Turkish Archives of Pediatrics

SCIENTIFIC LETTER
DOI: 10.5152/TurkArchPediatr.2024.24013

Advanced Management of Mucoceles: Clinical Perspectives and Modern Treatment Techniques

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Pediatric dentistry warrants a precise approach to managing oral soft tissue lesions, given the unique oral health challenges that children face.[1] These lesions, including mucoceles, pyogenic granulomas, aphthous ulcers, hemangiomas, gingival fibromas, eruption cysts, and ranulas, present as alterations in the oral mucosa's color, size, or structure.[2,3] Their development can be attributed to various factors such as trauma, irritation from dental appliances, infections, allergies, and autoimmune disorders, emphasizing the need for comprehensive understanding for effective prevention and treatment.[2] Treatment for oral soft tissue lesions in children varies depending on the type, severity, and symptoms.[1] Mucoceles are common benign oral lesions characterized by fluid-filled sacs typically form on the inside of the lower lip or the floor of the mouth and are more prevalent in children and adolescents.[4] They commonly affect both major and minor salivary glands, presenting as small, painless, translucent or bluish, soft, rubbery lesions. These are the most common minor salivary gland disorder and frequently biopsied in pediatric patients[3,4] and are classified into 2 types: extravasation and retention.[4,5] Treatment of mucoceles depends on size, location, and age.[5]

Among the various available management techniques, surgical approach is the most common choice and includes 3 possible approaches, i.e. simple excision of the lesion, marsupialization, and complete excision of the lesion along with the associated salivary gland.[6] In a case series by Saskianti et al,[7] all 4 cases had an uneventful healing[7] conventional surgical excision with a scalpel was favored for its low recurrence rate. A comparative study by Bahadure et al[8] confirmed that conventional surgery is the definitive treatment for oral mucoceles in pediatric patients. Following surgery, patients experienced improved comfort, chewing, and speech, with a reduction in lip-biting behavior.[7] Surgical excision, while considered the gold standard due to its cost-efficiency and effectiveness in preventing recurrence,[3] has several drawbacks including potential lip disfigurement, damage to adjacent ducts, and the formation of satellite lesions. In cases of recurrence, it is recommended to remove the cyst along with adjacent salivary glands down to the muscle layer.[9,10] Hydro dissection, involving injection under pressure saline and lidocaine with 1:100 000 epinephrine into the dissection plane, is used across various surgical fields to facilitate excision.[11] Choi et al[11] reported minimal postoperative discomfort of mild limitations in tongue movement and swelling resolving spontaneously. Four-week follow-up revealed complete mucosal healing without significant scarring and high patient satisfaction. Compared to other techniques, hydro dissection resulted in less bleeding, fewer neural and soft-tissue injuries, and lower recurrence rates.[11]

Cryotherapy, which employs extreme cold for tissue destruction, has advanced since Arnott's early cancer treatments. Liquid nitrogen, the most common cryogen, reaches −25°C to −50°C, inducing inflammation and lesion destruction.[12,13] Techniques include closed systems with nitrous oxide probes and open systems with liquid nitrogen spray, leading to extracellular crystallization, cell membrane hardening, and intracellular electrolyte toxicity, ultimately causing cell death.[14] Case reports document successful lesion healing without complications.[13,15] In a study of 30 patients, cryotherapy significantly reduced pain and swelling by the seventh postoperative day, with minimal discomfort. Delayed healing occurred in 3 patients,

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Received: January 17, 2024
Revision Requested: February 20, 2024
Last Revision Received: September 24, 2024
Accepted: September 25, 2024
Publication Date: November 11, 2024

Cite this article as: Godhi BS, Yurembam S, Cherukodath SPF, HP J, HP C. Advanced management of mucoceles: clinical perspectives and modern treatment techniques. *Turk Arch Pediatr.* 2025;60(1):103-105.

and 2 cases (6.7%) showed lesion recurrence.[16] Despite challenges like unpredictable swelling and imprecise freezing depth, cryotherapy remains an effective, minimally invasive treatment with few long-term side effects.[12,17]

