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Review Article

Medication-related osteonecrosis of the jaw: Prosthodontic considerations

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ABSTRACT

Medication-related osteonecrosis of the jaw (MRONJ) can be triggered by several antiresorptive and antiangiogenic medications, including bisphosphonates (BRONJ), denosumab (DRONJ), and other agents used to treat osteoporosis and metastatic bone cancer. Prosthodontists and surgeons continue to face new challenges because of this condition. Despite the current evidence showing that extensive surgical intervention and laser surgery have the highest healing rates, surgical reconstruction is not always possible for large jaw defects requiring prosthetic reconstruction. Moreover, surgical treatment may not be an option in some patients because of other medical conditions. In these patients, MRONJ may develop into a chronic disease with limited resolution and they may seek prosthetic rehabilitation for aesthetic and functional reasons. Therefore, prosthetic intervention may be necessary for some patients with MRONJ even in the absence of a surgical defect. Denture trauma has been reported to be a risk factor for MRONJ, and few reports have discussed the prosthodontic considerations needed for patients with this condition. The aim of this review is to highlight the prosthodontic considerations that would decrease the risk of triggering MRONJ in susceptible patients.

1. Introduction

Medication-related osteonecrosis of the jaw (MRONJ) can be triggered by several antiresorptive and antiangiogenic medications, including bisphosphonates (BRONJ), denosumab (DRONJ), and other medications used to treat osteoporosis and metastatic bone cancer [1]. Prosthodontists and surgeons continue to face various challenges because of this condition [1–4]. Conservative therapy, such as treatment of exposed necrotic bone with antibiotics and mouthwash [5] or hyperbaric oxygen [6], and jaw resection and reconstruction [7] are options for the treatment of MRONJ. Despite current evidence showing that the highest healing rates (80%–100%) are achieved by extensive surgical intervention or laser surgery [8], large jaw defects are not always amenable to surgical reconstruction and may require prosthetic reconstruction [3,9,10]. Moreover, surgical treatment may not be an option if other medical conditions are present; in these patients, MRONJ may develop into a chronic disease with limited resolution [11]. Patients with active MRONJ may also seek prosthetic rehabilitation for aesthetic and functional reasons. Therefore, prosthetic intervention may be needed for patients with MRONJ even if there is no surgical defect. Although denture trauma has been reported to be a risk factor for MRONJ [12], few reports have discussed prosthodontic considerations in these patients [10,11,13,14]. A drug holiday before dental treatment has been demonstrated not to reduce the risk of BRONJ because bisphosphonates can persist in the tissues for up to 12 years [15]. Therefore, there is a need to clarify the prosthodontic considerations that should be adopted during rehabilitation of patients with MRONJ. The aim of this review is to highlight prosthodontic considerations that would help to decrease the risk of triggering MRONJ in susceptible patients based on the available literature.

2. Methods

The PubMed, Web of Science, Google Scholar, and Scopus databases were searched for articles related to prosthodontic treatment of patients with MRONJ. The following search terms were used: “osteonecrosis of the jaw,” “jaw necrosis,” “antiresorptive agent,” “bisphosphonate(s),” “denosumab,” “medication,”

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"antiresorptive(s)," "antiresorptive agent," "denture," "prosthesis," "obturator," "rehabilitation," "prosthodontic treatment," "clinical considerations," and "prosthetic management". The following related entry key words were used in different combinations using the Boolean operators "AND" and "OR" when searching the four databases: #1 ("osteonecrosis" OR "osteonecrosis of the jaw" OR "jaw necrosis") AND #2 ("bisphosphonate(s)" OR "denosumab" OR "medication" OR "antiresorptive" OR "antiresorptive agent") AND #3 ("denture," OR "prosthesis," OR "prostheses," OR "obturator," OR "rehabilitation," OR "prosthodontic treatment," OR "clinical considerations" OR "prosthetic management"). Articles on prosthetic rehabilitation of patients with MRONJ published in English were obtained for further review.

3. Results

In total, 12 articles, consisting of 6 case reports [10,11,13–16], 1 book chapter [17], and 5 reviews [18–22], were selected based on title and abstract and reviewed for prosthodontic recommendations during rehabilitation of patients with MRONJ. The following considerations were identified.

