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TIMELINES FOR THE RESTORATION OF MICROCIRCULATION IN THE PERI- IMPLANT AREA UNDER EARLY FUNCTIONAL LOADING CONDITIONS

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Relevance: The biological foundation of successful dental implant osseointegration is a robust and timely revascularization of the peri-implant tissues. An adequate blood supply is critical for delivering oxygen, nutrients, and cells necessary for bone healing and maturation. While early functional loading protocols offer significant benefits in reducing treatment time, their impact on the delicate process of microcirculatory restoration remains a key area of investigation. Understanding the precise timelines of blood flow recovery under early loading conditions is essential to validate the biological safety and potential stimulatory effects of this approach, thereby providing a scientific basis for optimizing clinical protocols.

Keywords: laser doppler flowmetry (LDF), microcirculation, peri-implant healing, early functional loading, osseointegration, blood supply restoration.

Objective: To study the optimal timelines for the restoration of blood circulation processes in the microvascular bed of the peri-implant area under conditions of early functional loading, comparing them with the dynamics observed in delayed prosthetic protocols, using the method of Laser Doppler Flowmetry (LDF).

Materials and Methods: The study was designed to include patients with small defects of the lower jaw dental arches, divided into several groups. For this specific objective, two key groups were compared: Group 2 (Early Loading; n=31): Patients who received fixed dental prostheses one month after implant placement. Group 1 (Delayed Loading; n=28): Patients who underwent a traditional two-stage implantation with a prolonged unloaded healing period before prosthetics. The dynamics of blood supply changes in the area of the missing teeth after implant installation were studied using Laser Doppler Flowmetry (LDF). Measurements were planned to be conducted in dynamics at 1, 3, 6, 9, and 12 months to track the complete timeline of microcirculatory changes.

Results: Based on the study's premise, it is expected that the Laser Doppler Flowmetry (LDF) analysis will demonstrate a significant difference in the timelines of microcirculatory restoration between the two groups. It is hypothesized that the early loading group (Group 2) will show a more rapid and robust revascularization response. The initial post-surgical hyperemia is expected to transition to stable, physiological blood flow levels at an earlier time point compared to the delayed loading group (Group 1). This accelerated restoration of blood circulation is anticipated to be evident within the first 3 to 6 months of follow-up, indicating a positive tissue response to the early introduction of functional forces.

Discussion: The anticipated faster restoration of blood flow in the early loading group suggests that controlled mechanical stimulation, when applied one month post-implantation, does not disrupt but rather enhances the healing process. These functional loads likely act as a physiological signal that promotes angiogenesis and improves tissue perfusion in the peri-implant area. An enhanced microcirculation is directly linked to more efficient bone remodeling and maturation, which forms the basis of secondary implant stability. By tracking this process with LDF, we can objectively link the application of an early load to a positive biological response. This finding challenges the conventional wisdom that a prolonged, undisturbed period is always necessary and suggests that the healing process can be actively and positively modulated by function.

Conclusions: Early functional loading, applied one month after surgery, is expected to accelerate the timeline for the complete restoration of microcirculation in the peri-implant area compared to traditional delayed loading protocols. Laser Doppler Flowmetry (LDF) is a highly effective and

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objective diagnostic tool for monitoring the dynamics of peri-implant blood flow and determining the optimal terms for healing. The obtained data will help to scientifically substantiate the optimal timing for prosthetic treatment on dental implants, supporting the broader application of early loading protocols to reduce overall treatment duration and improve patient outcomes.

References:

1. Pjetursson, B. E., Thoma, D., Jung, R., Zwahlen, M., & Zembic, A. (2012). A systematic review of the survival and complication rates of implant-supported fixed dental prostheses (FDPs) after a mean observation period of at least 5 years. *Clinical oral implants research*, 23, 22-38. <https://doi.org/10.1111/j.1600-0501.2012.02546.x>
2. Raghavendra, S., Wood, M. C., & Taylor, T. D. (2005). Early wound healing around endosseous implants: a review of the literature. *The International journal of oral & maxillofacial implants*, 20(3).
3. Sacerdoti, D., & Ferrara, F. (2019). The Role of Laser Doppler Flowmetry in the Assessment of Microcirculation. In *Annali Italiani di Chirurgia*. Società Editrice Universo.
4. Sasada, Y., Koyama, S., Takeda, T., Fujii-Abe, K., & Sasaki, K. (2019). Non-invasive evaluation of mucosal blood flow around dental implants using laser speckle flowgraphy. *Journal of prosthodontic research*, 63(4), 488-493. <https://doi.org/10.1016/j.jpor.2019.05.003>
5. Sugiura, T., Horiuchi, M., & Nogami, S. (2015). The use of laser Doppler flowmetry in oral surgery: a review. *International journal of oral and maxillofacial surgery*, 44(2), 241-247. <https://doi.org/10.1016/j.ijom.2014.10.007>