Accidental Displacement of the Dental Implant into the Medullary Space in the Posterior Mandible: Case Reports

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INTRODUCTION

With its high survival rates, dental implant surgery is now regarded as a predictable method for oral rehabilitation.[1] Nevertheless, as more implant surgeries are performed, the number of accidents and complications associated with implants increase. In addition, an unexpected implant displacement discomposes the surgeon and damages adjacent structures, such as the maxillary sinus or the inferior alveolar nerves, resulting in serious complications.[2] However, accidents and complications can be minimized with adequate presurgical evaluations.[2]

When cortical bone is insufficient in providing primary stability, implant fixture may migrate to the maxillary sinus or the medullary space during implant placement.[3,4] It has been reported previously that in patients with poor bone quality, thin cortical bone, and short residual bone height, it is more likely for the implant fixture may become displaced or migrate into the maxillary sinus in the posterior maxilla.[5,6] However, displacement of an implant into the medullary space during implant placement in the posterior mandible is an unusual complication associated with dental implants.

This report discusses two cases in which the implant fixture was accidentally displaced to the medullary space during a routine implant placement in the posterior mandible. The importance of presurgical evaluation and surgical precautions to prevent displacement are also discussed.

CASE REPORTS

Case 1

A 57-year-old female patient had undergone implantation of the left mandibular first molar in a local clinic. The patient was referred to the Department of Oral and Maxillofacial Surgery because of displacement of the fixture. The fixture was located deep and near that mandibular border (Figures 1 and 2). Block osteotomy was performed at the cortical bone using Piezosurgery (Mectron, Carasco, Italy) in order to remove the fixture without injuring the mandibular nerve. The large trabecular porosity and exposed mandibular nerve could be observed. The cortical block was put in place and fixed with a microplate and microscrews after the fixture was removed (Figure 3). The patient complained of dysesthesia on the left side of her chin, and was subsequently prescribed medication for recovery of the mandibular nerve in the Department of Oral Diagnosis and Oral Medicine. The patient was later diagnosed with osteoporosis through a bone mineral density test.

Case 2

A 67-year-old female patient with no medical history was transferred to our department due to displacement of an implant fixture during placement of an implant on the right mandibular first molar in a local clinic. Panoramic radiography and computerized tomography (CT) confirmed that the fixture was displaced into the medullary space (Figures 4 and 5). The fixture invaded the inferior alveolar canal in the vicinity of the mental foramen, and very thin cortical bone and large trabecular porosity were observed. The trabecular porosity within the medullary space was large, and the fixture was movable and loose; therefore, the implant could not be removed by reverse torque. The crestal hole was expanded with Piezosurgery, and the fixture was removed. The CT images showed that the implant had invaded the inferior alveolar canal; to minimize the postsurgical inferior alveolar nerve injury, bone grafts and other treatments were not performed. To prevent nerve injury by hematoma or edema, dexamethasone and nonsteroidal antiinflammatory drugs were prescribed. Fortunately, the patient improved without complications and was transferred back to the local clinic. The patient was later diagnosed osteopenia.

DISCUSSION

In the case of atrophic mandible, mechanical stress is low for a long time, which results in bone loss as accelerated osteoclast-mediated bone resorption and decreased osteoblast-mediated bone formation. This phenomenon is referred to as "disuse osteoporosis," and it accelerates the local resorption of cancellous bone.[7] In other words, the loss of trabecular bone is attributed to rapid loss associated with osteoclastic destruction presenting perforations of the trabeculae, and to slow bone loss presenting as decreased osteoblastic deposits, which results in thinning of the bone.[8]

The persistence of the red bone marrow in some particular bone might lead to a well-known focal osteoporotic bone marrow defect, an asymptomatic radiolucent lesion that is most commonly located in the posterior mandible in patients