4. Making impressions

The quality and quantity of the ridge are diminished in cancer patients because of the accelerated loss of trabecular and cortical bone, which makes the ridge more vulnerable to functional loads transferred through the prosthesis [20]. Therefore, the primary goal of prosthetic treatment in patients with MRONJ must be to minimize the pressure exerted on the mucosa by the dental prosthesis [14]. If a removable prosthesis is planned, functional loads on the basal seat should be decreased by using minimal pressure impressions and functional border placement to create a "snowshoe" effect, which reduces the force per unit area while providing retention and stability [20]. Mucosal support should be avoided in critical areas of vulnerable tissue, areas of healed MRONJ, and sites of recent extractions [17]. Preliminary impressions are made in irreversible hydrocolloid and elastomeric materials are used for making the definitive impression in a pressure-less fashion [10,11,15]. Special attention should be paid to procedures used for border molding [11]. Undercuts should be blocked out and areas of anatomic alterations should be relieved on the diagnostic cast before making the definitive impression [13,15]. As a precaution, Göllner et al. recommend a single dose of a prophylactic antibiotic and oral rinsing with a mouthwash for 1 min before oral preparation and impression making to minimize the risk of infection [14].

5. Jaw relation and occlusion

Use of a heat-polymerized denture base when registering the jaw relation is recommended [10,11]. This allows the rims to be more stable, provides insight regarding the retention of the dentures at an early stage and reduces the likelihood of finding occlusal discrepancies when the prosthesis is delivered [11,23]. Acrylic cuspless/monoplane teeth are recommended for less stress transmission to the remaining bone and to reduce unwanted horizontal forces [20]. Within functional limits, narrowing the occlusal table and reducing vertical overlap of prosthetic teeth may also be recommended [20].

6. Retention of the prosthesis

The presence of remaining natural teeth can improve retention of the obturator and wire clasps that rest on the remaining dentition can be used to increase stability [24]. Göllner et al. recommend rigid stabilization of a dental prosthesis using telescopic crowns to minimize the risk of inducing MRONJ [14]. The risks of mobility of the prosthesis and displacement of the denture base are lower when there is a rigid connection between the prosthesis and the abutments than when a removable partial denture retained by clasps is used [14,25]. For edentulous patients, a dental implant can be considered for anchorage of the prosthesis [26]. However, this remains a controversial issue because the risk of implant failure is increased in patients taking bisphosphonates, especially those with cancer, who are likely to be receiving high doses of these agents [1,27]. Given the lack of research and the controversy surrounding dental implants in these patients, it is advisable to avoid them altogether, along with all other types of oral surgery [22].

7. Denture base material and processing

Göllner et al. recommend a heat-polymerized resilient liner as a denture base material [14]. Some authors have suggested a denture base material consisting of heat-activated acrylic resin that is polymerized using a long cycle at a low temperature and reaches boiling point only at the end of polymerization [13]. In case of incomplete healing of a fresh wound, a temporary resilient material can be used to reline the denture base and be replaced later by a definitive heat-polymerized resilient liner when healing is complete [14]. Göllner et al. also suggested that if a definitive soft liner material is used, it should be changed at shorter intervals depending on its roughness and stiffness [13]. A minimum thickness of 1.5–2 mm is necessary to distribute the pressure on the supporting tissues underneath the denture base [28], and some authors even recommend 3 mm [29,30]. Application of a resilient denture liner to the denture base would prevent localized stresses and distribute the load more evenly over the denture base [14,29]. In this way, a resilient liner can act as a cushion to reduce pressure, allowing the soft tissue to heal and bone remodeling to proceed without complications [29–31]. However, the risk of bacterial or fungal contamination is greater with a denture liner than with hard acrylic resin [32]. Therefore, frequent cleaning with a 5.25% sodium hypochlorite solution is recommended [33]. Another limitation is the reduction in both tensile strength and shear bond strength between the resilient lining materials and the denture base [34,35]. More successful results can be achieved by selecting the surface treatment according to type of resilient lining material to increase the bond strength [36].

8. Denture delivery

All denture edges should be rounded and smoothed by meticulous finishing and polishing, especially in the lower jaw. A pressure-indicating paste should be used at the installation appointment to identify and relieve areas of excessive pressure that could traumatize the oral mucosa [13]. If maxillary or mandibular tori, sharp bony ridges, or any structure that would interfere with insertion and removal of the prosthesis are present, adequate relief should be provided in these areas to avoid injury [13]. There is a risk of developing sore spots after delivery of new dentures. Kivovics et al. observed denture-induced mucosal injuries in 87% of patients in the first week, 50% in the second week, and 7% in the third week after complete denture insertion [37]. There could be a significant risk of development of MRONJ at this time, and patients receiving new dentures must be informed about the potential risk of sore spots and MRONJ. Should such spots appear, the patient should consult their dentist immediately to remove the cause. If this cannot be done in a timely manner, the dentures should not be worn until an appointment is scheduled, even if the areas involved cannot be recognized later [17].

