Osseointegration of Mobile Posterior Single-Tooth Implants with SLA Surface: Report of 2 Cases

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The conditions for achieving osseointegration of endosseous implants have been well established. The criteria that validate this result concern the physical properties of the implant (eg, material, surface properties), its controlled loading, and its primary stability. Theory regarding primary stability has evolved in recent years. Two clinical cases of totally mobile yet eventually successful sandblasted, large-grit, acid-etched implants serve as illustrations of the possible success of implants deprived of primary stability. In certain circumstances, and if certain recommendations are enforced, it may be possible to consider the preservation, with success, of implants that are completely mobile. INT J ORAL MAXILLOFAC IMPLANTS 2004;19:443–447

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Upon examination of present implant technology, it is evident that it has evolved since the introduction of the principles of osseointegration articulated by Brånemark and coworkers. Notably, there have been changes with regard to single-tooth restorations, the osseous response to implant surfaces with varying characteristics, and the utilization of osseous receptor sites that show irregular or incomplete healing.

Immediate implant placement after tooth extraction has been shown to be a viable technique.[1–5] The criteria that predict success for implants placed immediately after extraction can be discerned by a review of the literature. Primary stability seems to be a major criterion. For satisfactory primary stability, it appears that the artificial root form needs to be placed from 3 to 5 mm beyond the bottom of the bony alveolus.[6] This question of initial stability of the implant, and the establishment of a definition of this term, has been the object of multiple publications[7–10]; while primary instability, a term whose definition is imprecise because it refers to an ensemble of clinical situations, has given rise to relatively limited literature.[11–16]

An implant is considered to be mobile if it may be rotated or depressed with gentle force.[15] The most extreme degree of mobility, total implant mobility, is characterized by instability upon axial or lateral loading.[11] The author's definition of extreme or total mobility corresponds to the situation wherein there exists no possibility of establishing a congruence between the osseous receptor site and the design of the implant. This situation is encountered either immediately after extraction or at some time after the extraction, in which case it is accompanied by resorption of alveolar bone. The amplitude of implant mobility may then be several millimeters in all directions. This description should be distinguished from the relative implant mobility usually described in completely healed edentulous sites, which may be explained by the weak density (type 4 bone).[17] This implant instability is very limited compared to total implant mobility. It has often been measured by the Periotest (Siemens, Munich, Germany), whose values range from –5 to +5 for ITI implants (Straumann, Waldenburg, Switzerland), on a general scale that ranges from –8 (clinically fixed) to +50 (very unstable).[18]

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Fig 1a Initial clinical situation.

Fig 1b The mandibular left first molar is beyond repair and shows a bony defect near the mandibular canal.

Fig 1c At 2.5 months, the site is not completely filled with hard tissue.

Fig 1d *(Right)* The depth gauge was mobile at 4.2 mm in the insufficiently healed site.

Fig 1e *(Far right)* At 3 months, the first test was a twisting test of the implant using a key and ratchet.

Fig 1f Radiograph of the implant at 3 months.

Fig 1g Radiograph of the implant-supported restoration at 7 months.

The aim of this presentation was to show, using 2 clinical case reports, that implants with a sandblasted, large-grit, acid-etched (SLA) surface (Straumann) that show extreme mobility can be maintained with success and loaded under normal conditions.

CASE 1

A 48-year-old man was referred to the author's private practice with the goal of replacing his mandibular left first molar, which had been diagnosed as unrestorable because of periodontal involvement, with an implant (Fig 1a). The tooth, which had a ceramometal restoration (Fig 1b), was extracted during periodontal surgery, with the aim of obtaining maximum debridement of the socket while preserving the residual alveolar support. Extension of the bony lesion was important because it was close to the inferior dental nerve.

