Case Report

Socket Sclerosis—An Obstacle for Orthodontic Space Closure?

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ABSTRACT

Background: Socket sclerosis is a rare reaction to tooth extraction resulting in high-density bone in the center of the alveolar process, where, under normal circumstances, cancellous bone is to be expected.

Materials and Methods: In an adult orthodontic patient, routine extractions of the mandibular first permanent bicuspids were performed, resulting in socket sclerosis and unsuccessful orthodontic space closure. Orthodontic mini-implants were inserted to augment anchorage and aid in space closure.

Results: In the presence of socket sclerosis, conventional orthodontic mechanics failed to close the extraction spaces. However, with absolute anchorage in place, space closure occurred at a nearly normal rate. After treatment, no signs of socket sclerosis were discernible on the periapical radiographs.

Conclusion: Socket sclerosis can be an obstacle for orthodontic space closure if traditional mechanics are employed. However, mini-implant–reinforced anchorage can lead to successful space closure, resulting in complete resolution of the sclerotic sites. (*Angle Orthod.* 2009;79:800–803.)

KEY WORDS: Socket sclerosis; Bone pathology; Mini-implants; Mini-screws; Space closure; Anchorage

INTRODUCTION

Sclerosis of the jaws is a not-uncommon finding that has been described extensively in the dental literature. It can occur in different degrees of severity, ranging from the congenital systemic form called osteopetrosis (Albers-Schoenberg disease, marble-bone disease, osteosclerosis fragilis generalisata) to the very benign form of idiopathic sclerosis of the jawbone.[1–6] Localized sclerosis of the jawbone presents as a round radiopacity most commonly found in the region of the dental periapex, and it is considered a lesion that is usually formed in direct response to localized chronic inflammation.[7,8] It is called condensing osteitis, focal sclerosing osteomyletis, or focal periapical osteopetrosis.[9–11] It most often appears in females and is usually located in the mandible. The most frequently affected site is the periapex of the first molar, and the second most frequently affected site is the periapex of the second premolar.[4,10] In contrast to this finding, some localized radiopacities cannot be linked to any inflammation and are thus called *idiopathic sclerosis of the jawbone*.[3,6,12–14]

A rarely reported finding that is probably closely related to idiopathic sclerosis is socket sclerosis. To date, only five references could be found in the literature describing this phenomenon.[15–19] While the same finding has been named differently in every publication, the term *socket sclerosis*, which best describes this radiopaque lesion, was introduced by Burell and Goepp.[18] Radiographically, socket sclerosis occurs postextraction and presents as a radiopaque lesion similar in appearance to the dental root that was removed during the extraction.[15,18,19] While a series of defined events occurs in the normal healing of the extraction socket, certain disturbances in the healing process appear to lead to socket sclerosis.[18,20] According to Burell and Goepp,[18] three steps lead to osteosclerosis of the socket:

1. Lack of lamina dura resorption. This is in itself not pathognomonic of socket sclerosis, but it represents the first unconditional step to formation of a sclerotic socket.[18]

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2. Deposition of dense sclerotic bone along the inner aspect of the lateral walls of the alveolar socket. Deposition usually begins in the depth of the socket and continues crestally. As healing progresses, bone of considerable thickness and density can be identified radiographically in the periphery of the former socket with a bandlike area of decreased density at the center of the lesion, potentially mimicking a root canal. At this point in the healing process, the sclerotic lesion can easily be confused with a residual root fragment.[18,19]
3. Finally, deposition has been completed, resulting in an entire socket consisting of dense sclerotic bone within the bounds of the previously present lamina dura.[18]

Microscopically, socket sclerosis appears as dense trabeculations of sclerotic bone.[18] Similar observations can be made in the healing extraction sites of vitamin A–deficient rats, thus pointing to some disturbance in the bone metabolism; however, in humans, the cause is uncertain.[21] In one publication, a connection between socket sclerosis and systemic diseases was investigated, but the results remained inconclusive.[18]

The occurrence of socket sclerosis normally goes unnoticed clinically because there are no signs or symptoms associated with this finding, and thus, it is usually not clinically significant. Only radiographs taken at a later postoperative date will reveal socket sclerosis. The only situation in which socket sclerosis may become clinically significant is if the extractions were carried out for orthodontic purposes. In this case, the spaces created by the extractions are meant to be closed by the movement of teeth. Here, the reactive sclerosis may act as an obstacle to tooth movement, increasing treatment time or potentially making complete space closure with adequate root parallelism impossible.

The presentation of this orthodontic case is aimed at demonstrating that traditional orthodontic mechanics face significant difficulties closing spaces in the presence of socket sclerosis and to propose a possible solution to this problem.

MATERIALS AND METHODS

A female orthodontic patient presented with bilaterally congenitally missing maxillary lateral incisors, impacted canines, and a Class III tendency. She was treatment planned for extraction of mandibular first bicuspids to resolve all crowding in the lower arch and to allow, after the exposure of the canines, maxillary space closure in terms of canine substitution in the maxillary arch. The extraction of the mandibular first bicuspids was carried out without complications and, clinically, wound healing appeared to be normal. Orthodontic space closure was attempted with traditional orthodontic mechanics. Because space closure was not successful, the patient was referred to the skeletal anchorage clinic at Case Western Reserve University at age 31 after 4 years in treatment (Figure 1). CBCT progress records revealed rootlike radio-opaque structures in the former extraction sites (Figures 2 and 3). After periodontal evaluation, residual root fragments were ruled out, and the diagnosis of idiopathic sclerosis of the jaws was made. A literature review was conducted with the aim of finding recommendations to resolve this obstacle for orthodontic tooth movement. However, only five articles were found reporting this finding: no publication addressed treatment of the sclerotic socket to allow orthodontic space closure. After explaining this situation to the patient, insertion of orthodontic mini-implants to increase anchorage was

