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Implant-prosthetic Rehabilitation after Removal of a Maxillary Cyst with Maxillary Sinus Involvement, without using Bone Augmentation Materials

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Abstract

Inflammatory odontogenic cysts are among the most frequent lesions of the maxillary bones. Through their evolution, these pathological formations may affect adjacent anatomical structures such as the nasal fossae or the maxillary sinus. Patient rehabilitation is a time-consuming process that can be a challenge for medical practitioners. In this study, authors present the case of a patient with a maxillary cyst involving the maxillary sinus, rehabilitated by implant-prosthetic treatment without using bone augmentation materials. Removal of the maxillary cyst was performed with the preservation of the maxillary sinus membrane, with apicectomy of the teeth adjacent to the cyst and extraction of the causative tooth. The post-cystectomy bone defect was protected with a pericardium membrane, and after 6 months postoperatively, a dental implant was placed in the edentulous area. Three years after cystectomy, the presence of mature bone in the defect area and the stability of the implant-prosthetic restoration could be observed. The rehabilitation method proved to be effective in obtaining a predictable and stable therapeutic outcome.

Keywords: odontogenic cysts; dental implant; bone defect; periapical lesions.

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1. Introduction

Periapical lesions originating in the infected dental pulp are the most frequent lesions of the jaw bones [1]. Most of these are periapical granulomas or apical periodontitis lesions and cysts [2,3]. The development of inflammatory periapical cysts is associated with dental pulp infection and gangrene. Inflammatory factors stimulate epithelial rests of Malassez and periapical epithelial cells which subsequently proliferate and develop into a cystic lesion [1,4-6]. Inflammatory cysts of odontogenic origin are divided by the World Health Organization into two categories: radicular cysts and residual cysts [7]. Despite the existence of these two categories, which are otherwise similar in terms of clinical, histological features as well as therapeutic approach, the difference between the two classes is strictly given by the presence of the causative tooth in the arch [1]. The majority of the inflammatory cysts occur in young or middle-aged adults, the highest incidence being in the third to the fifth decades of life.1 Inflammatory odontogenic cysts are most frequently located in the frontal maxillary area [1,8]. The evolution of inflammatory odontogenic cysts is a constant increase in size; some of them can reach considerable sizes, invading adjacent anatomical structures such as the maxillary sinus or the nasal cavity [9]. During their evolution, they can present acute complications with consequences on the entire human body [10,11]. The recommended therapeutic approach to maxillary cysts is a controversial subject. Some authors recommend conservative treatment, consisting of marsupialization of the cyst [12,13]. The major disadvantages of this method are the long healing time and a relative predictability of treatment associated with longer treatment duration and implicitly, limited dental rehabilitation possibilities. Another method reported in the literature is cystectomy with the application of augmentation material to the bone defect [9]. Cystectomy is a radical and efficient modality to treat maxillary cysts, but the use of bone augmentation material represents a relatively debatable option, particularly in the context where bone formation in the sinus floor after elevation of the sinus mucosa is reported in the absence of bone augmentation material [14,15]. Through this study, authors want to present the possibility of implant-prosthetic rehabilitation after removal of a maxillary cyst involving the maxillary sinus, without using bone augmentation material in the cystic cavity.

2. Case report

Male patient aged 23 years presented for examination due to deterioration of the crown of the maxillary left second premolar, accompanied by mild pain on axial pressure. Anamnesis and general clinical examination evidenced a clinically healthy patient, without a history of alcohol, tobacco or other substance use. The disease history showed that the first premolar underwent endodontic treatment 5 years before, and a metal-ceramic crown was placed subsequently. Intraoral examination evidenced horizontal tooth mobility in bucco-palatinal direction of about 1 mm and vertical mobility of 1mm. The oral mucosa exhibited no color changes, palpation in the left upper oral vestibule at the level of the maxillary left second premolar root was accompanied by mild pain. Panoramic X-ray was indicated for the imaging assessment of the case, final diagnosis making and implementation of the treatment plan. Radiological examination revealed the presence of radiolucency in the left maxillary alveolar ridge, partially including the roots of the maxillary premolars and first molar (**Figure 1**).

