Dental Implant Considerations in Patients with Sarcoidosis: A Review

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***Abstract*—Sarcoidosis is a chronic multisystem granulomatous disease characterized by the formation of non-caseating granulomas in affected tissues. Although the lungs and lymphatic system are most commonly involved, the disease may affect virtually any organ, including structures within the oral and maxillofacial region. Oral manifestations are relatively rare but may involve the salivary glands, oral mucosa, and jaw bones, thereby influencing dental treatment planning. Dental implants represent a predictable and widely accepted treatment modality for the rehabilitation of partially or completely edentulous patients; however, systemic diseases affecting immune regulation and bone metabolism may influence implant success. In patients with sarcoidosis, chronic granulomatous inflammation, altered calcium metabolism, and the use of long-term corticosteroid therapy may potentially compromise bone healing and osseointegration. The purpose of this review is to discuss the pathophysiology of sarcoidosis, its oral manifestations, and the clinical considerations relevant to implant therapy in affected individuals.**

I. INTRODUCTION

Sarcoidosis is a systemic inflammatory disorder of unknown etiology characterized histologically by the presence of non-caseating granulomas in involved tissues. The disease most frequently affects the lungs and intrathoracic lymph nodes but may also involve the skin, eyes, liver, nervous system, and skeletal structures. The formation of granulomas represents an exaggerated immune response to unidentified antigens, resulting in chronic inflammation and tissue remodeling [1].

The prevalence of sarcoidosis varies geographically and among different ethnic populations, with reported rates ranging from approximately 5 to 40 cases per 100,000 individuals. The condition most commonly occurs in adults between the second and fifth decades of life and demonstrates a slight female predominance [2]. Although oral involvement is relatively uncommon, sarcoidosis may affect the oral mucosa, salivary glands, and maxillofacial bones, occasionally presenting as the initial manifestation of systemic disease [3].

Dental implants have become a widely accepted treatment option for replacing missing teeth, with high long-term success rates reported in healthy individuals. The success of implant therapy relies heavily on the biological process of osseointegration, which involves the formation of a direct structural and functional connection between bone and the implant surface. Systemic conditions that alter immune responses, bone metabolism, or wound healing may influence the stability and longevity of dental implants [4]. Sarcoidosis represents one such condition in which systemic inflammatory processes and pharmacological therapies may affect implant outcomes.

II. PATHOPHYSIOLOGY OF SARCOIDOSIS AND ITS RELEVANCE TO IMPLANT DENTISTRY

The hallmark feature of sarcoidosis is the development of non-caseating granulomas composed primarily of epithelioid macrophages, multinucleated giant cells, and activated T lymphocytes. These granulomas form as part of a cell-mediated immune response and may lead to tissue destruction and fibrosis in chronic stages of the disease [1].

Involvement of osseous structures in sarcoidosis, although uncommon, has been documented in several studies. When the jaws are affected, granulomatous inflammation may lead to localized bone resorption

and radiolucent lesions. Such alterations in bone architecture may compromise the quality and quantity of bone available for implant placement and may influence the stability of implants placed in affected regions [5].

Immune dysregulation plays a central role in the pathogenesis of sarcoidosis. Increased activation of T helper lymphocytes and macrophages results in elevated production of inflammatory cytokines such as tumor necrosis factor-alpha, interleukin-2, and interferon-gamma. These cytokines are known to influence bone remodeling by altering the balance between osteoblastic bone formation and osteoclastic bone resorption. Persistent inflammatory activity may therefore interfere with the biological processes required for successful osseointegration [6].

Another important systemic feature of sarcoidosis is its effect on calcium and vitamin D metabolism. Activated macrophages within granulomas are capable of converting inactive vitamin D into its active form, leading to increased intestinal calcium absorption and, in some cases, hypercalcemia and hypercalciuria. Alterations in calcium metabolism may influence bone density and turnover, potentially affecting implant stability and long-term bone maintenance around implants [7].

