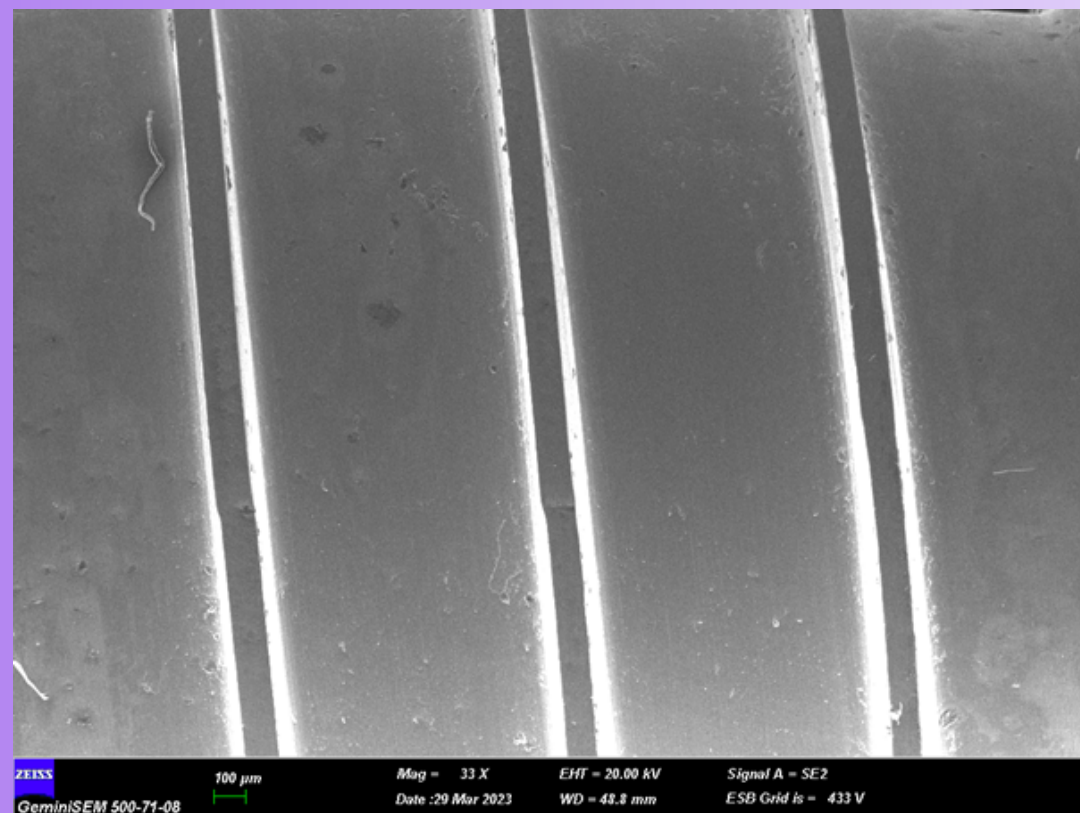
SEM IMAGES OF 4 UNTREATED IMPLANTS



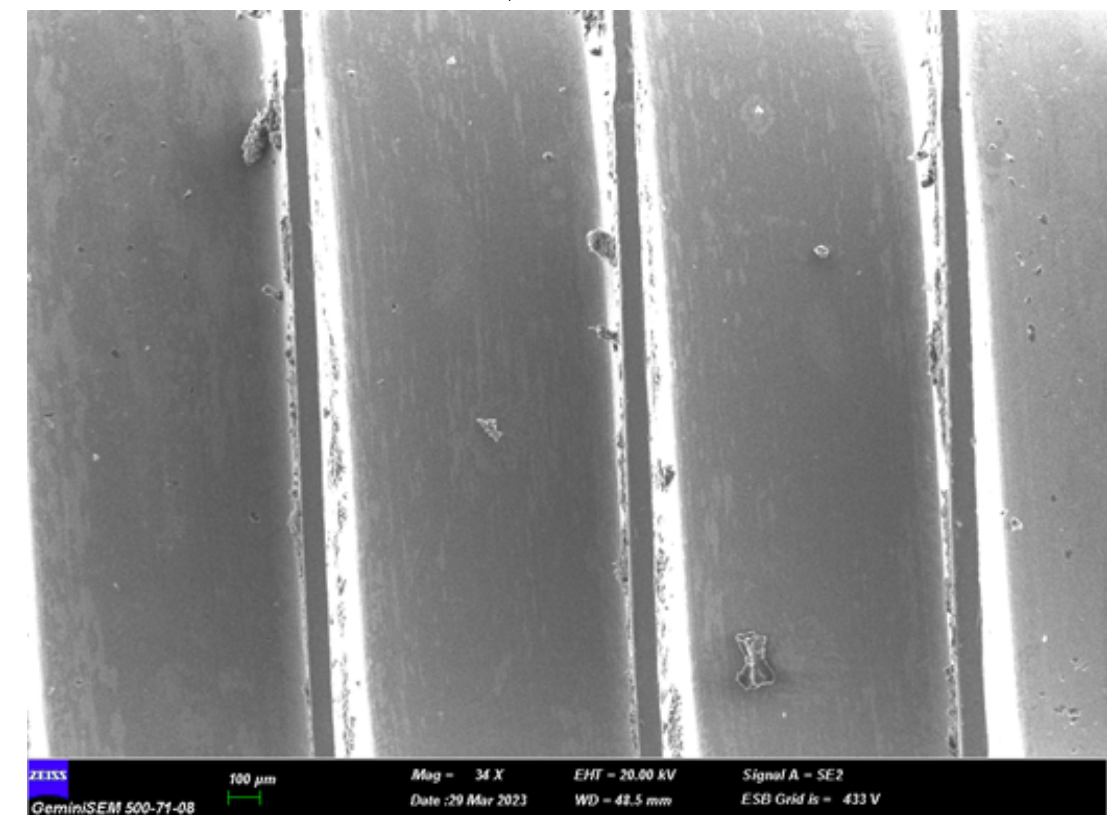
3,4 x 9 mm



3,4 x 11 mm

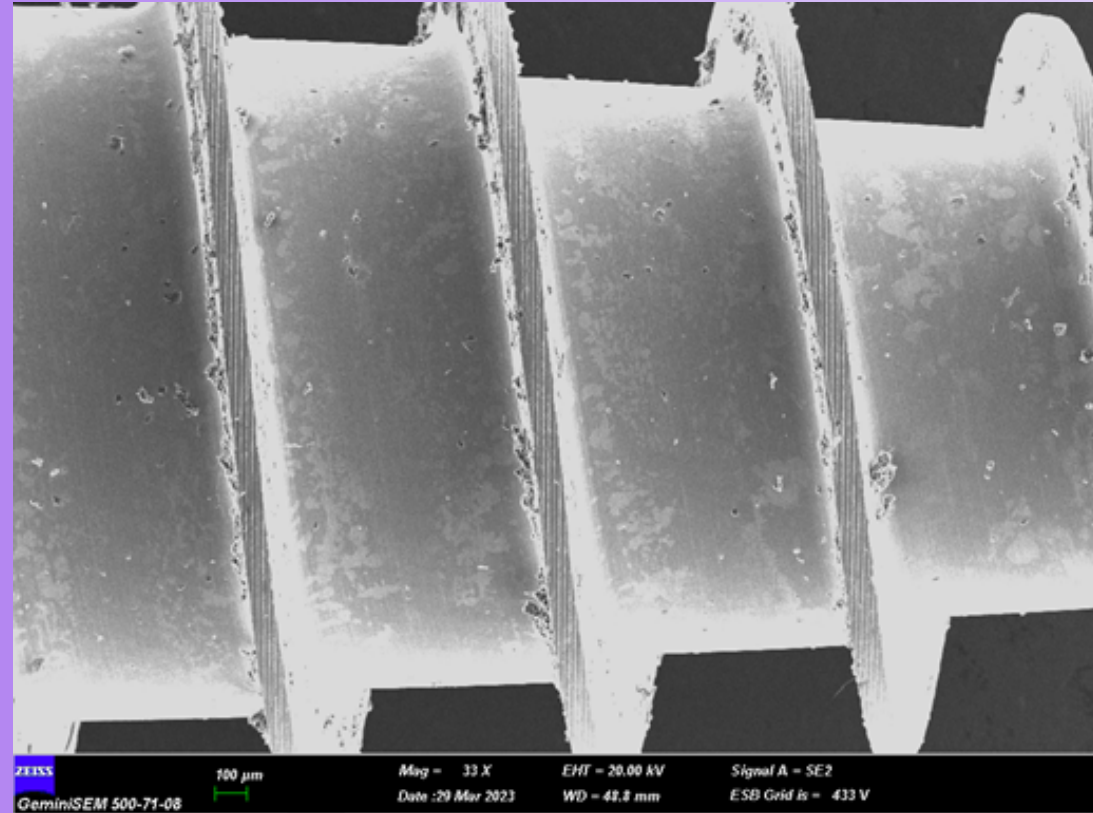


