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Soft Tissue Changes After Third Molar Extraction: A Review

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Abstract
Third molar extraction is a common oral surgical procedure frequently associated with postoperative soft tissue changes, including edema, trismus, gingival recession, and delayed mucosal healing. These changes are influenced by surgical factors such as flap design, bone removal, and duration of surgery, as well as patient-related factors including age, systemic health, smoking, and oral hygiene. Adjunctive strategies, notably platelet-rich fibrin (PRF), platelet-rich plasma (PRP), low-level laser therapy (LLLT), and minimally invasive or flapless surgical techniques, have demonstrated improved soft tissue healing, reduced postoperative discomfort, and faster recovery. Complications such as alveolar osteitis and persistent periodontal defects further underscore the importance of optimizing surgical technique and postoperative care. Advances in biomaterials, pharmacological support, and minimally invasive approaches emphasize a patient-centered, evidence-based strategy for enhancing postoperative outcomes.

Keywords: Third Molar Extraction, Soft Tissue Changes, Edema, Trismus, Periodontal Health

Introduction

Third molars, or wisdom teeth, are the final set of molars to erupt in the oral cavity, typically between 17 and 25 years of age, and due to their posterior position and high likelihood of impaction. Extractions are commonly indicated for conditions such as impaction, caries, pericoronitis, periodontal disease, cystic or neoplastic changes, and involvement of adjacent teeth, while in certain cases, they may also be necessary to facilitate orthodontic, prosthodontic, or surgical treatment plans.[1] Although prophylactic extraction of asymptomatic, disease-free third molars remain a subject of debate and is generally discouraged unless there is a substantial risk of future pathology, younger patients often experience reduced postoperative morbidity, making early intervention advantageous compared with older individuals, who are more likely to present with periodontal complications or delayed eruption.[2] A key aspect of third molar surgery is the spectrum of postoperative soft tissue changes, which include alterations in gingival contour, buccal soft tissue volume, and mucosal thickness, typically characterized by an initial reduction over the first few months, followed by partial recovery or stabilization by six months. These changes, while partly influenced by surgical technique and flap design, are not always directly correlated with underlying

alveolar bone remodeling, and may present clinically as gingival recession or localized soft tissue thinning adjacent to the extraction site.[3] In the initial post-surgical period, which lasts up to three months, there's a notable reduction in soft tissue volume and changes in contour. By the mid-term, around six months, some of this volume partially recovers, inflammation stabilizes, and the tissue reattaches. In some cases, the volume returns to a level similar to the baseline. Long-term outcomes are still under observation, but generally, the soft tissue remains healthy or improves without ongoing inflammation.[4,5] This article gives an overview on soft tissue changes after 3rd Molar Extraction

Review of Literature

From a pathological perspective, impacted third molars are often associated with pronounced inflammatory responses, including epithelial hyperplasia and connective tissue inflammation, and in some instances, the development of cystic changes, showing the potential for more severe complications (Anjum et al., 2014).[6] Surgical technique has also been studied as a contributing factor, though recent evidence suggests that flap design may not exert a substantial long-term influence on periodontal healing, with Pardo et al. (2023) reporting no significant differences in periodontal outcomes six months after extraction, implying that the choice of flap may be less critical than previously assumed. Several adjunctive strategies and pathological considerations have been explored in the context of soft tissue changes following third molar extraction.[4] The application of platelet-rich fibrin (PRF) has been consistently reported to enhance postoperative healing, with studies demonstrating reductions in pain, edema, and tenderness when PRF is placed in the extraction socket (Phong et al., 2023; Sybil et al., 2020).[7,8] In randomized trials, Afat et al. (2019) further highlighted that patients treated with PRF achieved superior mucosal healing scores at 7, 14, and 21 days compared with control groups, indicating its significant role in promoting faster soft tissue recovery. [9]