Two and a half months later, a 4.8×8-mm wide-neck solid screw-type ITI implant with an SLA surface was placed, but the absence of newly formed hard tissue in the bony alveolus (Fig 1c) combined with the proximity of the mandibular canal made it impossible to attain lateral and apical bone anchorage. Although large, the implant was totally mobile once placed. When positioned in the alveolus the implant would only maintain itself in vertical balance because of the nonmineralized connective tissue present. The intraoperative radiograph showed the depth of the implant in position and the absence of congruence between the implant and the bony constituents and provided an indication of the size of the bone's flare (Fig 1d).

The sutures played an important role in achieving immobilization, as did manipulation of the soft tissues. The scrupulous adaptation of the flaps, using continuous sutures, was assured with firmly tightened knots. The patient was instructed to avoid chewing on the side with the implant, and hygiene manipulations were gentle and limited to mouthwashes. Assessment of the healing took place at 15-day intervals so as to evaluate the peri-implant tissue.
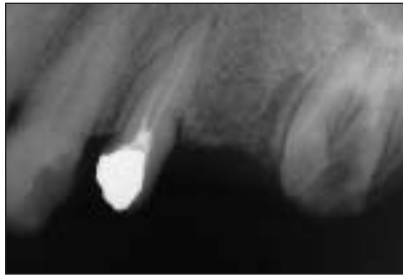
Fig 2a Radiograph of maxillary left first molar showing the extent of caries.
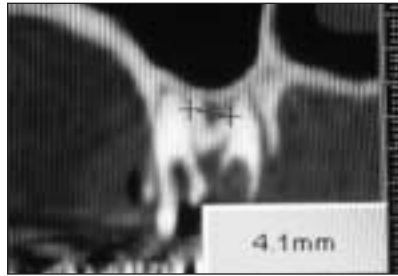

Fig 2b Computerized tomography indicating 4.1 mm of bone availability in the buccopalatal region for the first molar. The final 4.2-mm twist drill removed all the bone for implant anchorage.

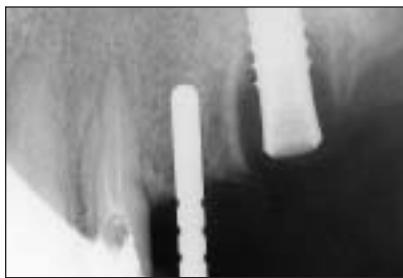**Fig 2c** Extraction of the first molar left little interradicular bone.

Fig 2d Intraoperative radiograph showing the positioning of the implant replacing the molar and the appearance of the residual bone.

Fig 2e The implant was stabilized by the combined forces of the flaps and the mattress sutures.

Fig 2f Radiograph at 3 years and 2 months indicating additional support for the molar replacement provided by an adjacent splinted restoration.

At 3 months, carefully performed clinical tests and supporting radiographic evidence confirmed the possibility of proceeding with the fabrication and placement of an implant-supported restoration (Figs 1e and 1f).

A wide-neck abutment was seated with a controlled rotational force of 35 N/cm, confirming the lack of mobility. The definitive crown was cemented and exhibited immobility at a 7-month examination (Fig 1g).

CASE 2

A 62-year-old woman was referred for a consultation regarding the replacement of a missing maxillary left second premolar and an existing first molar, which had been diagnosed as unrestorable because of extensive caries (Fig 2a). The decision was made to place 2 SLA ITI implants (Straumann)—a 4.1 × 12-mm implant to replace the missing premolar, and a 4.8 × 8-mm implant to be placed immediately following extraction of the first molar.

After extraction of the first molar using a periodontal flap, 3 bone alveoli remained. The wide 8-mm implant was placed between them (Figs 2b and 2c). Successive drillings resulted in the elimination of alveolar bone corresponding to the trifurcation. Once in place, the implant no longer had anchorage, either laterally or apically, and the implant was limited apically by the maxillary sinus (Figs 2b and 2d). Stabilization of the mobile implant was accomplished primarily with a palatal flap that had thick fibromucosal tissue, with the help of a buccal flap. The buccal flap served to position the collar of the implant so that it was pinned against the palatal flap. The sutures were continuous vertical and horizontal mattress sutures (Fig 2e). Tightening the knots rendered the implant stable to slight pressure. Instructions were given to the patient to assure good plaque control. The patient was instructed to avoid any chewing on the implant for a period of 4 weeks.