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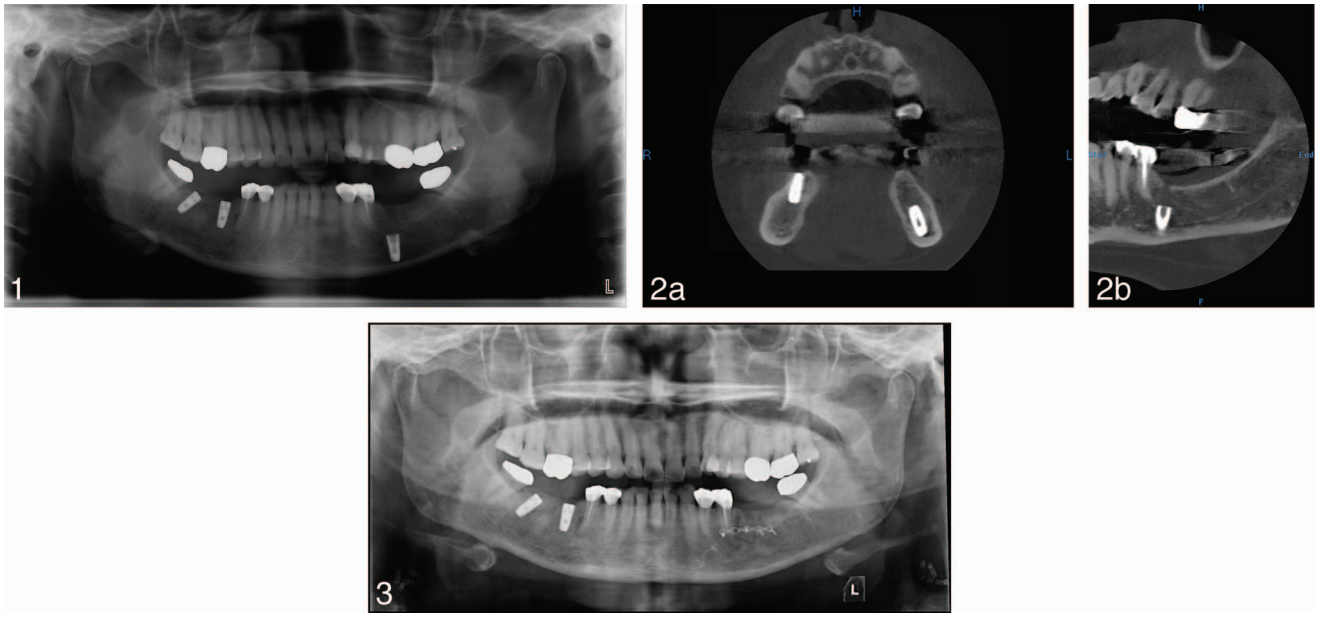

Figures 1–3. Figure 1. Sunk fixture of left mandibular 1st molar was observed in panoramic view. **Figure 2.** The displaced fixture was located below the mandibular canal near the mandibular border. **Figure 3.** The fixture was removed and cortical block bone was fixed with a microplate.

between 40 and 60 years old. However, knowledge about the etiology of this phenomenon is lacking.[9]

Osteoporosis is a skeletal disorder characterized by compromised bone strength. The World Health Organization defines osteoporosis as based on bone mineral density (BMD).[10] White and Rudolph[8] reported that cancellous bone in the jaw may respond similarly to other cancellous bone in patients with osteoporosis. Jonasson et al[11] reported that the alveolar bone of the mandible undergoes an aging process, and the thickness of the trabeculae, the spacing between the trabeculae, and the trabecular connectivity in the jaw are altered in patients with osteoporosis compared with healthy subjects. In addition, it has been reported that BMD and osteoporosis can be predicted by evaluating the thickness of the trabeculae, the spacing between the trabeculae, and the trabecular connectivity of the mandible on panoramic radiographs. Holahan et al[12] reported that no such correlation exists between BMD and bone quality as assessed by the surgeon's touch at the time of implant placement, and that a surgeon's subjective assessment of bone quality is associated with implant survival. They also showed that a diagnosis of osteoporosis or osteopenia has no statistically significant effect on the failure rates of dental implants. In patients with low bone quality, such as those with osteoporosis and osteopenia, dental implant surgery is not contraindicated.[12]