4,3 x 7 mm

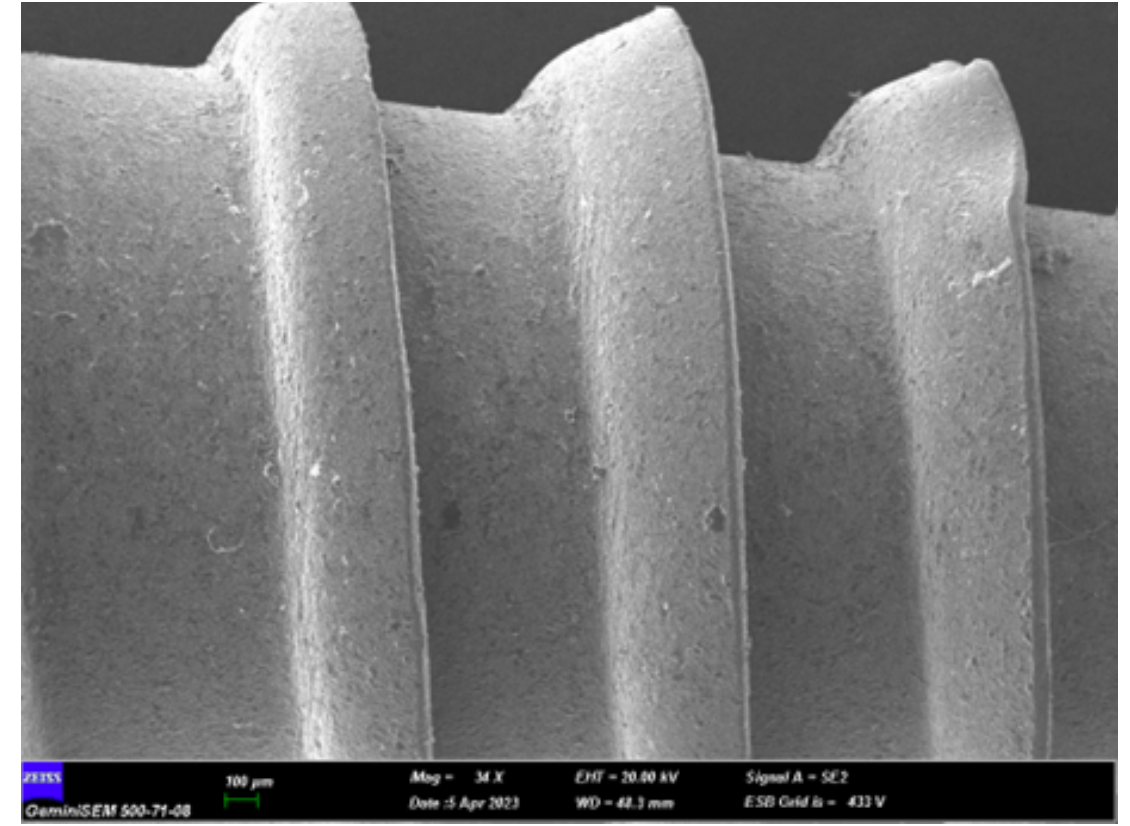


4,3 x 9 mm

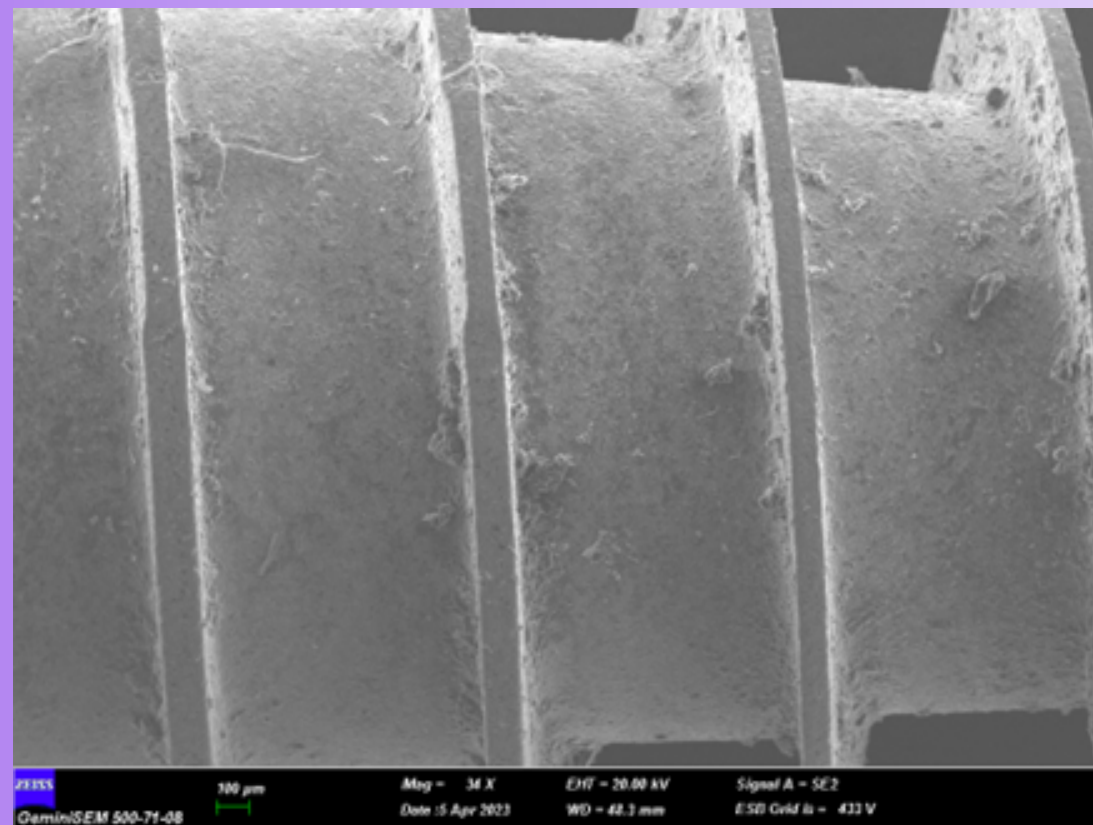
SEM IMAGES OF 4 SLA TREATED IMPLANTS