III. ORAL MANIFESTATIONS OF SARCOIDOSIS

Oral manifestations of sarcoidosis are reported in approximately 0.5–5% of patients and may involve various oral tissues. The gingiva, buccal mucosa, lips, palate, and tongue have all been described as potential sites of involvement. Clinically, oral sarcoidosis may present as nodular lesions, mucosal swelling, ulcerations, or gingival enlargement. In certain cases, enlargement of the salivary glands may result in xerostomia and associated oral discomfort [3].

Osseous involvement of the jaws may present radiographically as poorly defined radiolucent lesions or areas of bone destruction. These lesions may occasionally resemble periodontal disease, cystic lesions, or neoplastic processes, making diagnosis challenging without histopathological confirmation. Granulomatous infiltration of alveolar bone may compromise periodontal support and potentially affect the stability of dental implants placed in the affected region [5].

Although rare, cases of peri-implant bone loss associated with sarcoidosis have been reported in the literature. In such cases, histological examination of peri-implant tissues revealed granulomatous inflammation consistent with sarcoidosis, suggesting that the disease process may directly involve tissues surrounding dental implants [8].

IV. IMPACT OF SARCOIDOSIS ON IMPLANT OSSEOINTEGRATION

Osseointegration is a complex biological process involving coordinated bone remodeling, vascularization, and immune regulation. Successful implant integration requires an environment that supports osteoblast activity and new bone formation while minimizing inflammatory responses. Systemic diseases characterized by chronic inflammation may disrupt this balance and impair the integration of dental implants [4].

In patients with sarcoidosis, persistent immune activation and cytokine release may influence the cellular mechanisms involved in bone remodeling. Increased levels of inflammatory mediators may stimulate osteoclastic activity, leading to enhanced bone resorption and potentially compromising the stability of implants. Despite these theoretical concerns, several case reports have demonstrated successful implant rehabilitation in patients with stable sarcoidosis, suggesting that implant therapy may be feasible when the disease is well controlled [9].

Nevertheless, clinicians should remain aware of the possibility that sarcoid granulomas may develop within peri-implant tissues, particularly in patients with active disease. In such situations, peri-implant bone loss may occur despite adequate oral hygiene and prosthetic design, highlighting the importance of careful monitoring in these patients [8].

V. INFLUENCE OF SYSTEMIC THERAPY

The management of sarcoidosis often involves pharmacological therapy aimed at suppressing the inflammatory response. Corticosteroids remain the primary treatment modality and are frequently administered for prolonged periods in patients with chronic or severe disease. Long-term corticosteroid therapy is associated with several systemic effects that may influence dental implant outcomes, including

delayed wound healing, suppression of immune responses, and decreased bone formation [10].

In addition to corticosteroids, other immunosuppressive agents such as methotrexate, azathioprine, and tumor necrosis factor inhibitors may be prescribed in patients who do not respond adequately to steroid therapy. These medications may further compromise the body's ability to respond to infection and may influence the healing process following implant surgery [11].

Chronic steroid therapy may also contribute to reduced bone mineral density and osteoporosis, which could potentially affect the primary stability of implants and the maintenance of peri-implant bone levels over time.

VI. CLINICAL CONSIDERATIONS FOR IMPLANT THERAPY

The decision to place dental implants in patients with sarcoidosis should be based on a comprehensive evaluation of the patient's systemic health and disease status. Implant therapy is generally considered more predictable when the disease is stable or in remission and when systemic inflammation is adequately controlled [12].

Radiographic assessment plays a critical role in treatment planning. Imaging modalities such as panoramic radiography and cone-beam computed tomography allow clinicians to evaluate bone density, detect possible granulomatous lesions, and assess the anatomical suitability of potential implant sites [13].

During implant placement, surgical techniques should aim to minimize trauma to bone and surrounding tissues. Adequate irrigation during osteotomy preparation, careful handling of tissues, and the achievement of sufficient primary stability are essential for promoting successful osseointegration. In patients receiving long-term corticosteroid therapy, consultation with the patient's physician may be necessary to determine appropriate perioperative management and assess the need for steroid supplementation [14].

