A 10-Year Longitudinal Study of 160 Implants Simultaneously Installed in Severely Atrophic Posterior Maxillas Grafted With Autogenous Bone and a Synthetic Bioactive Resorbable Graft

Marcelo C. Manso, DDS, MScD, PhD,* and Thomas Wassal, DDS, MSc, PhD†

Purpose: *This study intended to evaluate by clinical and imaging parameters the long-term predictability of osseointegrated implants inserted with specific simultaneous sinus lift approach in very atrophic posterior maxillas using a synthetic bioactive resorbable graft and autogenous bone graft.*

Patients and Methods: *A total of 160 implants were inserted in 57 maxillary sinus of 45 consecutive patients (16 men, 29 women) presenting 4 mm or less of residual subsinus bone in a simultaneous approach with the sinus lift procedure. All patients were surgically treated by the same surgeon and received the same modified technical and biomaterial protocol with a composite graft made of autogenous bone and a synthetic bioactive resorbable graft (OsteoGen, Impladent, Holliswood, NY) in a 1:1 rate. Among the inclusions criteria was a minimum loading time of 6 months to assure bone response activity. All patients were followed up for a mean period of 61.7 months (range, 20–132 months) with clinical, digital pictures, and radiographic aspects. Specific cases were followed up with computerized tomography scans (27.2%) with the consent form signed.*

Results: *Survival and success rates were 98.05% and 94.85%, respectively.*

Conclusion: *Advanced posterior maxillary resorption with extensive expanded sinus (SA-4 condition) can be safely treated by a simultaneous sinus lift approach and implant insertion using the technical protocol and biomaterials studied. (Implant Dent 2010;19:351–360)*

Key Words: atrophic maxilla, sinus lift, synthetic bioactive graft, bone graft

The posterior edentulous maxilla has always presented "the great challenge" when implant placement are considered. Low-quality bone and expanded maxillary sinus are often special concerns. Sinus lift procedures by the maxilla lateral wall approach, introduced by Tatum[1] and first published by Boyne and James,[2] proved to be safe and was well consecrated during the 90s with the Consensus Conference on the Sinus Graft.[3]

The simultaneous approach (sinus lift with immediate implant placement) has been advocated by several studies.[3–7] A polemic and controversial aspect relates to the necessity or lack of existing residual bone, of at least 5 mm to promote the primary stability. Block and Kent[4] reported their first technique using medullar-cortical blocks to achieve the primary stability where <3 mm of residual native bone was present. Again, in 1997, the author showed further results and so begun a lot of researches.[5] Another author with the same methodology reported a 100% success rate of an important 3.5 years follow-up study of >100 implants simultaneously placed during sinus lifts with <5 mm of residual subsinus bone.[6] As a matter of fact, the use of intramembranous corticocancellous bone grafts harvested from iliac crest as a way to achieve primary stabilization of threaded implants in simultaneous sinus-lift approach is still being advocated.[7]

Although the simultaneous concept always looked for better results, the staged approach demonstrated predictable success rates. However, the majority of those studies used extraoral donor sites for the largest reconstructions such as iliac crest, tibia, or calvaria.[5,6,8,9]

Since 1998, after a pioneer study,[10] several authors have been showing good

*Maxillofacial Surgeon, Head of Graduate and Advanced Implant Dentistry Programs, Brazilian Institute of Implant Dentistry, Rio de Janeiro, Brazil.
†Maxillofacial Surgeon, Head of Master and Post-Doctoral Programs, São Leopoldo Mandic Dental School and Dental Research Center, São Paulo, Brazil.

Reprint requests and correspondence to: Marcelo Corrêa Manso, DDS, MScD, PhD, Largo do Machado 54, conj 907, Laranjeiras, Rio de Janeiro, Brazil, Telephone: 21-22056785/21-2205-1190, E-mail: marcelo@manso.odo.br

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Table 1. Inclusion/Exclusion Criteria for the Population Studied (Stages I and II)

Inclusion	Exclusion
Consecutive patients by the same surgeon	Debilitating systemic diseases
4 mm or less of subsinus bone with simultaneous approach	Use of restrictive medicines
At least 6 mo of prosthetic load	Less than 6 mo of prosthetic load

Table 2. Stage I—From Implant Surgery to Prosthetic Impression Authorization; Stage II—After Prosthetic Functional Loading (6 mo at Least)

Aspect	Stage I	Stage II
Patients	45	44
Sinus	57	55
Implants	160	154

results for the simultaneous approach without extra-oral involvement.[11–14] However, problems with the primary stabilization of the implants in such scarce amount of bone is frequently reported and solutions based on particulate graft condensation around the implants and placement of nonthreaded implants have been considered.