Although the long-term survival rate of implants may not be affected, accidents induced by a decrease in bone density can occur in the mandible from bone loss due to aging, cancellous bone resorption from abnormal remodeling by osteoclasts and osteoblasts, asymptomatic bone marrow defects, and osteoporosis if assessment is not performed before surgery. Prevention of accidents by conducting a preoperative examination of the patient should be a priority for the surgeon. To assess bone quality before implant placement, cone-beam CT[13] and Hounsfield unit by CT[14] may be utilized. The CT can provide data on the relative distribution of cortical and cancellous bone, the location of vital structures such as the inferior alveolar canal, and the presence of large medullary spaces.[15] Turkyilmaz et al[14] suggested the use of bone density values in the Hounsfield unit from preoperative CT as a predictor of bone quality. Panoramic radiograph is an assessment method that could be readily used in a clinic, although it varies widely depending on equipment, and its reproducibility is low. Hence, it is difficult to use only panoramic radiographs to evaluate the bone density of patients who are suspected to have loose trabecular patterns. Bender and Seltzer[16] reported that the radiographic appearance did not differ between and after the removal of cancellous bone in a cadaver study. They suggested that osteoporotic bone marrow defects in the posterior mandible may be masked by cortical bone on preoperative panoramic radiographs. Lindh et al[17] reported that the same jaw may have diverse structures depending on the location. Therefore, it is important to assess

Figure 4. Panoramic radiograph showing inferior displacement of the fixture.