VII. MAINTENANCE AND LONG-TERM MONITORING

Long-term success of dental implants depends not only on proper surgical placement but also on effective maintenance and monitoring. Patients with systemic inflammatory diseases such as sarcoidosis should be enrolled in regular recall programs to allow early detection of peri-implant complications. Clinical examinations should include assessment of peri-implant soft tissues, probing depth measurements, and radiographic evaluation of crestal bone levels [15].

Because chronic inflammatory conditions may predispose individuals to peri-implant mucositis or peri-implantitis, strict oral hygiene practices and professional maintenance visits are essential. Early identification and management of inflammatory changes may help preserve peri-implant bone and prolong implant survival.

VIII. CONCLUSION

Sarcoidosis is a multisystem granulomatous disorder that may present unique challenges in implant dentistry due to its effects on immune regulation, bone metabolism, and systemic pharmacological therapy. Although oral involvement is relatively uncommon, granulomatous lesions affecting the jaws and peri-implant tissues may influence implant stability and long-term outcomes. Current evidence suggests that dental implant therapy can be successfully performed in patients with stable sarcoidosis; however, careful patient selection, thorough medical evaluation, and meticulous treatment planning are essential. Close collaboration between dental clinicians and medical specialists, combined with regular postoperative monitoring, is necessary to ensure optimal implant outcomes in this patient population.

REFERENCES

[1] Iannuzzi MC, Rybicki BA, Teirstein AS. Sarcoidosis. N Engl J Med. 2007;357(21):2153-65.

[2] Valeyre D, Prasse A, Nunes H, Uzunhan Y, Brillet PY, Müller-Quernheim J. Sarcoidosis. Lancet. 2014;383(9923):1155-67.

[3] Neville BW, Damm DD, Allen CM, Chi AC. Oral and Maxillofacial Pathology. 4th ed. St Louis: Elsevier; 2016.

[4] Albrektsson T, Branemark PI, Hansson HA, Lindström J. Osseointegrated titanium implants: requirements for ensuring a long-lasting, direct bone-to-implant anchorage in man. Acta Orthop Scand. 1981;52(2):155-70.

[5] Suresh L, Radfar L. Oral sarcoidosis: a review of literature. Oral Dis. 2005;11(3):138-45.
[6] Reich JM. Neoplasia in systemic sarcoidosis. Sarcoidosis Vasc Diffuse Lung Dis. 2006;23(2):101-12.
[7] Baughman RP, Lower EE, du Bois RM. Sarcoidosis. Lancet. 2003;361(9363):1111-8.
[8] Alawi F. Granulomatous diseases of the oral tissues: differential diagnosis and update. Dent Clin North Am. 2013;57(4):657-71.
[9] Berglundh T, Armitage G, Araujo MG, Avila-Ortiz G, Blanco J, Camargo PM, et al. Peri-implant diseases and conditions: Consensus report of workgroup 4 of the 2017 World Workshop. J Periodontol. 2018;89(Suppl 1):S313-8.
[10] Judson MA. The diagnosis of sarcoidosis. Clin Chest Med. 2008;29(3):415-27.
[11] Baughman RP, Culver DA, Judson MA. A concise review of pulmonary sarcoidosis. Am J Respir Crit Care Med. 2011;183(5):573-81.
[12] Misch CE. Dental Implant Prosthetics. 2nd ed. St Louis: Elsevier Mosby; 2015.
[13] Esposito M, Grusovin MG, Worthington HV. Interventions for replacing missing teeth: dental implants in patients with systemic diseases. Cochrane Database Syst Rev. 2013;(3):CD003539.
[14] Koyama S, Handa T, Ito Y, Watanabe K, Tanizawa K, et al. Comparison of clinical characteristics of patients with sarcoidosis and other granulomatous diseases. Respir Investig. 2014;52(6):361-6.
[15] Rizzato G, Montemurro L. Sarcoidosis and bone metabolism. Sarcoidosis Vasc Diffuse Lung Dis. 1997;14(2):123-9.