Several biomaterials have been advocated with trustable results for sinus lift procedures when mixed with autogenous bone graft (ABG) and controversies turns around the ideal rate.[15,16] The synthetic bioactive resorbable graft (SBRG) has been studied for decades, but a consistence study involving specific data collection about extreme expanded sinus conditions with immediate implant placement is lacking.[17–21] As so, this study intended to evaluate by clinical and imaging parameters the long-term predictability of a specific simultaneous approach protocol described for very atrophic posterior maxillas using SBRG/ABG composite grafts and also threaded implants.[14]

PATIENTS AND METHODS

Patients

A total of 160 implants were inserted in 57 maxillary sinus of 45 consecutive patients (16 men, 29 women) presenting <5 mm of residual subsinus bone in a simultaneous approach with the sinus lift procedure. All patients were surgically treated by the same surgeon and received a same technical and biomaterial protocol. The inclusion/exclusion criteria are listed in Table 1 and was relevant to a minimum loading time (prosthetic loaded) of 6 months to assure bone response activity. The study was approved by the ethical committee of Sao Leopoldo Mandic's Dental Research Center (Campinas/São Paulo, Brazil) and recognized by the Brazilian Educational and Culture Ministry, PhD committee. The population and implant distribution is presented in Table 2.

Pre- and Postoperative Medication

Antibiotics consisted of 300 mg of clindamycin (Dalacin-C; Pharmacia/Pfizer, Sao Paulo, Brazil) 1 hour before surgery and 3 times a day after, then continued for 14 days after surgery. Patients with intolerance history received clavulanate-potentiated amoxicilin (Clavulin; Glaxo Smith Kline, Rio de Janeiro, Brazil) with the same dosage. A combination of nonsteroidal drugs (acetaminophen/ibuprofen) and a long-acting glucocorticoid (dexamethasone) was also used for pain and anti-inflammatory control for 72 hours after surgery (decreasing dose on second and third day).

Implant Selection

One hundred sixty-one implants (9 cylinders and 152 threaded) were from SteriOss System (NobelBiocare Company, Yorba Linda, CA); 11 implants were from Branemark System-MKIII TiUnite (NobelBiocare Company, Gotemborg, Sweden) and 9 implants were from 3i-Osseotite (Implant Innovation, Palm Beach, FL). This number of implants represented exclusively those placed in areas with residual subantral bone measuring 4 mm or less, other implants even in the same sinus were not quantified.

Biomaterials

The biomaterials strategy were the same in all cases and consisted of a composite graft. Autogenous bone were collected from the mandible retromolar area, particulated with a bone mill (Neodent, Parana, Brazil) and represented 50% to 60% of the graft. The remaining volume were filled with a SBRG (OsteoGen HA Resorb, Impladent, Holliswood, NY) when limited to 40%.

Surgical Technique

All patients underwent surgical procedures under local anesthesia with mepivacaine (3%) with epinephrine (1:100,000) (Scandicaine; Septodont, São Paulo, Brazil) and perioral sedation with midazolam (Dormonid; Roche, São Paulo, Brazil). The surgical procedure for maxillary sinus augmentation has been described elsewhere.[14] In brief, lateral maxillary sinus osteotomy by Tatum was performed with the lower aspect of approximately 7 mm over the sinus floor limit, combined with stripping off the sinus membrane to create a subsinus cavity into which the implants and the graft material could be placed (Fig. 1, A–C). The implants socket were drilled according to the manufacturer's specifications except for the last drill that was substituted for a reduced screw-tap to perform bone threads smaller than the implant diameter (Fig. 1, B). Finally, the usual screw-tap was used only for a quarter turn to make easier the contra angle-driven insertion of the implants. The grafts were applied using an incremental approach: the autogenous bone was first placed in direct contact with the implant bodies, and SBRG layers were interposed with new autogenous layers. The external layers were carefully receiving more and more percentage of SBRG and finally the most external layer constituted only SBRG (Fig. 1, D). At this time, a collagen membrane (Colla-Cote, Zimmer Dental, USA) was used for dressing the graft. Second stage surgeries were performed after 11 months elevating a full-thickness flap for direct visualization of bone healing at the lateral aspect of the maxilla. Healing caps were placed, and interrupted mattress sutures were applied (Fig. 1, E).

