In Situ Examination of Implant Sites with Support Immersion Endoscopy

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Pathologies of the implant cavity wall currently cannot be diagnosed by direct observation because of the rapid pollution of the optical systems used. A technique to examine prepared implant sites intraoperatively to diagnose possible risk factors for the osseointegration process is presented. Examination of implant cavities is performed with support immersion endoscopy (SIE). Using a specially designed support and irrigation sheath (SIS), a 1.9-mm endoscope can be placed at a certain distance to the underlying bone surface. When immersed in a bleeding implant site, the endoscope window is cleaned by continuous laminar irrigation flow to allow observation of the cavity walls under variable magnification. Cortical and cancellous bone structures can be differentiated in situ and pathologies detected during capillary bleeding. Two case reports citing practical applications are reported. By means of SIE, possible risk factors during and after implant cavity preparation can be detected. (Int J Oral Maxillofac Implants 2002;17:703–706)

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Implant placement requires an atraumatic surgical procedure and frequent cleaning of the cutting instruments to provide sufficient irrigation during drilling of the cavities.[1] Spontaneous bleeding from the implant site can prevent direct visualization of the prepared implant site. Therefore, possible risk factors for the osseointegration of an implant arising from failures of implant cavity preparation may not be identified, although they might influence the outcome of implant surgical interventions.

Endoscopy as a tool for minimally invasive surgery has been used for arthroscopy of the temporomandibular joint.[2] In endodontic surgery, Held and coworkers[3] reported on endoscopic identification of roots in the sinus and on endoscopically controlled root-end preparation under magnification. Bahcall and Barss[4] recommended endoscopic imaging of the root canal as a possible future technique during non-surgical endodontic treatment. Engelke and Deckwer[5] used maxillary endoscopy to control the preparation of subantral space during sinus floor augmentation. Engelke[6] reported on an advanced minimally invasive subantroscopic laterobasal sinus lift performed endoscopically and controlled through a laterobasal access of 5 mm.

Previously, it has been difficult to view the structure of implant sites after preparation of the cavity endoscopically because of the pollution of the endoscope window with blood when introducing it into the freshly prepared cavity. With a newly developed support immersion endoscope (SIE), the surgeon can assess the bone structure at the implant interface for possible risk factors endoscopically immediately before placing the implant. The detection of risk factors shall be demonstrated by 2 patient reports.

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Fig 1 Instrumentation for SIE: 1.9-mm Storz-Hopkins endoscope and support and irrigation sheath together with a dental implant.

Fig 2 Support immersion endoscope placed in a posterior mandibular implant cavity.

METHODS

SIE (Fig 1) consists of the following components:

1. A conventional 1.9-mm-diameter Storz-Hopkins endoscope (Karl Storz, Tuttlingen, Germany) with video chain and analog or digital video unit
2. Support and irrigation sheath (SIS)
3. Device for continuous laminar irrigation flow (CLIF)

The SIS is mounted on the endoscope and has an integrated irrigation canal that ends at the endoscope window. The irrigation canal is connected to an irrigation system with sterile physiologic saline solution. The endoscope is positioned in the implant cavity and supported at any part of the osseous wall in such a way that there is a constant observation position (Fig 2). To view the cavity wall structure, a high irrigation flow rate is required, primarily for cleaning the endoscope window. A continuous laminar fluid stream is maintained to provide clean fluid in the space between the endoscope window and the area observed. The magnification factor ranges between 2.5× and 20×, depending on the endoscope position relative to the object (optical magnification) and the camera zoom factor (digital magnification).

CASE REPORTS

Patient 1

A 49-year-old man was seen for the placement of 3 implants in the posterior mandible. Clinical examination gave no evidence for anatomic anomalies; the orthopantomogram showed sufficient vertical bone height.

During cavity preparation for an implant in the first molar position, the surgeon registered compact bone structure during preparation with the pilot and 2-mm twist drills (Friadent, Mannheim, Germany). While using the definite stepped final drill of the Friadent system, a sudden change of pressure during drilling was registered, indicating possible perforation of the instrument.

Immediately, SIE was performed. The result is shown in Fig 3a. Survey of the implant cavity showed type 1 bone primarily, with a circumscript basal defect. The soft tissue could be identified clearly as fatty tissue of the floor of the mouth. No bleeding was observed. Therefore, it could be ascertained that an injury of the mandibular canal had not occurred. The placement of a 3.8 × 13-mm Friadent implant was completed as planned (Fig 3b). Healing occurred uneventfully.

Patient 2

A 54-year-old man was operated on to replace a maxillary left canine and left second premolar. Because of transverse insufficient bone volume, a splitting osteotomy of the canine region was performed for alveolar reconstruction. To verify intraoperatively mobilization of the lateral bone lamella, the SIE was introduced into the cavity and the fracture gap was inspected. Proper mobilization was observed after lamellar splitting. During the inspection, a cotton fiber was detected at the cervical aspect of the distal bone fragment and identified to be part of a cotton swab that had been used for compression of the bone fragment after mobilization (Fig 4). Under endoscopy it was removed and the implant placed.