At 11 weeks, clinical and radiographic evaluations indicated that fabrication of the crown restoration could be started. A 15-degree angled abutment was connected with a controlled rotational force of 35 N/cm and the completed prosthesis was cemented in place. The radiographic image at 3 years and 2 months confirmed bone anchorage after functional loading (Fig 2f). A second implant placed in the missing premolar space healed uneventfully and was able to be used in a splinted prosthesis to provide additional support for the molar replacement.

DISCUSSION

Numerous factors are commonly cited as contributing to the stability of an implant during the placement surgery: the drilling technique, the use or absence of tapping, the type and quantity of bone available, the presence of bicortical anchorage, the quality of the blood clot within the alveolar bone, the topography of the implant surface, and the design, length, and diameter of the implant. To avoid the risk of possible absence of initial implant stability, practitioners have tried to use endosseous implants, varying their length, then their diameter, to improve results.[19,20] Careful planning, including the planned operating technique, also is useful for achieving implant immobilization.[21]

When faced with a mobile implant and the legitimate fear of failure (related to fibrous integration[22]), the clinician will likely opt not to retain the mobile implant and will arrange to place a new implant at a later date, when more optimal conditions are present. If the bone site permits, placement of a longer and/or wider implant will improve the prognosis.

The healing of mobile implants has been the object of as few studies in animals[11,12] as in humans.[13–16] Human studies have emphasized the confidential aspect of their possible conservation.

Some of those studies have stressed the nature of hydroxyapatite-coated implants, which, they show, exhibit better bone-implant contact than those that are not hydroxyapatite-coated, whether or not the implants are mobile during placement. Implant surface characteristics play an important role in bone response, and studies of the SLA-surface implant have shown that the removal torque values obtained in the short term suggest a higher percentage of bone-implant contact.[23] In another study, SLA implants were loaded at 6 weeks. At 2 years postloading, the success rate was 99%. The abutment was attached with a moment of force of 35 N/cm without countertorque. There was no rotational implant effect, and no pain was felt by the patient.[24] These same criteria have been used by the present author to determine implant success, in addition to the usual conditions such as stability of the implant, a normal radiograph, and the absence of pain and infection.

Perhaps more than the design of the implant or its metallic substrate, the SLA surface, or rather, its osteoconductive properties[25] facilitate the establishment of continuity with the bone with fine trabeculation as in the case of animals. These results seem equally valid in cancellous bone.[26] In the healing around a mobile implant, it is difficult to distinguish between the results of osteophilic action, the surface state, and immobilization by means of the sutures. There are other inexplicable aspects as well, such as why the implants in the 2 cases presented, which were not lacking in micromovements, did not develop fibrous healing. The fact that transmucosal implants were involved does not seem to have played a role in compromising the healing by risking premature loading with a bolus of food, and the interplay of mucosal and muscular components.

CONCLUSION

The 2 cases described in this report and their results, followed in Case 1 for 7 months and in Case 2 for 3 years and 2 months, suggest the possibility of achieving success with mobile implants. Faced with total implant mobility, which can be the forerunner of failure, the clinician, after informing the patient, might consider the option of conserving the implant. The conditions for success depend on the type of implant surface chosen and the stabilization of the implant, among other factors. It is important to choose an implant with a rough surface. ITI's SLA surface, which has osteoconductive properties, facilitates peri-implant bone formation.

"Artificial" stabilization of the mobile implant can be accomplished by soft tissue management, eg, by positioning soft tissues with sutures to stabilize them firmly. However, this immobilization is not equivalent to that provided by bone anchorage, primarily because function results in forces that are inevitably transmitted to the implant.

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