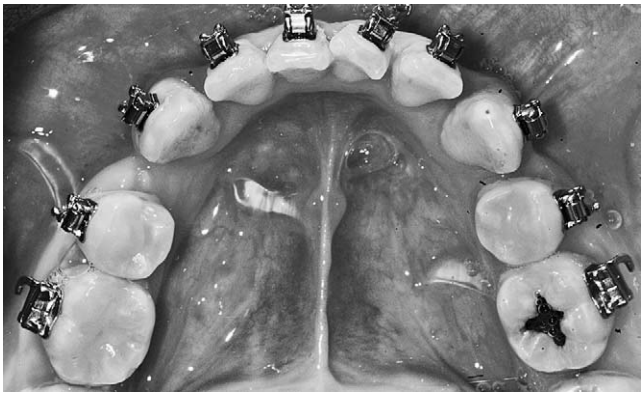

Figure 1. Occlusal view of the mandibular arch at the time of referral to the skeletal anchorage clinic.

Figure 2. Sagittal CBCT slice through the mandibular alveolar process illustrating sclerotic socket in Stage II (arrow).

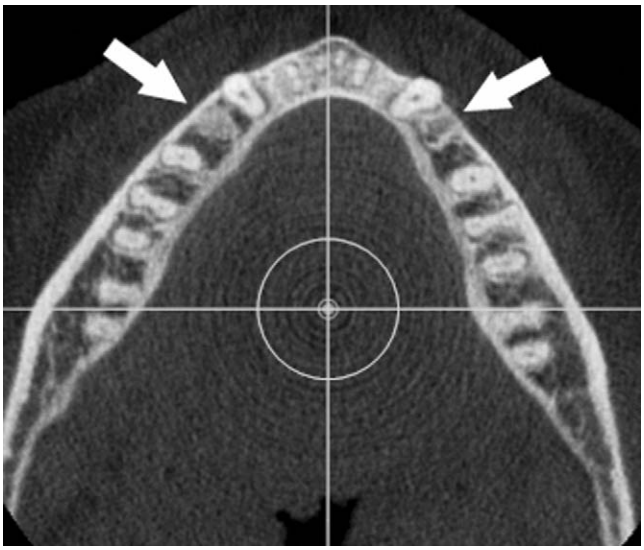

Figure 3. Horizontal CBCT slice through the mandible illustrating bilateral sclerosis of the sockets in Stage II (arrows).

suggested and informed consent was obtained. Self-drilling orthodontic mini-implants 6 mm in length (TOMAS System, Dentaurum, Ispringen, Germany) were placed bilaterally interradicularly between the mandibular second bicuspids and first molars. Indirect anchorage was installed by connecting the second bicuspids to the orthodontic mini-implants using stainless-steel ligatures (Figure 4) as described by Baumgaertel et al.[22] Elastomeric modules were used to obtain retraction of the anterior segment.

RESULTS

With absolute anchorage provided by the orthodontic mini-implants, space closure occurred at a nearly normal rate of 1 mm per month.[23] Including detailing of the occlusion, the treatment time from inserting the mini-implant until removal of orthodontic appliances was 13 months (Figure 5). Posttreatment periapical radiographs revealed complete resolution of the sclerotic sockets and adequate root parallelism without any resorption of the roots (Figure 6).

Figure 4. Buccal view of the orthodontic mini-implant.

Figure 5. Occlusal view of the mandibular arch after completed space closure and removal of orthodontic appliances.

DISCUSSION

Socket sclerosis is a condition in which abnormal healing of the extraction socket leads to the presence of dense sclerotic bone in the center of the alveolar process, which may present as an obstacle to orthodontic space closure. The cause for this unusual healing reaction is still unknown. The present patient clearly suffered from poor oral hygiene over the course of treatment and chronic gingivitis. Thus, an interesting question for future research would be: could chronic low-grade inflammation of the periodontal tissues lead to such a healing response?

Regardless of the origin, this is a condition both orthodontists and periodontists or oral surgeons may encounter over the course of their career, but the current literature offers no guide for treatment. This case report illustrated that increased anchorage through orthodontic mini-implants and directed force application aided in orthodontic space closure, even in a case in which space closure with traditional mechanics was impeded by socket sclerosis. Visual inspection of the posttreatment periapical radiograph revealed no damage to the adjacent dental roots at the conclusion of treatment.

Similar to the origin of the condition, an explanation for the favorable treatment result remains up to speculation at this point. Orthodontic mini-implants do not alter the biology of tooth movement. They increase the anchorage of specific tooth segments and allow for more predictable tooth movement and possibly the application of different force levels without the potentially detrimental effect of anchorage loss. One possible explanation could be that slightly higher forces were used for space closure in the presence of the mini-implant–reinforced anchorage that exceeded a certain

Figure 6. Posttreatment left and right periapical radiographs demonstrating resolution of sclerotic sockets.

threshold necessary to initiate remodeling of the bone. However, force levels were not measured over the course of the treatment, and therefore, this is pure speculation.

Clearly, more research is required in this area, and future histological studies (eg, on vitamin A–deficient rats) may be able to provide more information on this interesting topic.

CONCLUSIONS

- Socket sclerosis can be an obstacle for orthodontic tooth movement. Absolute anchorage mechanics may be a valid treatment option in cases in which socket sclerosis occurred as a result of an irregular healing process.

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