9. Follow-up

Patients with a history of MRONJ must be monitored closely when receiving mucosa-supported dentures, and the denture base must be relined frequently to prevent imbalanced distribution of occlusal force, which may induce denture trauma and reactivate MRONJ [10]. If the prosthesis is ill-fitting or highly mobile, the mucosa can be injured, thereby permitting entry of oral flora into the bone [38,39]. Ill-fitting dentures and painful spots are reportedly the second most common reasons for MRONJ triggered by this mechanism [40]. Therefore, the health of the denture-bearing tissues should be assessed clinically and radiographically every 2–3 months [19,20]. Leven et al. recommend the use of a permanent soft lining between follow-up visits for patient with active MRONJ [11] to improve the retention and stability of the prosthesis and limit any trauma to the denture-bearing area by providing a cushioning effect. It is recommended that the prosthesis be kept out of the mouth for at least 12 h daily [20].

10. Patients with active MRONJ

Conservative prosthetic treatment is recommended for patients with active MRONJ [11,15]. When the patient still has regions of MRONJ present at the initial visit, a successfully delivered prosthesis may improve quality of life by decreasing pain and improving function and aesthetics [16]. A well-fitted clean denture may prevent secondary infection of MRONJ and facilitate healing [11,14]. An acrylic base plate, which would act as both a training plate and a cover plate, can also be used until definitive treatment is provided [16].

11. Fixed prostheses

The risk of MRONJ appears to be lower with fixed partial dentures than with mucosa-supported removable partial dentures. However, it is still important to pay particular attention to the biological width to avoid bacterial invasion of the junctional epithelium [18]. Ideally, a supragingival prosthetic margin should be provided to minimize the possibility of severe damage to the gingival tissue and facilitate check-ups and oral hygiene at home [41]. Antibiotics and a moderately strong local mouth rinse (chlorhexidine) can be considered during preparation and impression making [17].

12. Temporary prostheses

Sore spots and subsequent MRONJ lesions are more likely to develop with provisional removable prostheses than with permanent dentures because the former are generally less stable and less supported by the residual teeth or gums after extractions or surgery. Indeed, some authors advise strongly against the use of a provisional prosthesis to bridge the time gap until delivery of a definitive prosthesis [14]. Therefore, a temporary prosthesis should be planned and installed cautiously with careful and stringent recall considering the patient's level of self-care as well as their risk of MRONJ [17].

13. General guidelines for prosthodontic rehabilitation of patients with MRONJ

Some authors have recommended a rehabilitation protocol similar to that used in patients undergoing radiotherapy to the head and neck [13,42]. Marx [4] and Ruggiero [3] suggested the use of obturators for reconstruction of maxillary defects after resection of BRONJ. Troeltzsch et al. [10] concluded that obturators are a safe and predictable treatment option for long-term oroantral fistula after surgical treatment of MRONJ in well-selected patients [10]. Göllner et al. [14] used a non-invasive prosthetic therapy with telescopic overdentures and a heat-polymerized resilient liner and observed no complications during 2 years of follow-up. It has also been reported that dentures may reduce the risk of recurrence of MRONJ post-treatment provided that good oral hygiene is maintained [11], possibly because the mucosa is protected from external trauma when the prosthesis is relieved or relined. As suggested by Marunick and Gordon [15], if the prosthesis cannot be used atraumatically, as in the case of first-time denture wearers, it should not be used for mastication. In such cases, the patient should use it only for esthetic purposes [13]. Before antiresorptive treatment is started, preprosthetic surgery should be performed, if possible, to remove bony spikes and spicules that act as points of stress concentration during denture use [20]. Decisions regarding continued use of a current prosthesis, fabrication of a new prosthesis, or any invasive surgical procedures should be based on clinical judgement as dictated by the presenting condition, medical profile, and needs of the patient [15,22]. When a new denture is inserted, there is a risk of sore spots appearing that may develop into MRONJ [37]. Therefore, dentures that have been worn successfully for a long period should not be changed if there is no history of sore spots [17]. Successful treatment also depends on the patient's self-care ability and their compliance with the recommendations for daily hygiene of the prosthesis and the defect. A multidisciplinary team approach is essential for patients receiving antiresorptive therapy as part of their oncology treatment [17]. The relationship between the oncology team, dental team, and the patient should aim to reduce the risk of MRONJ by emphasizing preventive measures and a need for consistent communication.

14. Conclusions

There is still a lack of robust research data that can be used to formulate guidelines for prosthetic rehabilitation of patients with MRONJ. The primary goal of the prosthesis should always be to minimize pressure on the bearing tissues. A high level of oral hygiene and prosthesis care is essential, as well as close monitoring of the denture-bearing tissues and prosthesis at 2–3-month intervals. A multidisciplinary team approach is required to reduce the risk of MRONJ. Further long-term research is needed to develop a safe prosthodontic rehabilitation protocol for MRONJ that can be tailored to the needs of individual patients.

Conflicts of interest

None.

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