Improvement of Dental Implant Quality as a Key Factor for Successful Implantation

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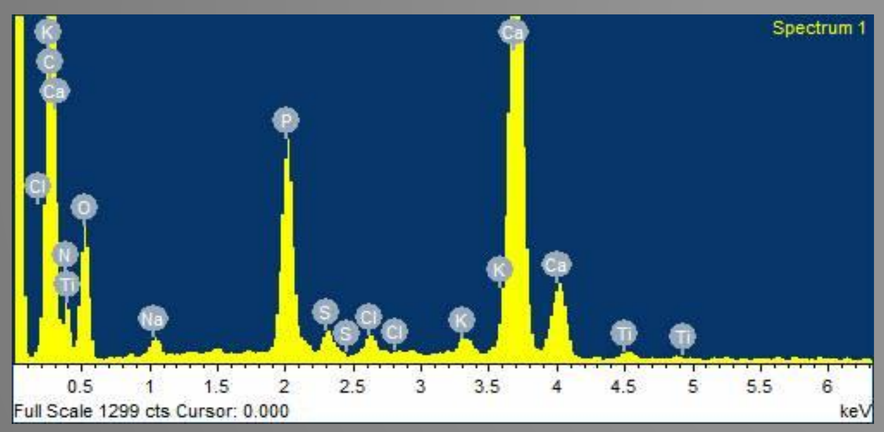
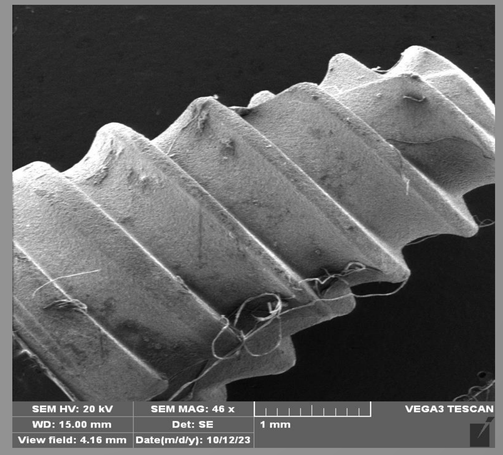
Aim: The aim of this study was to evaluate the influence of implant surface quality on successful implantation using scanning electron microscopy (SEM) analysis, with emphasis on surface morphology and contamination as determinants of osseointegration.

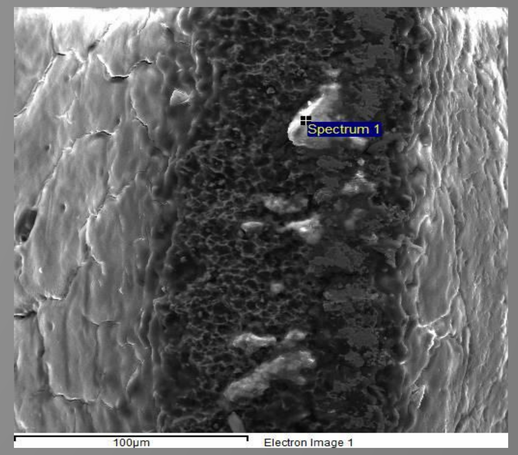
Introduction: Dental implant therapy is a reliable treatment option for the replacement of missing teeth; however, early and late implant failures still occur, often related to inadequate implant surface quality. Surface characteristics and cleanliness play a critical role in the process of osseointegration and long-term implant stability. Therefore, improving implant quality, particularly at the surface level, has become a key focus of contemporary implant research.

Material and methods: A samples of dental implants was analyzed using scanning electron microscopy (SEM) to assess surface topography, microstructural features, and the presence of surface contaminants. Implants with different surface treatments were examined and compared. SEM imaging was complemented by qualitative evaluation of surface irregularities and contamination patterns potentially associated with impaired biological response.



Chemical analysis





Dental implants analysis with SEM microspopy
-Micro and nano-topography-

Results: SEM analysis revealed significant differences in surface morphology and cleanliness among the examined implants. Implants with optimized surface structures demonstrated homogeneous micro- and nano-topography, favorable for bone–implant interaction. In contrast, implants showing surface contamination and irregularities exhibited features associated with reduced bone contact and increased risk of early implant failure. The findings suggest a strong correlation between surface quality, biological response, and implant stability

Conclusion: SEM-based evaluation confirms that implant surface quality is a critical factor for successful dental implantation. High-quality, contamination-free implant surfaces promote predictable osseointegration and long-term stability. Incorporating SEM analysis into implant quality assessment provides valuable insight for improving implant design, manufacturing, and clinical outcomes.