The Brown

PerioDontaLetter

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Spring

From Our Office to Yours...

Rehabilitation of the edentulous posterior maxilla with endosseous dental implants often poses a clinical challenge. Premature loss of maxillary posterior teeth often results in substantial loss of alveolar height and width, which is further complicated by pneumatization of the sinus cavity. In effect, the bone is lost from below (crestal) and diminished from above by coronal expansion of the sinus.

Before the introduction of bone augmentation procedures, patients with deficient alveolar bone in the posterior maxilla were limited to rehabilitation with removable prostheses, short root-form implants, subperiosteal implants or cantilevered conventional restorations.

Today, there are a number of predictable procedures available to elevate the floor of the sinus from an alveolar crestal approach which will permit placement of dental implants and definitive restorations of choice.

In this current issue of ***The PerioDontaLetter,*** *we discuss the sinus graft procedure via "crestal" approach.*

As always, we welcome your comments and suggestions.

Sinus Elevation via Crestal Approach

Sinus floor elevation with bone augmentation of the maxillary sinus is a highly predictable and effective procedure to increase bone volume in the posterior maxilla.

Success rates are equal to or better than that of all implants placed in non-grafted maxillary bone in or out of the sinus. Consequently, even in situations where the interocclusal dimension is normal or only moderately increased due to loss of bone height, bone augmentation of the maxillary sinus is frequently indicated.

A viable alternative to the classic lateral window technique, it is also known as the crestal approach, the osteotome technique, sinus tap up and the Summers technique. The advantages of the sinus graft via the crestal approach over the lateral window technique are:

- It is less invasive.
- It is quicker, simpler, and therefore usually more economical.

Figure 1. Initial examination shows tooth number 14 with severe endodontic and periodontic involvement and a guarded to poor prognosis. (See Figures 2, 3 and 4 on page 2)

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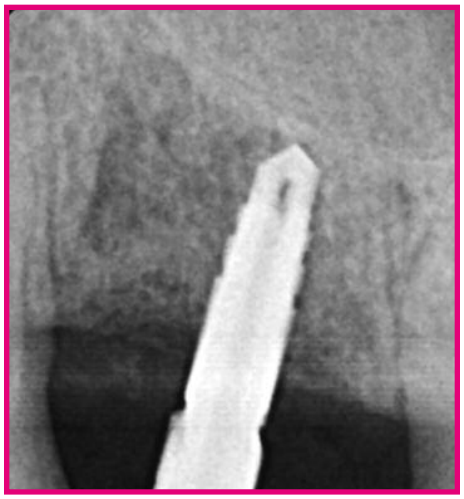

Figure 2. Five months after extraction and upon surgical entry, the implant drill extended to the floor of the maxillary sinus.

Figure 3. The implant and bone graft were placed simultaneously utilizing the crestal approach sinus lift technique.

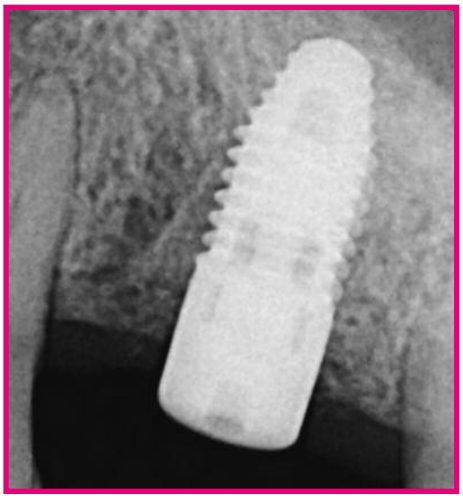

Figure 4. Four months following implant placement and sinus lift, a postoperative radiograph helps to confirm osseointegration.

- It is usually accompanied by simultaneous placement of the implant, making it more time efficient.
- It reduces postoperative discomfort.
- It preserves the integrity of the sinus cavity.