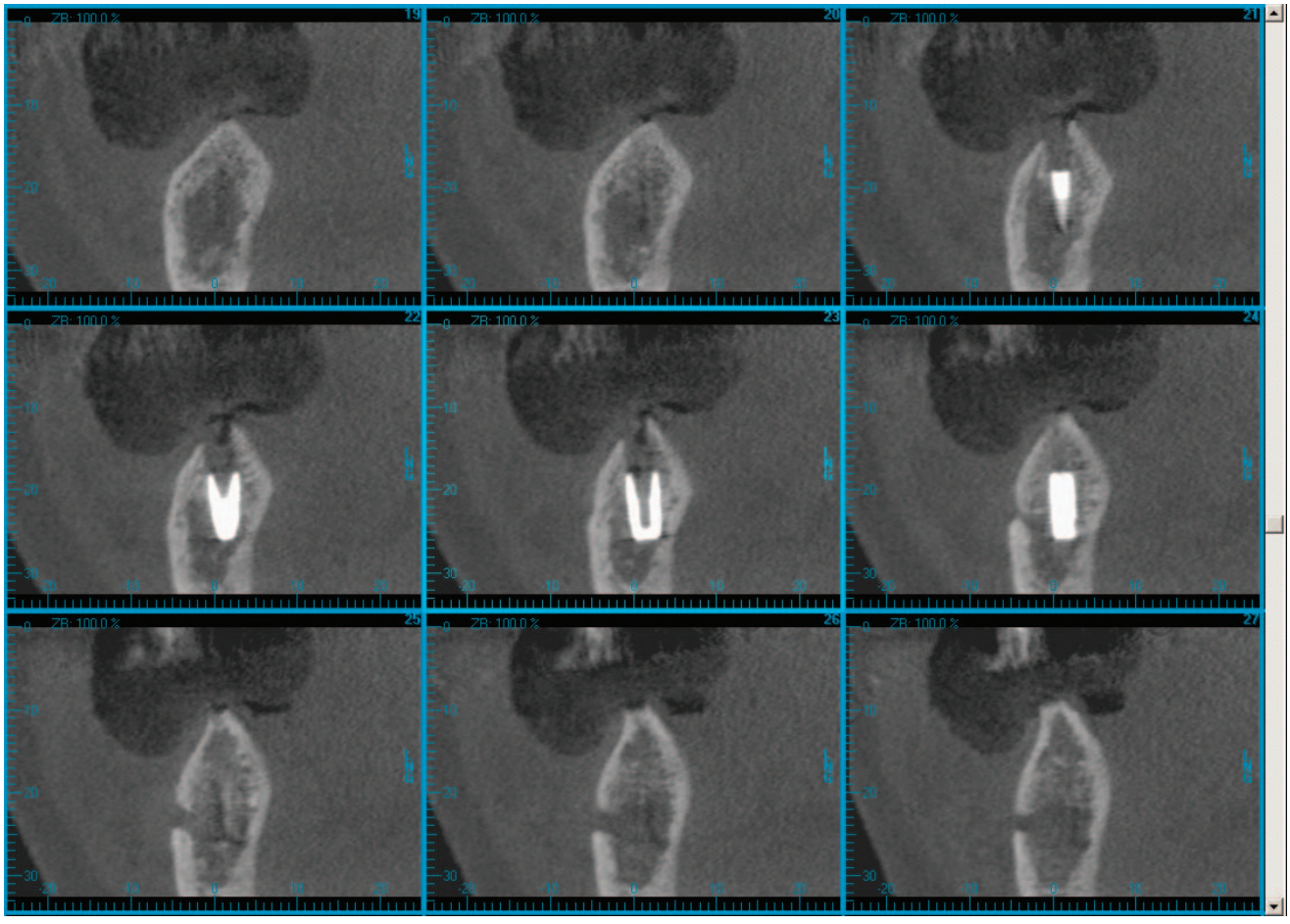

Figure 5. Coronal computerized tomographic view showing the fixture apparently displaced near the mental foramen.

the precise trabecular pattern of the placement site before implant placement by using periapical radiograph as a reference.

When reviewing precautions in placing implants in the mandible, Parfitt[18] reported that the shape, size, and thickness of the trabeculae of healthy jawbone are very diverse depending on the location. Generally, the compact bone of the alveolar crest is very thin, which makes it very difficult to anchor the implant in the posterior mandible. In addition, trabecular porosity in the mandible is increased toward the posterior area, and in elderly women or patients with osteoporosis, the mandible consists of very thin cortical bone and low-density trabecular bone.[19] Therefore, it may help to evaluate bone density of the mandible at a specific site in addition to the overall bone density of the mandible before implant placement in selected patient.

Primary stability is important to prevent accidental displacement and for the early success of implants. Primary stability is defined as biometric stability immediately after implant insertion,[20] and is influenced by the length, diameter, design, surface of the implant fixture, the insertion technique, and the surrounding bone.[20] It has been reported that stability during implant placement is influenced more by cortical bone thickness (not total bone thickness) than implant length.[4] Bone quality and quantity exert important influences on the primary stability of implant; this is significant because poor primary stability, caused by an inability to establish an intimate bone-to-implant contact, causes early loss of the implant.[21–23] If sufficient stability is not obtained during implant placement, micromotion occurs. Micromotion impedes bone healing; thus, fibrous tissue capsules are formed, which causes implant mobility and, ultimately, implant failure.[24,25]

Primary stability is compromised by overdrilling the implant hole, poor bone quality, an excessively short fixture, and immediate placement of the implants.[3] Accidental displacements in the posterior mandible are associated with overtreatment of the implant preparation, poor primary stability, or poor planning. When primary stability is lacking, the implant should be substituted with a wider and longer self-tapping implant, or, if that is not possible, placement should be delayed by 2 months.[3] The optimal selection is described as an implant that is more than 4.0 mm in diameter and 12.0 mm in length in the posterior mandible with poor bone quality.[19]

For implant placement in patients with a medical history of osteoporosis or in women past the middle age (even those without a history of osteoporosis), it may be necessary to use preoperative CT to evaluate the bone density of the site where the implant will be placed. In addition, when the implants are placed in the posterior mandible of patients with poor bone quality or loose bone marrow patterns, it is recommended that

implants with the maximal diameter should be placed and that cortical bones anchors should be sufficiently secured.

Abbreviations

BMD: bone mineral density

CT: computerized tomography

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