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Covered Socket Residuum (CSR) After Tooth Extraction – Radiological Finding, Physiological Healing Mechanism, and Surgical Implications

Introduction

Advances in three-dimensional imaging, particularly cone beam computed tomography (CBCT), have led to an increasing detection of non-mineralized areas within former extraction sockets. These findings should be described as *Covered Socket Residuum* (CSR). In clinical practice, CSR is frequently—and often incorrectly—equated with pathological entities such as fatty-degenerative osteonecrosis of the jaw (FDOK) or neuralgia-inducing cavitational osteonecrosis (NICO). This conflation has contributed to diagnostic uncertainty and controversial therapeutic approaches. The aim of this article is to clarify the biological meaning of CSR, to differentiate radiological findings from histopathological diagnoses, and to derive rational surgical consequences.

CSR as a Radiological Phenomenon

CSR describes a radiological appearance characterized by non-mineralized or low-density areas within an extraction socket that are covered by a cortical or partially mineralized bony layer. Importantly, CSR is a descriptive radiological term and does not constitute a diagnosis. It reflects the complex and patient-specific dynamics of post-extraction bone healing, including socket collapse, inward movement of alveolar walls, and incomplete ossification of the socket center.

Recent evidence supports this interpretation. In a prospective randomized clinical study, Ghanaati et al. demonstrated that CSR can be detected in former third molar sockets despite the

application of regenerative approaches such as platelet-rich fibrin (PRF). These findings indicate that CSR may occur as part of a physiological healing process rather than representing an inherent pathological condition[1].

Physiological Socket Remodeling and Cavitation Formation

Further insight into post-extraction healing has been provided by radiological studies on premolar extraction sites. Ghanaati and colleagues described a programmed socket collapse accompanied by the formation of cavitations within the alveolus. These cavitations were shown to result from the interaction of bone apposition along socket walls and simultaneous dimensional reduction of the alveolar ridge, rather than from necrotic or inflammatory pathology[2]. This paradigm challenges the traditional assumption that socket healing necessarily leads to complete and homogeneous bone fill.

Differentiation from FDOK and NICO

A critical clinical implication of these findings is the strict differentiation between CSR and entities such as FDOK or NICO. While CSR represents a radiological observation, FDOK and NICO are pathological diagnoses that require histopathological confirmation[3]. Radiological imaging alone is insufficient to establish these diagnoses. Consequently, equating CSR with FDOK or NICO based solely on imaging findings is scientifically and clinically unjustified.

Surgical Implications

From the perspective of modern oral and maxillofacial surgery, these insights underscore the necessity of developing standardized and biologically sound surgical concepts following tooth extraction to support bone regeneration and minimize the persistence of CSR. Preventive strategies include atraumatic extraction techniques, socket preservation measures, and biologically guided augmentation protocols.

In this context, **Guided Open Wound Healing (GOWH)**[4] represents a key surgical principle. Rather than enforcing premature primary closure, GOWH allows controlled neo-epithelization of the socket-related ridge part under guided conditions, thereby respecting the physiological remodeling dynamics of the extraction socket. By maintaining an open but protected wound environment, GOWH facilitates physiological drainage, reduces the risk of encapsulating non-mineralized tissue, and promotes structured bone regeneration while avoiding the formation of enclosed residual cavities.

When surgical revision of a CSR is indicated, the application of GOWH enables direct visualization and debridement of the socket while preventing the re-entrapment of poorly mineralized or biologically altered tissue. In such cases, the removed tissue should routinely be submitted for histopathological analysis. Only this approach allows a reliable distinction between physiological healing patterns and true pathological alterations. This evidence-based and biologically oriented strategy is essential for establishing diagnostic clarity, reproducibility, and resource-efficient decision-making under constrained conditions.

Conclusion

CSR should be regarded as a frequent radiological manifestation of physiological post-extraction socket volume loss, collapse, and subsequent bone remodeling, rather than as a pathological diagnosis per se. A clear conceptual distinction between CSR as a radiological finding and NICO as well as FDOK as histopathological entities is therefore essential. Integrating this perspective into surgical planning represents a crucial step toward a rational, patient-specific, and future-oriented approach in oral and maxillofacial surgery.References:

References

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