The procedure is technique-sensitive and requires meticulous surgical skills.

The primary indication for maxillary sinus elevation and bone augmentation, specific for the placement of endosseous dental implants, is an alveolar bone height in the posterior maxilla of less than 8mm.

A variety of bone graft materials have been used successfully. As with all bone grafting procedures, autogenous bone is the most predictable. But due to the nature of sinus grafting, donor or allograft bone, as well as bovine-derived xenograft tissue, are also very successful and eliminate the need for a donor site.

The Origin

The original technique developed by Dr. Robert Summers used bone graft material in the osteotomy as a cushion for the sinus floor elevation.

Although there are many variations in technique, osteotomes are used to gradually increase compressive forces against the floor of the sinus by adding incremental quantities of graft material until the floor of the sinus fractures (infracture) without tearing the sinus membrane.

Osteotomes are hand-held instruments used with a mallet to raise the bony floor of the sinus cavity and through which bone graft material may be delivered into the sinus cavity. Because of the high degree of accuracy that can be achieved with this technique, clinicians can easily modify the quality and quantity of bone around implants to ensure a stable fit.

After the sinus floor is raised, bone graft materials are continually introduced slowly through the osteotomy site and into the maxillary sinus. This process continues to elevate the membrane and thus produces a vertical expansion of the bone height in a localized area of the maxillary sinus.

Once the sinus membrane is elevated with bone graft material to the desired height, the implant osteotomy is completed and the implant can be inserted. Multiple individual sites can be elevated and prepared simultaneously through individual osteotomy sites. Radiographically, a successfully-elevated sinus will have a dome-like appearance in the area of added bone.

Reports of this technique demonstrate increased bone height from 2 to 7mm with an average of 3.8mm. Thus the crestal approach is a useful technique for increasing the vertical height of bone up to about 4mm. If more vertical bone is needed, the lateral wall (Caldwell-Luc) approach may be a more advantageous method.

Autogenous bone is often considered the gold standard for bone augmentation because of its osteoconductive, osteoinductive and osteogenic properties. But numerous studies have demonstrated clinical success using many variations and combinations of bone graft materials.

The osteotome technique may be contraindicated for sinuses that have an acutely sloped floor or septa in the location of the planned osteotomy.

Other Technique Variations

Because the osteotome-assisted procedure is technique-sensitive, a number of

Figure 5. An examination radiograph reveals severe bone loss and a hopeless prognosis on tooth number 4 and an extremely questionable prognosis on tooth number 5.

devices and alternative techniques have been introduced to overcome the incidence of Schneiderian membrane perforation.

- Trephines are surgical instruments with serrated, hollow cylindrical blades used with a hand piece to create an osteotomy. The core of bone created by the trephine is then carefully pushed apical to the sinus floor, together with implant and bone graft for future implant placement. This technique has the advantage of increasing the quality, quantity and volume of bone being mobilized.
- The hydraulic sinus condensation (HSC) technique introduced by Chen and Cha uses a high speed air-rotor handpiece. Once the round diamond bur hits the junction between bone and membrane, and a pinhole is created, the water pressure from the handpiece at the surgical site provides just enough force to atraumatically lift the membrane superiorly from the sinus floor. A bone graft mixture is first pushed gently against the membrane and then inside the sinus cavity, raising the sinus to the proper height for implant placement.
- The Cowell Sinu-Lift System™ uses a handheld, rotary device that applies controlled pressure to rupture or infracture the floor of the sinus. The method employs a handpiece-driven tap drill to infracture the floor of the sinus as well as to produce a ridge splitting effect.
- Piezoelectric surgical devices use an electric-powered ultrasound for a variety of bone cutting activities. The device cuts only hard tissues, thus minimizing the danger of damage to the sinus membrane. It allows very precise cutting.