Postoperative Edema after Third Molar Extraction

Postoperative swelling, or edema, is a common inflammatory reaction that follows third molar surgery, primarily resulting from tissue trauma caused by flap reflection, bone removal, and surgical manipulation. The underlying mechanism involves hyperemia, vasodilation, and increased capillary permeability, which promote fluid accumulation within the interstitial spaces through both transudation due to slowed blood flow and exudation linked to the inflammatory process. Inflammatory cell migration, particularly granulocytes and monocytes, further contributes to tissue swelling.[10] Clinically, edema typically reaches its peak between 24 and 72 hours postoperatively, coinciding with the height of the inflammatory response and maximal fluid retention. Several factors influence its severity, including the type of flap design used, with triangular and envelope flaps producing variable but often clinically insignificant differences, as well as surgical difficulty, where longer operative times and extensive bone removal are associated with greater soft tissue trauma. Patient-related factors such as age, gender, body surface area, and individual variations in inflammatory response also play a role in determining the extent of swelling.[11] Management strategies focus on minimizing tissue trauma and controlling inflammation: the use of cold compresses during the immediate postoperative period reduces vascular perfusion and limits edema formation, while corticosteroids given pre- or postoperatively suppress inflammatory mediator release and significantly decrease swelling.[12] Nonsteroidal anti-inflammatory drugs (NSAIDs) also provide dual benefits of analgesia and anti-inflammatory action, thereby reducing edema. Additionally, minimally invasive surgical techniques, including careful flap handling and piezosurgery for bone cutting, lower postoperative

tissue injury, while secondary closure or use of drains can prevent fluid accumulation beneath tightly sutured tissues. Overall, effective prevention and management of postoperative swelling enhance patient comfort, reduce morbidity, and promote faster recovery after third molar extraction.[13]

Trismus after Third Molar Extraction

Trismus, defined as restricted mouth opening, is a frequent postoperative complication of third molar extraction and results from muscle spasm, inflammation, and edema involving the masticatory muscles, most notably the medial pterygoid. Surgical trauma, including flap elevation and bone removal, induces soft tissue inflammation and edema that trigger protective muscle spasms, while direct injury to muscles or tendons during the procedure can further aggravate the condition.[14] In some cases, local anesthetic injection techniques, particularly multiple needle insertions or inadequate disinfection, may provoke muscle irritation and contribute to postoperative trismus. Infection or persistent low-grade inflammation around the surgical site can also exacerbate spasm and prolong recovery. Clinically, trismus typically appears within hours to one day after surgery, peaks around 24–48 hours when inflammation is maximal, and gradually resolves within 7–14 days, with uncomplicated cases often regaining normal mouth opening by the end of the first week; persistence beyond this period may signal complications such as infection or osteomyelitis.[15] The severity of trismus is influenced by the angulation and position of the impacted tooth, with disto-angular and horizontal impactions or those in close proximity to the mandibular ramus associated with greater trauma and muscle irritation.[16] Additional risk factors include thin or fractured lingual bone plates and extensive flap elevation near the ramus. Management strategies aim at reducing inflammation and promoting muscle relaxation: physiotherapy in the form of jaw-opening exercises is critical for restoring mobility, NSAIDs are routinely prescribed to decrease pain and inflammatory swelling, and corticosteroids may be indicated in severe cases to suppress the inflammatory response and facilitate faster recovery.[16]

Periodontal Changes in Adjacent Teeth after Third Molar Extraction

Extraction of impacted third molars has notable implications for the periodontal health of adjacent second molars, with changes primarily observed in pocket depth, gingival recession, and attachment levels. Impacted third molars frequently contribute to periodontal pocket formation distal to the second molar due to plaque retention, food impaction, and chronic inflammation, and studies following extraction have reported variable outcomes some demonstrating significant reductions in pocket depth following removal of the tooth and resolution of inflammation, while others describe persistent or newly developed pockets, particularly when pre-existing periodontal defects were present.[17] Early extraction, before periodontal complications arise, is generally associated with improved pocket depth and reduced long-term risk of periodontal breakdown.[18] Gingival recession and clinical attachment loss are additional concerns, often occurring in cases with pre-existing disease or when surgical trauma, extensive flap manipulation, or improper tissue handling compromise healing.[19] Although healing may restore attachment levels over several months, a subset of patients continues to exhibit persistent attachment loss distal to the second molar. Surgical technique plays a decisive role, with flap design and suturing directly influencing outcomes: triangular flaps provide superior access but may cause greater soft tissue trauma, whereas envelope flaps often preserve interdental papillae more effectively.[20] Optimal suturing, ensuring secure soft tissue adaptation without excessive tension, enhances healing and supports attachment gain, while minimally traumatic and modified flap approaches have been shown to reduce postoperative periodontal

defects. Long-term studies suggest that early intervention generally promotes healthier periodontal conditions adjacent to second molars, but delayed or complicated extractions may predispose to lasting periodontal pockets, attachment loss, or bone defects.[21] Consequently, careful surgical planning with attention to flap design, suturing techniques, and timing of extraction is critical to preserving the periodontal integrity of neighboring teeth.[21]

