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Evaluation of the capability of a new water lift system to reduce the risk of Schneiderian membrane perforation during sinus elevation

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Abstract. The purpose of this study was to evaluate the effectiveness of a new water lift system used as a surgical instrument in the crestal approach of the sinus membrane lifting operation and the capability of this technique to reduce the risk of Schneiderian membrane perforation in comparison with a lateral approach using piezoelectric surgery. 50 sinus membrane-lifting operations were performed. Patients were randomized in 2 groups to receive either lateral sinus elevation with piezosurgery or crestal sinus elevation using the new surgical device. Schneiderian membrane perforation was noted in 6 patients (24%) from the group undergoing the lateral sinus floor elevation approach, but no perforation was observed in the group with the crestal infiltration technique ($P = 0.01$). Aside from membrane perforation, haematoma was present in 3 patients (12%) from the group with lateral sinus floor elevation with no cases in the other group. No microbial infections were noted in the 50 consecutives cases. This study demonstrated that maxillary sinus floor elevation using the water lift system via the crestal approach is a predictable procedure with a low complication rate, compared with the lateral approach with piezoelectric surgery.

Key words: Schneiderian membrane perforation; sinus membrane-lifting; lateral approach; crestal approach; water lift system.

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Implant therapy is being included in treatment plans more routinely because of its high success rates. Lack of available bone and enlarged sinus cavities are often a major obstacle to the placement of dental implants in the posterior maxilla. To increase the amount of bone in the maxilla, the sinus floor elevation procedure, or subantral augmentation, has been developed. This procedure involves placing bone-graft material in the maxillary sinus to increase the height and width of the alveolus[4,15].

The entry into the maxillary sinus is generally performed via the lateral access window (modified Caldwell-Luc technique), or a less invasive approach through the crest of the alveolar ridge. In both cases, the Schneiderian membrane, covering the bony sinus, must be gently separated from the sinus floor and elevated to contain graft material that is placed inferiorly. The Schneiderian membrane is composed of periosteum covered by a multi-

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layered cylindrical respiratory epithelium, which constitutes an important barrier for protection and defence of the sinus cavity. The integrity of this membrane, along with the patency of the periosteum, is essential for the health and normal function of the maxillary sinus[16].

The objective of this study was to assess the effectiveness of a new water system for sinus membrane lifting via the crestal approach in the reduction of risk of Schneiderian membrane perforation in comparison with a lateral approach using piezoelectric surgery.

Patients and methods

From October 2009 to July 2010 (9 months), 50 sinus floor elevation procedures were performed in adult patients (≤65 years old) by the same oral surgeon. Patients were included if their residual bone under the maxillary sinuses was less than 7 mm. Patients who showed any uncontrolled systemic disease, ongoing chemo- or radiotherapy or a history of maxillary sinus diseases were excluded. Before treatment, all patients were clinically and radiographically examined (by panoramic radiography and computed tomography scanning in selected cases) for available bone volume, bone quality, anatomy and any existing sinus pathology. The presence of sinus septa was an exclusion criterion. Follow-up examinations, clinically and radiography, were performed at baseline, 1 week, 4 weeks and 8 weeks, using intraoral digital and panoramic radiographs.

Patients were randomized into 2 groups to receive either lateral sinus elevation with piezosurgery or crestal sinus elevation using the new surgical instrument.

The device is a water lift system, which consists of two different components. The first is an intraosseous small titanium screw used for bone anchorage with hermetic infiltration of the sinus floor (the length/diameter of the titanium screws used for bone anchorage were 5/3.5 5/4, 8.5/3.5 and 8.5/4 mm) (Fig. 1). The second part is a hermetic connector, which injects liquid through the intraosseous element.

Antibiotic prophylaxis was delivered to all patients (amoxicillin or amoxicillin and clavulanic acid), starting approximately 1 h before surgery and continuing for 7 days after surgery. In all patients, simultaneous placing of implants was planed at the same time as grafting. The length of the implants ranged from 10 to 15 mm in both study groups. All patients were informed extensively about the procedures, including surgery, bone substitute material, and implants. Written informed consent was obtained in all cases.

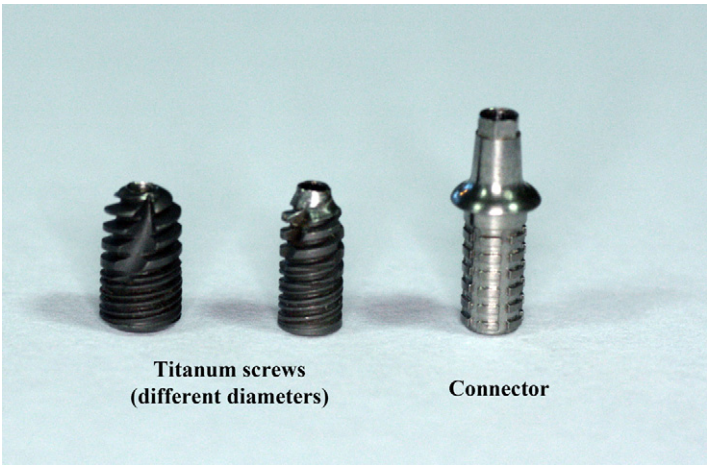

Fig. 1. Sinus infiltration device for the crestal approach.

Crestal approach with sinus infiltration

A crestal incision slightly towards the palatal aspect through the entire length of the edentulous segment was performed, and supplemented by buccal releasing incisions mesially and distally. Full thickness flaps were elevated to expose the alveolar crest and a part of the lateral wall of the maxillary sinus. In some cases, a flapless technique (without any incision) was used. An ultrasonic piezoelectric device (Surgysonic II, ESACROM SRL, Imola, BO, Italy) with a trephine tip to prepare the bed of the sinus infiltration device and a round tip to break the sinus floor with minimal access (≤1.5 mm) to the sinus membrane was used. Once access to the sinus cavity was achieved the membrane was examined for perforation and the patient was asked to perform

Fig. 2. Sinus elevation with the infiltration device (surgical view).