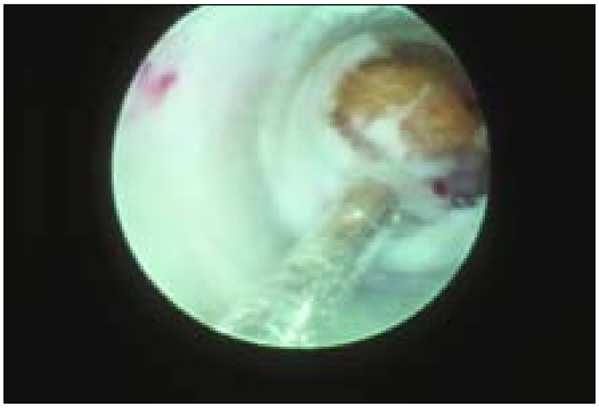

Fig 3a Endoscopic view of implant site with a probe placed. An apical basal perforation of the lingual plate and fatty tissue are visible.

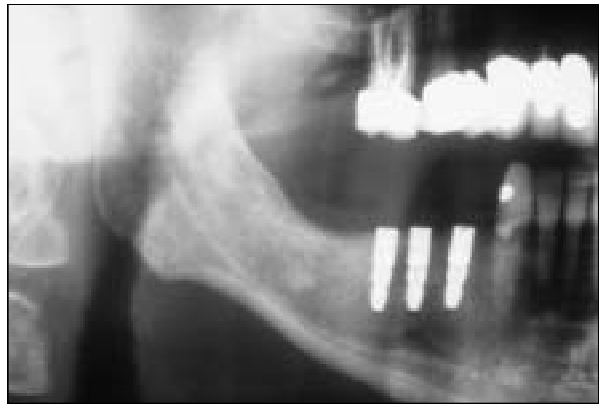

Fig 3b Radiograph after placement of 3 Friadent stepped-cylinder screw implants.

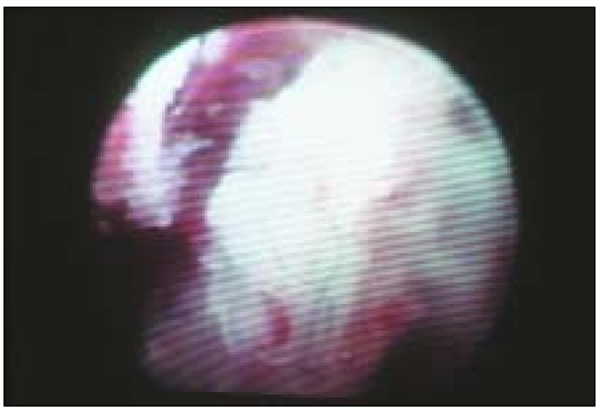

Fig 4 Visualization of an alveolar fracture at a maxillary canine implant cavity following alveolar splitting osteotomy. A cotton fiber *(blue)* is visible in the inferior aspect of the image.

Fig 5 Endoscopic view of cortical bone of a freshly prepared implant cavity. Wall structures are clearly visualized despite ongoing bleeding.

DISCUSSION

The visualization of a bony implant site has previously been performed preoperatively according to Lekholm and Zarb[7] to discern bone quantity and quality. By use of computed tomography (CT), a 3-dimensional image can be obtained with a relatively low dose of radiation.[8] Nevertheless, an intraoperative inspection of the extension and possible complications within the implant cavity is difficult with CT.

When used in freshly prepared implant cavities, conventional endoscopy has 2 major shortcomings: pollution of the endoscopic window, and difficulties in focusing on the operation site. Experience has shown that the use of conventional endoscopes or intraoral cameras frequently requires interruption of an ongoing surgical procedure because of a time-consuming cleaning process of the endoscope window. In contrast, a fluid stream during SIE enables the surgeon to clean the endoscope window continuously even in the presence of ongoing capillary bleeding (Fig 5).

With respect to posterior mandibular implant sites, the shape and possible defects of implant cavities can be perused intraoperatively, which may be critical, if preparation occurs close to the mandibular canal. In the case presented (patient 1), the type of perforation was identified as a lingual cortical plate defect, and continued implant placement was supported by excluding an exposure or lesion of the inferior alveolar nerve. High magnification was required to allow an adequate view of the cotton fiber foreign body. Although wood fibers have been reported to cause granulomatous peritonitis and cotton fibers have been identified as possible cause of a intra-arterial granuloma after cardiac catheterization, it remains unclear if cotton fibers could lead to dental implant failures as well.[9,10] The presence of cotton fibers at the implant interface may cause a local inflammatory response as known from polyethylene particles at the bone-implant interface.[11]

Support endoscopy enables the clinician to view intraoperatively the implant-bone interface from an adequate working distance.[6] The endoscope need only be placed on the hard tissue surface with no further manual guidance. The endoscopic examination usually requires less than 2 minutes and is easily performed without side effects for the patient.

The use of immersion endoscopy can be an adjunct to intraoperative surgical procedures. Its application as a routine procedure may not be cost-effective, but when needed, the instrumentation can be useful.

CONCLUSION

By direct intraoperative magnified observation, SIE allows the identification of possible risk factors inside implant cavities and neighboring structures under ongoing capillary bleeding conditions. Thus it can enhance the quality of surgery providing a new dimension of visual examination of vital bone tissue in implant dentistry.

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