Specialty Drills

- The Dentium Advanced Sinus Kit (DASK)™ by Dentium USA allows clinicians to perform both crestal and lateral approaches with one kit. As with other specialty drills, DASK drills are compatible with standard implant handpieces. This one has a diamond impregnated cutting edge that removes the bone from the sinus floor.
- The Hatch Reamer™ is a sinus lift kit manufactured by SinusTech America. The kit features a unique reamer design that cuts, lifts and elevates the floor of the sinus, all with one tool. The reamer is designed to minimize the possibility of damage to the sinus membrane, while forming an appropriate-sized osteotomy site for implant placement and allowing for the placement of bone grafting materials into the elevated sinus cavity.

The Art of Lifting the Membrane

Once the membrane has been successfully separated from the sinus floor, a number of techniques have been known to actually lift the membrane.

Many of the earlier techniques utilize grafted bone being pushed with an osteotome, a bone packer, or simply with the drill or device used previously.

An inflated latex balloon filled with sterile saline was used as early as 1998 in Brazil for controlled separation of the sinus membrane in a lateral window technique. Called the balloon sinus lift, it has been modified for crestal approach and this device is now distributed through Meiseinger and Zimmer in the US.

Conclusion

The maxillary sinus represents an anatomic location which requires special techniques for implant placement because bone is not normally found in this sinus.

With the advancement of sinus graft procedures and equipment for a crestal approach, maxillary sinus bone augmentation is now more than 97 percent effective. This success rate makes sinus grafting the most successful bone grafting done today.

As always, good preoperative diagnostics and a healthy sinus are critical to the success of sinus grafting. 3-D imaging of the sinus preoperatively is rapidly becoming utilized prior to any type of sinus elevation procedure.

Figure 6. Following the removal of teeth numbers 4 and 5 and socket preservation bone grafting, a postoperative radiograph reveals insufficient bone height for implant placement in the number 4 position.

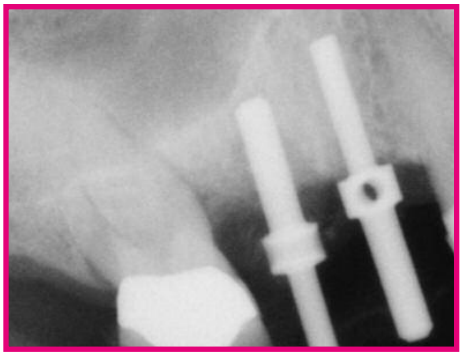

Figure 7. Depth gauge markers were utilized to determine the location of the sinus floor and to check for parallelism.

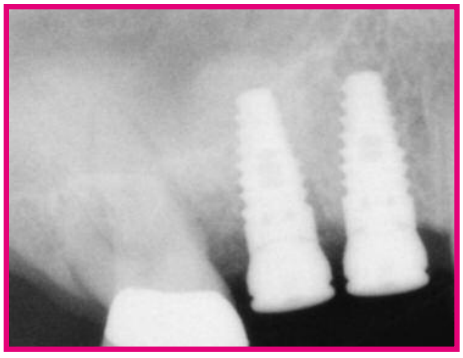

Figure 8. Following a crestal approach sinus lift on tooth number 4, two implants were placed in the edentulous area.

Saliva - The New Diagnostic Frontier

The National Institute of Dental Research has identified salivary diagnostics as one of its primary targets for research funding. It has set a goal to determine by 2013 the efficacy of using salivary diagnostics to monitor health and diagnose at least one systemic disease.

The three major salivary glands produce over one liter of saliva each day and 1166 proteins have been identified that could be used for diagnosing a variety of diseases. Today, saliva provides a source of cellular and bacterial DNA for genetic testing for oral cancer, caries susceptibility, periodontal disease or salivary gland disease and systemic diseases.

Salivary tests already exist for two bacteria associated most prominently with tooth decay -- Streptococcus mutans and Lactobacillus -- and salivary tests for Porphyromonas gingivalis and many other bacteria associated with periodontal disease.