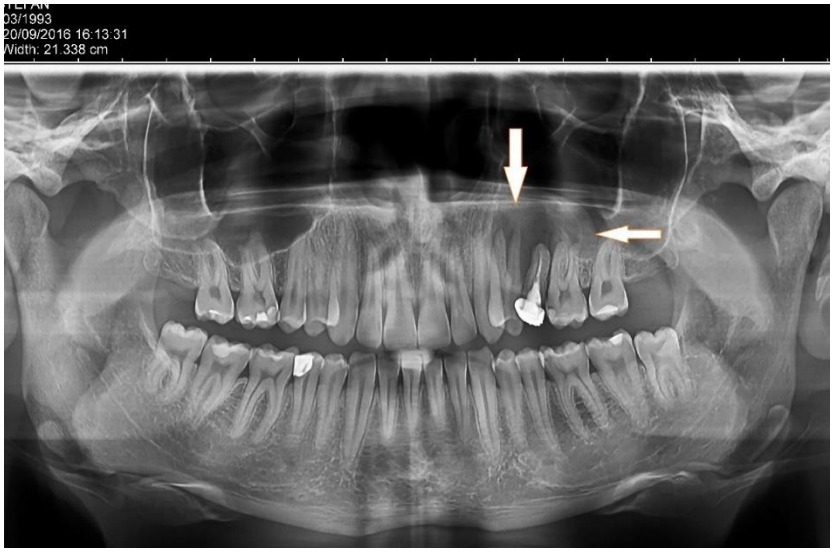

Figure 1: Radiological examination

Cone beam computed tomography (CBCT) was indicated to determine lesion characteristics such as size, the relationship with adjacent natural elements, the degree of involvement of maxillary teeth roots (**Figure 2**).

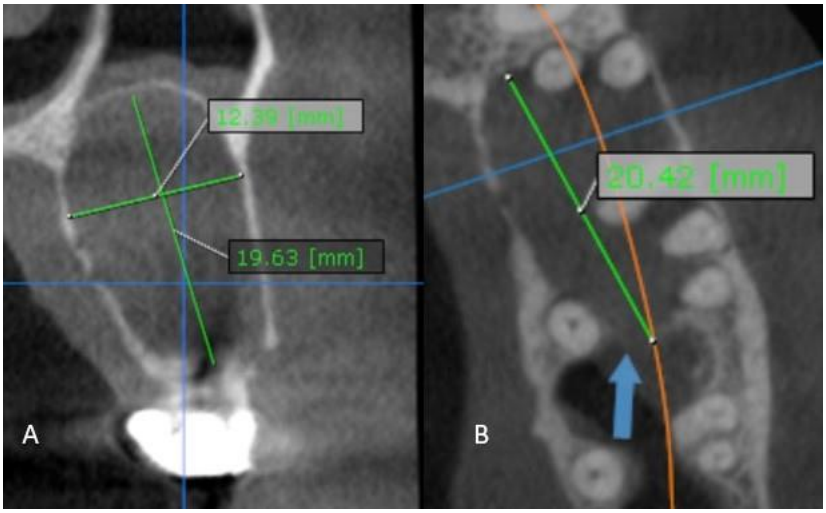

Figure 2: Cone beam computed tomography, measurement of the lesion size: bucco-palatinal diameter (A)and antero-posterior diameter (B)

CBCT evidenced the presence of cystic appearance lesions in the left maxillary alveolar rim that included almost the entire maxillary second premolar root and part of the maxillary first molar and premolar roots. Measurement of the lesion size showed a maximum vertical diameter of 19.63 mm and an bucco-palatinal diameter of 12.39 mm (**Figure 2A**), and a maximum antero-posterior diameter of 20.43 mm, with the disappearance of bone limits in relation to the maxillary sinus at the level of the maxillary first molar (**Figure 2B**). After radiographic evaluation, the treatment plan was presented to the patient. The patient signed an informed consent for implementation of the treatment plan, as well as for use and publication of his personal data for scientific purposes. The patient signed a written consent for the publication of images, and institutional

approval was not necessary. In the first stage of treatment, endodontic treatment of the maxillary first molar and premolar was performed in order to preserve them in the dental arch (**Figure 3**).

Figure 3: endodontic treatment of the maxillary first molar and premolar

After endodontic treatment, under local anesthesia, an incision with a scalpel blade no. 15C was carried out in the free gingiva at the level of the maxillary second premolar, which continued with two unloading oblique incisions in the vestibular bone ridge. The mucoperiosteal flap was detached and the vestibular cortical bone was exposed. With a steel No 6 round bur under continuous cooling, the vestibular cortical bone was trepanated and the cyst membrane was exposed. The cyst membrane was detached from the bone with a curette; to avoid cyst membrane rupture, the contact with the maxillary bone was permanently maintained. After evidencing the limits in relation to the bone underlying the cyst membrane, the maxillary second premolar was extracted. Concomitantly with the tooth extraction, serous-citrine fluid was removed from the cystic cavity. The cyst membrane was clamped with curved Mosquito forceps and was slightly tensioned. With a fine elevator, the cyst membrane was separated distally from the maxillary sinus mucosa which remained intact. The cyst membrane was removed and sent for anatomopathological examination. Subsequently, with a cylindrical drill, the roots of the maxillary left first premolar and molar were apically resected. The residual cavity after cystectomy and resection was checked for possible cystic epithelium remnants (**Figure 4**).