A nonsurgical protocol using intralesional corticosteroid injections, particularly betamethasone, has proven effective in treating oral mucoceles. Corticosteroids, with their potent anti-inflammatory and sclerosing properties, reduce the size of dilated salivary ducts. In a study of 20 patients, 18 experienced complete regression.[10] Another report detailed the successful treatment of a nodular lesion, achieving complete resolution within 2 weeks and no recurrence after 1 year.[18] This simple, less invasive, and cost-effective approach serves as a viable first-line alternative to surgery,[10,18] but corticosteroid injection, preceded by cyst aspiration, induces pseudocyst wall collapse and a severe inflammatory reaction, leading to marked fibrosis.[19]

Sclerotherapy is a safe, cost-effective treatment for oral mucoceles, particularly in challenging locations. Classified into hyperosmolar, detergent, and chemical types,[20] STS (sodium tetradecyl sulfate), a detergent-type sclerosant, induces necrosis and sloughing within the lesion, leading to partial or complete regression.[21] Effective in managing mucoceles, pyogenic granulomas, ranulas, and vascular malformations,[22] STS has shown complete resolution in cases with minimal recurrence risk. This less invasive alternative to surgery is valuable in clinical practice.[23] Intralesional injection therapy with OK-432 (Picibanil), initially developed for cancer immunotherapy,[24] induces strong local inflammation and cytokine release, was first applied to lymphangioma by Ogita et al[25] in 1987. In a study, 20 patients received OK-432, resulting in complete lesion resolution in 16 and significant reduction in 4. This outpatient procedure is a safe and effective alternative to surgery.[26]

Laser-assisted surgery has revolutionized stomatology, offering precise, minimally invasive treatment for oral soft tissue conditions. This technique uses focused light energy and its major benefits include achieving hemostasis, enhancing surgical visibility, surgical site sterilization, and reduced need for suture placement due to minimal tissue damage.[27,28] Modern systems preserve biopsy samples by minimizing tissue carbonization. Diode lasers, particularly at 980 nm, cut more efficiently due to better water absorption. Neodymium-doped yttrium aluminium garnet (Nd:YAG) lasers, with high-energy output, enable precise soft-tissue ablation and coagulation. CO_2 lasers are ideal for broad-based intraoral lesions but may cause more scarring.[27,28] Erbium lasers, now used for soft tissue, minimize inflammation and thermal damage. KTP lasers are preferred for excisional biopsies and vascular lesions due to selective absorption, reducing deep thermal injury.[27,28]

Oral mucocele surgery, a key component of oral and maxillofacial procedures, has increasingly adopted minimally invasive techniques that prioritize patient comfort and effective outcomes.[28]

Lasers have revolutionized dental care, offering safe, precise, and minimally invasive mucocele excision especially in pediatric cases.[4,9] While minimally invasive techniques like marsupialization and laser-assisted excision are increasingly used for oral mucocele surgery, no single method is definitively superior.[28] A review by Scribante et al[28] underscores the advantages of laser therapy but emphasizes the need for randomized trials. Conservative management is advised for small, asymptomatic mucoceles,[3] whereas surgical removal is recommended for larger or recurrent cases to prevent relapse.[5] Other treatments for ranulas, such as aspiration, drainage, and marsupialization, have higher recurrence risks. Cryosurgery's effectiveness is inconsistent, and OK-432 injections, though effective, are contraindicated for penicillin-allergic patients and may cause adverse effects like fever and local pain.[29] Despite quicker recovery with laser therapy and cryotherapy,[9] surgical excision remains the gold standard due to its cost-effectiveness and low recurrence rate.[3]

Availability of Data and Materials: The data that support the findings of this study are available on request from the corresponding author.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – B.S.G., S.Y.; Design – B.S.G., J.H.P.; Supervision – B.S.G., J.H.P.; Materials – B.S.G., S.Y., S.P.F.C.; Data Collection and/or Processing – S.Y., S.P.F.C.; Literature Search – S.Y., S.P.F.C.; Writing – B.S.G., S.Y.; Critical Review – B.S.G., S.Y., J.H.P., C.H.P.

Declaration of Interests: The authors have no conflicts of interest to declare.

Funding: This study received no funding.

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