Five saliva proteins have been identified as the signature hallmark of squamous cell carcinoma. They can be collected and then identified in a simple saliva sample. This may lead to earlier diagnosis which will greatly increase survival. It is also possible to measure proteins of acute inflammation such as C-reactive protein or serum amyloid A which are known to be associated with arteriosclerosis or other markers of heart disease.

Immunologic assays for Helicobacter pylori, the bacteria associated with gastric ulcers, depend on the collection of saliva to determine bacterial load of H pylori and assist in the diagnosis of gastrointestinal problems. Indeed, salivary diagnostics has the potential to aid in the detection of the earliest stages of conditions such as HIV/AIDS, Alzheimer's disease, schizophrenia, myocardial infarction and many types of cancer. Research efforts are underway to develop such tests.

Decreased salivary flow or insufficient saliva (hyposalivation also known as xerostomia) is a common side effect of more than 400 commonly-used medications. An estimated 30 percent of those 65 years and older have a decreased salivary flow due to medications such as antihistamines, anti-hypertensives, anti-anginal, and antidepressant medications. Decreased salivary flow can dramatically alter the oral bacteria which in turn increases the incidence of dental caries and periodontal disease.

In some situations, saliva is actually more accurate than blood, urine or other common diagnostic tests, depending on the proteins or metabolites. For example, some of the viruses and bacteria that occur in the mouth can be readily detected in saliva.

A Nobel Prize-winning technology called the polymerase chain reaction is the basis for the tests to accurately analyze samples of saliva. A tiny saliva sample is taken so the DNA can be identified.

The DNA indicates the presence of a specific bacterial pathogen or a genetic signature unique to that patient.

Currently available oral DNA tests can identify 11 bacteria known to cause periodontal disease. If other unidentified bacteria are suspected, aneorobic culturing may be used to uncover them. A companion test called PST looks at the patient's genetic markers since there are genetic differences between individuals in terms of their immune response. These tests are available from ORALDNA Labs.

The same human papillomaviruses (HPV) associated with cervical cancer are also found in the oral cavity and, if present over long periods of time, can cause changes in cells, which are associated with some forms of cancer. ORALDNA Labs has also developed a test that can identify if this virus resides in the mouth. Early identification of HPV may prove to be an effective method of decreasing the risk of oral cancer.

The emerging science designed to analyze saliva will improve the diagnosis of oral and systemic diseases and many forms of cancer. It offers exciting possibilities to potentially change dental practice and patient care.

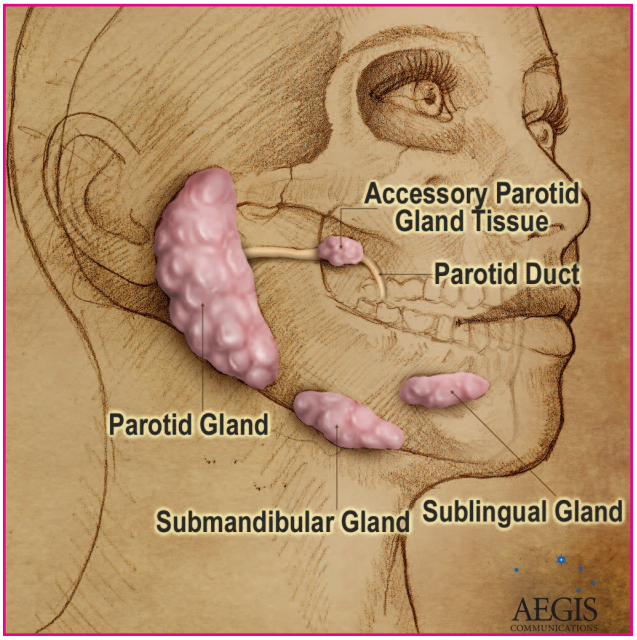

Fig. 9. The three major salivary glands produce over one liter of saliva each day and 1166 proteins have been identified that could be used for diagnosing a variety of diseases.

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