Infection and Alveolar Osteitis Impact on Soft Tissues

Alveolar osteitis, commonly referred to as dry socket, is a frequent postoperative complication of third molar extraction and is defined by the partial or complete loss of the protective blood clot within the extraction site. This disruption exposes the underlying bone, triggering inflammation, severe pain, and delayed wound healing. The pathogenesis involves a combination of surgical trauma, excessive irrigation, bacterial colonization, and systemic or behavioral factors such as smoking, poor oral hygiene, and the use of medications like oral contraceptives, all of which reduce vascularity and compromise clot stability. Difficult extractions with extensive tissue manipulation further increase the risk by mechanically disrupting blood vessels and soft tissue integrity.[22] Clinically, dry socket presents with intense localized pain that typically begins 1 to 4 days postoperatively and often radiates to adjacent regions; the extraction site appears erythematous with exposed bone, lacks the protective clot, and is tender on palpation. Additional features include halitosis, foul taste, and variable swelling or erythema of the surrounding soft tissues. The absence of a stable clot prolongs the inflammatory phase, delays epithelialization, and impairs mucosal closure, leaving the wound vulnerable to bacterial invasion and secondary infection. Soft tissue healing is significantly compromised, with persistent inflammation causing erythema, edema, and discomfort, thereby impeding oral function and extending recovery time. Effective management and prevention strategies that focus on atraumatic surgical techniques, infection control, and clot preservation are essential to minimizing the impact of dry socket on soft tissue healing.[23]

Factors Influencing Soft Tissue Changes after Third Molar Extraction

The extent and quality of soft tissue changes following third molar extraction are influenced by a combination of surgical, patient-related, and adjunctive factors. Among surgical variables, flap design plays an important role, with triangular flaps offering superior access but often at the expense of increased soft tissue trauma, while envelope flaps tend to preserve interdental papillae but may restrict surgical visibility.[13] Similarly, the amount of bone removal and overall duration of surgery directly correlate with postoperative tissue injury, inflammation, and edema, leading to more pronounced soft tissue alterations. Patient-related factors also substantially affect healing outcomes: older individuals typically experience slower recovery and greater volume changes due to diminished regenerative capacity, while systemic conditions such as diabetes or immunosuppression can delay healing and exacerbate inflammation. Smoking further compromises vascularity, increases infection risk, and hinders soft tissue repair, whereas good oral hygiene supports more favorable periodontal and mucosal recovery. [24]

Future Directions in Enhancing Soft Tissue Healing after Third Molar Extraction

Minimally invasive and flapless surgical approaches have emerged as important strategies to reduce postoperative morbidity by minimizing surgical trauma and preserving soft tissue integrity. These techniques employ smaller incisions, limited flap elevation, conservative bone removal, and precise tooth sectioning, with examples including laser-assisted minimal access procedures and modified envelope

flaps. By reducing dissection and maintaining vascularity, minimally invasive and flapless methods help lower the incidence of postoperative pain, swelling, and trismus while promoting faster mucosal healing. Clinical evidence suggests that these approaches provide superior patient comfort and improved recovery outcomes compared to conventional flap designs. Parallel advances in biomaterials further enhance soft tissue healing following extractions. Autologous platelet concentrates such as platelet-rich fibrin (PRF) and platelet-rich plasma (PRP) release growth factors that stimulate angiogenesis, collagen deposition, and soft tissue regeneration at extraction sites. Additional biomaterials, including collagen membranes, bioactive glass, and hydroxyapatite, act as scaffolds that support both soft and hard tissue repair. Adjunctive modalities like ozone therapy and low-level laser therapy (LLLT) contribute antimicrobial, anti-inflammatory, and biostimulatory benefits that accelerate healing. Furthermore, pharmacological innovations such as locally delivered antimicrobials, corticosteroids, and targeted anti-inflammatory agents complement these techniques by controlling infection, limiting inflammation, and optimizing the wound healing environment. Together, these advancements highlight a shift toward less invasive, biologically supportive, and patient-centered strategies for enhancing soft tissue outcomes after third molar extraction.[25]

Conclusion

Soft tissue changes following third molar extraction, including edema, trismus, and alterations in mucosal healing, are influenced by surgical technique, patient factors, and the use of adjunctive therapies. Understanding these changes is essential for optimizing postoperative outcomes, minimizing complications, and ensuring effective patient care. The adoption of minimally invasive approaches, flapless techniques, and biomaterial-based adjuncts has been shown to enhance soft tissue repair, reduce discomfort, and accelerate recovery. Incorporating evidence-based strategies in clinical practice therefore improves prognosis, promotes faster healing, and supports overall patient management after third molar surgery.

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