Figure 4: The residual cavity after cystectomy and resection

In the osteotomy area and over the post-extraction socket, an equine pericardium membrane (Bioteck S.p.A. Arcugno, Italy) was applied as an anti-epithelial invasion membrane, without addition of bone augmentation material. An incision was performed strictly in the periosteum of the mucoperiosteal flap, parallel to the occlusal margin in the mobile mucosa area. An advancement flap was created over the pericardium membrane, which was sutured in separate points with non-resorbable material. Oral antibiotic treatment with clindamycin 600 mg twice a day for 5 days and ketoprofen 100 mg every 12 hours for 3 days was initiated. Postoperative evolution was favorable; the sutures were removed at 10 postoperative days. Anatomopathological examination established the diagnosis of inflammatory cyst of odontogenic origin. Six months after cystectomy, control panoramic X-ray was performed (**Figure 5**), which evidenced a radiopaque appearance of the cystic lesion similar to the normal bone structure. In the center, a slight change in bone opacity, without pathological implications, could be identified.

Figure 5: control panoramic X-ray

In the edentulous area resulting from the extraction of the maxillary second premolar, a dental endoosseus implant (MegaGem Implant Co. Gyongsan-si, Republic of Koreea) 10 mm in length and 4 mm in diameter was placed at 0.5 mm below the bone. The implant was placed at 6 months after the cyst was removed. Three months after the placement of the dental endoosseus implant, its loading was carried out using a metal-ceramic crown. The patient presented for clinical and imaging control 3 months after prosthetic endoosseus implant loading (**Figure 6**), without any pathological changes being detected.

After 6 months, the patient presented for periodic control. Clinical examination evidenced no pathological changes in the area where the inflammatory cyst was present or in the implant-prosthetic restoration. Three years after cystectomy and more than 2 years after implant-prosthetic rehabilitation, postoperative evolution was favorable (**Figure 7**).

Figure 6: 3 months imaging control after prosthetic endoosseus implant loading

Figure 7: Three years after cystectomy and more than 2 years after implant-prosthetic rehabilitation

The dental endoosseus implant and bone stability were evaluated by imaging using retroalveolar X-ray (**Figure 8**), which showed peri-implant bone stability

Figure 8: Retroalveolar X-ray showed peri-implant bone stability

3. Discussion

Inflammatory cysts are the most common maxillary cysts. Extensive studies reveal that they are most frequently located in the anterior maxillary region [16]. Some authors report an incidence of inflammatory cysts higher than 60% in teeth requiring apicectomy [17]. Unless detected on time, these cysts evolve towards an invasion of adjacent anatomical structures like in the case described in this study [16]. The case presented in this study had a maxillary cyst and a tooth that needed to be extracted. Postoperative bone healing in such cases is most frequently accompanied by bone resorption both in terms of vertical dimension and vestibulo-oral dimension. The literature reports a 6-month bone resorption rate of 29-63% of the initial value for horizontal resorption and 11-22% for vertical resorption [18,19]. Bone resorption in the area of sinusal teeth, like in the case presented in this study, is accompanied by maxillary sinus pneumatization [20]. The alteration of the vertical and horizontal dimension of the maxillary alveolar ridge is even more pronounced when pathological formations are present which lead to increased hard substance loss. This is why the subsequent implant-prosthetic rehabilitation of residual edentulous areas will pose significant challenges for the treating doctor [18-20]. In the case of this patient, authors tried to prevent severe bone resorption by applying a pericardium membrane in order to stop epithelial cells from invading the bone defect resulting from cystectomy and extraction of the maxillary second premolar. This technique is based on the concept of blood clot stability derived from a great number of clinical studies that demonstrate successful bone and periodontal regeneration using membranes [21]. In this case authors used a pericardium membrane with a resorption duration of 3-4 months. Thus, the space occupied by the blood clot was in contact only with the pericardium membrane and the bony walls of the postoperative defect, except for a small distal area where it was in contact with the sinus mucosa. This technique is not faultless, the stability of the primary suture and postoperative scar formation being of major importance to obtain a stable outcome [21,22]. Maintaining the bone dimensions was paramount in this case, so that additional bone augmentation procedures were not necessary to provide the bone support required for dental endoosseus implant placement. In parallel, endodontic treatment of adjacent teeth having the apex in the cystic mass was performed. The aim of endodontic treatment was to prevent potential recurrences from one of the teeth whose apices were intended to be curetted, and apicectomies were carried out to eliminate the potential residual bacterial flora from

the apical canaliculi. A limitation of the current study is the fact that there is only one patient. Monitoring of the patient in the case presented in this study showed a favorable evolution 3 years after cystectomy, with bone formation in the cystic lesion and peri-implant bone stability. Spontaneous maxillary bone regeneration after cystectomy with or without bone augmentation material has been reported by other authors [23,24]. The conditions required to obtain good bone healing are preserving the bony walls, keeping the defect closed, maintaining the space and mechanical stability of the healing wound [23]. Peri-implant bone stability assessed 3 years after cystectomy was similar to that reported in the literature [25] the degree of resorption being practically negligible.

4. Conclusion

Removal of maxillary cysts without using bone augmentation material and subsequent implant-prosthetic rehabilitation is a reliable treatment method with stable and predictable results over time.

5. Disclosure

The author reports no conflicts of interest in this work

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