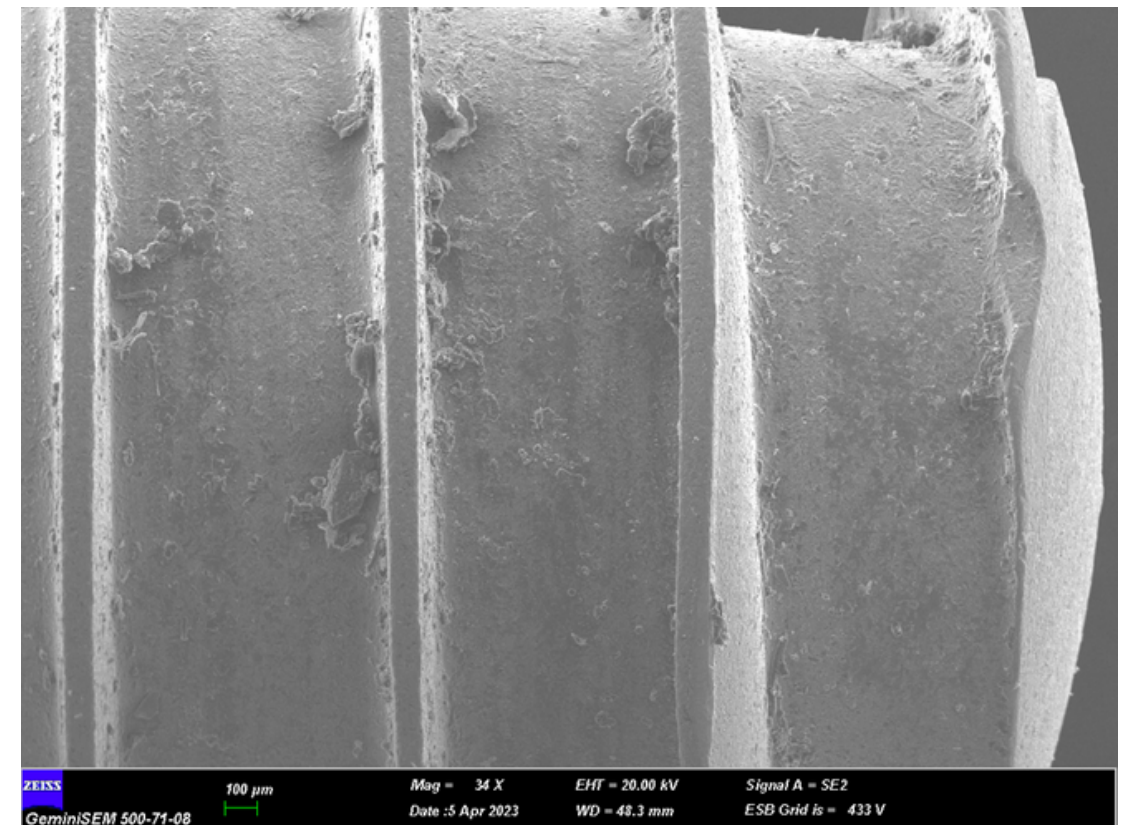
3,4 x 9 mm



3,4 x 11 mm

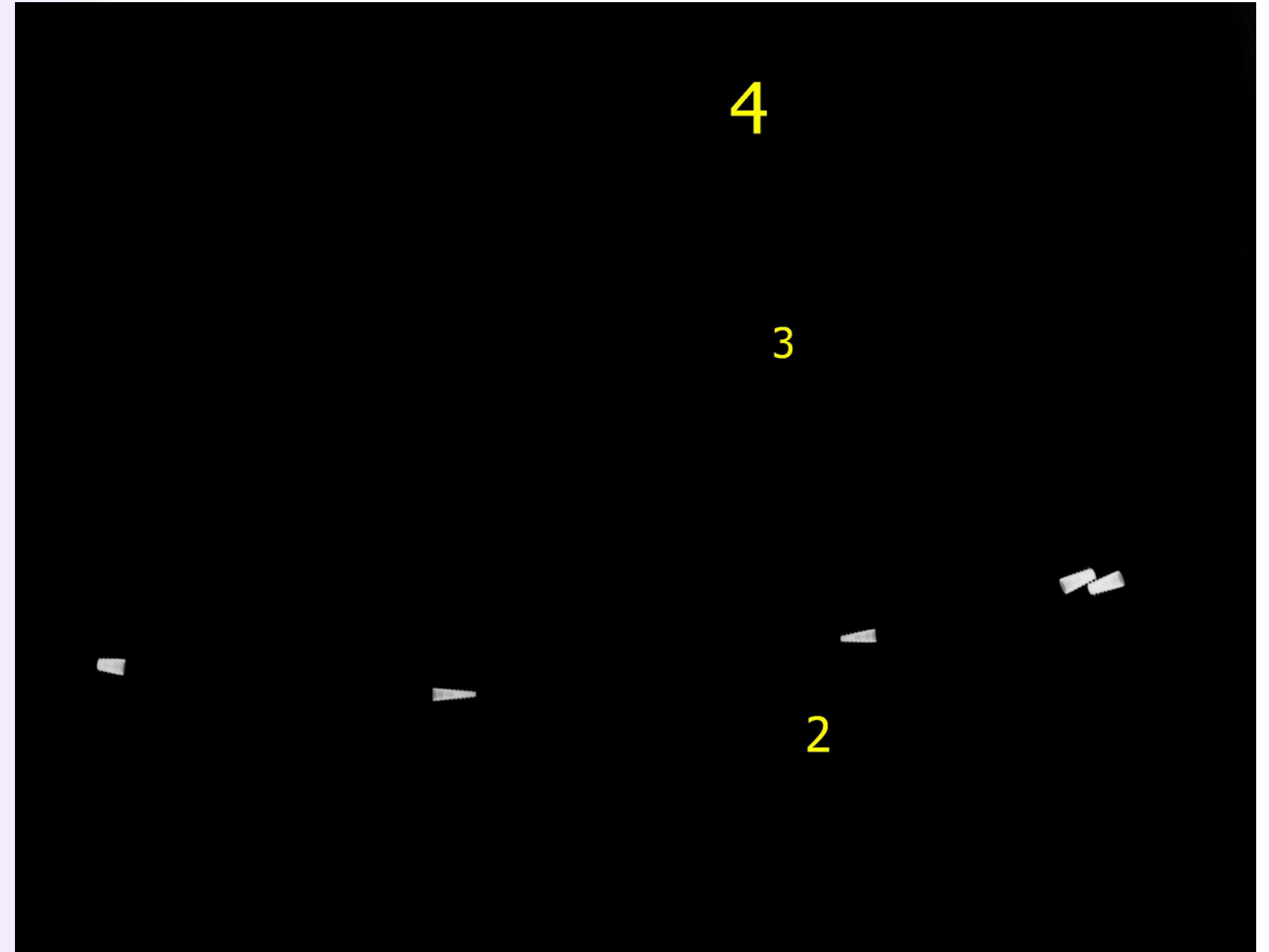


4,3 x 7 mm

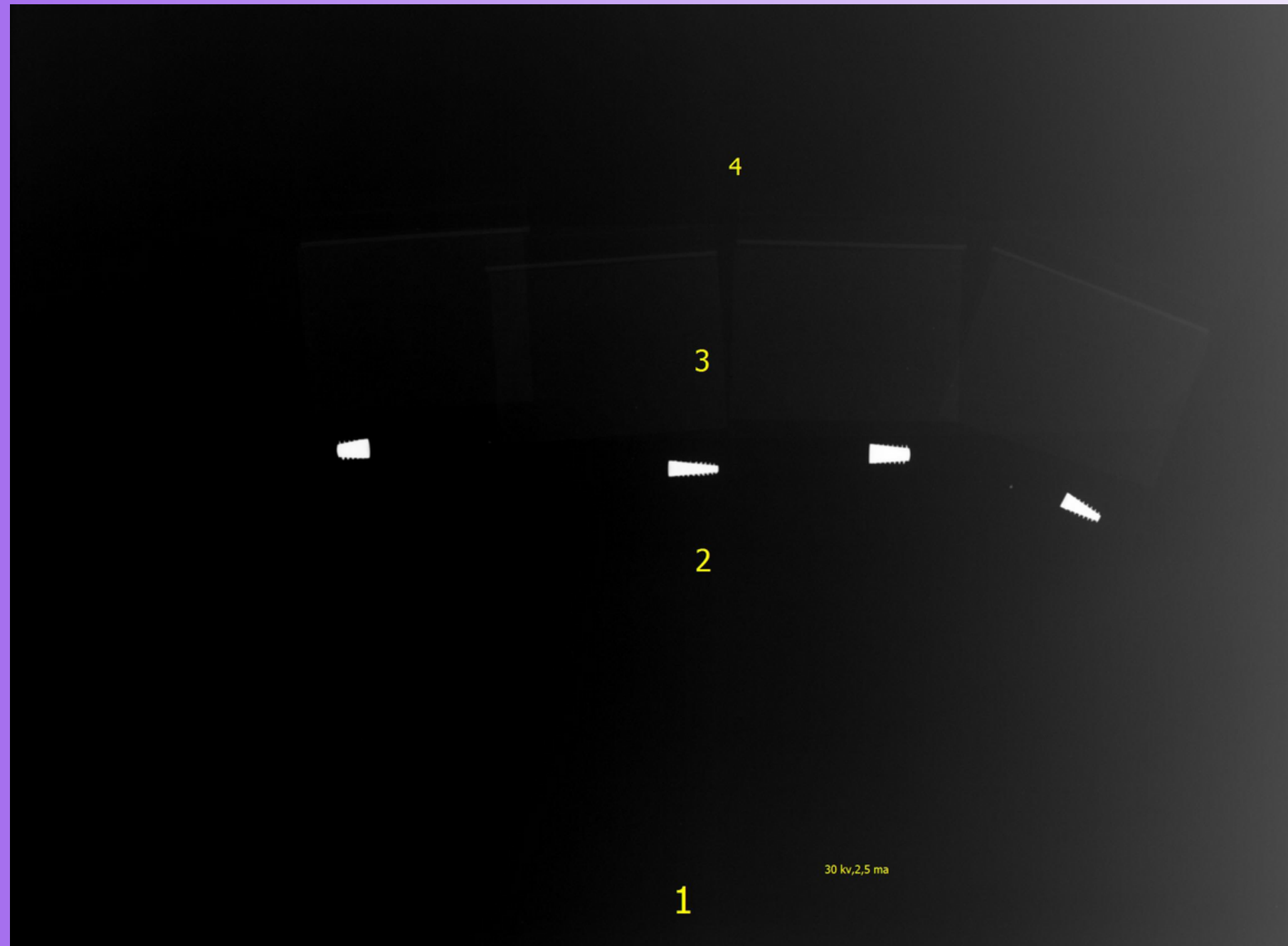


4,3 x 9 mm

RADIOGRAPHIC IMAGES OF 4 UNTREATED IMPLANTS



RADIOGRAPHIC IMAGES OF 4 SLA TREATED IMPLANTS



RESULTS

- **In the SEM and radiological images obtained as a result of our studies, it is seen that the SLA surface modification method creates roughness on the surface as a result of acid etching and sandblasting processes.**
- **While pits are not observed on the untreated implant surfaces, various pits and microcrack-like structures are observed on the surfaces of SLA-treated implants.**
- **Further studies and comparisons with mechanical tests are needed to investigate the effect of these pit and crack-like structures on the structural properties of the material in more detail.**

Thank you for
your
attention!