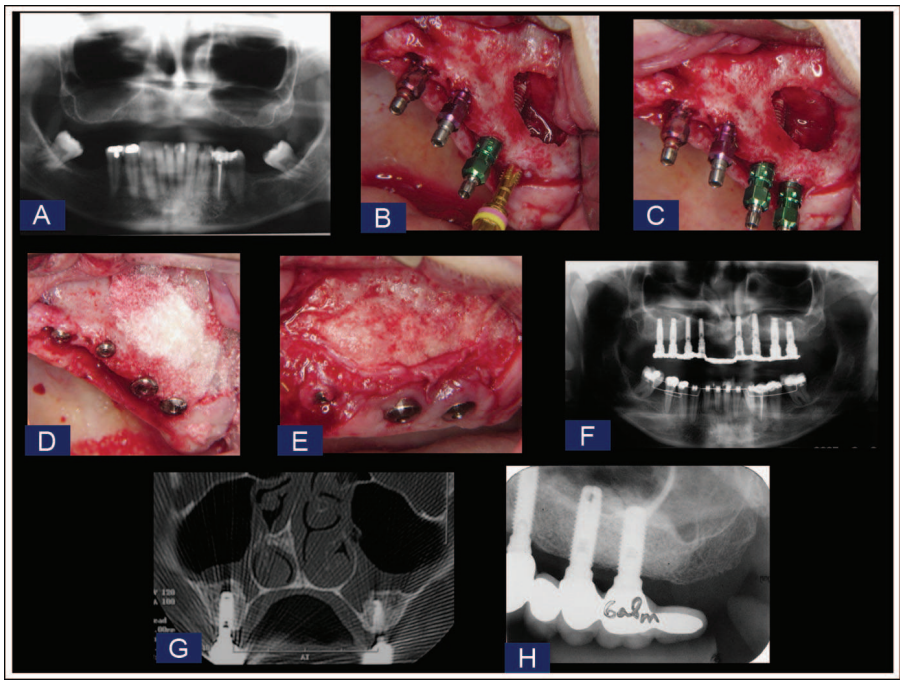

Fig. 1. Left sinus aspect of a bilateral atrophic maxilla reconstruction. Panoramic view: base line subsinus bone (**A**); 3.25 screw tap (**B**); threaded implants well positioned (**C**); external SBRG layer (**D**); lateral wall aspect after 11 months (**E**); panoramic view with temporary rehabilitation (**F**); sinus CT view after almost 7 years (**G**); and intraoral x-ray (**H**).

Table 3. Peri-implant MBL Classification and Implant Body Correlation

Levels	Bone Crest Level (Intraoral x-ray)
Level "0"	Necklace level, 0.7–1 mm
Level "1"	Between the necklace base and the first thread (not exposed), 1 mm
Level "2" (2.1;2.2;2.3 ...)	Threads exposed (out of bone), 0.6 mm each

Treatment and Follow-Up Protocol

Immediate and 15 days postoperative x-rays were done to assure final biomaterial retention. After that, patients were examined monthly until the recovery surgery with healing caps placement could be performed. This stage was considered as the stage I and represented success of early implant osseointegration and graft healing. Normally, clinicians took 1 or 2 months performing metal-ceramic rehabilitation, and the patients should be at least 6 months in function to be approved for the retrospective functional study (stage II). During the recall, new x-rays (panoramic and intra-oral) were requested and a clinical evaluation was performed. The clinical parameters investigated were pain, bleeding, mobility, exudations, or chewing discomfort. Crest bone loss around the implant neck was measured by using an implant computer mapping scale. All implants studied were digitally fractioned and measured by specific software in mm scale (Ulead Photoimpact 4.2 Canon,Tokyo, Japan). The values were applied to the radiographic images and a mathematic parameter could inform precise results. A diagnostic scale was created to classify the bone crest situation around each implant neck (Table 3). Finally, the majority of the extensive cases underwent computerized tomography (CT) scan evaluation (Fig. 1, G) with the consent form signed. CT scans were studied for the concerning two aspects: bone maintenance and maxillary sinus health (medical radiologic diagnoses).

The final analysis was executed concerning clinical surviving and success parameters based in both Misch *et al*[22] and Albrektsson *et al*[23] parameters. Gender distribution, smoke, postoperative infection, maxilla lateral wall bone regeneration, membrane perforation, and early implant exposure were also registered and correlated to failures and/or marginal bone loss.

RESULTS

A total of 45 patients (16 men, 29 women) ranging in age from 26 to 80 years (mean, 54 years) met the criteria for inclusion in this study. All patients could be evaluated on stage I. One patient was moved away during the beginning of the stage II study due to home care and return time inobservances. This patient represented 2 sinus and 6 implants.

Stage I Evaluation

All 57 sinus were considered satisfactory treated with 160 implants primary stabilized, well maintained and showed good osseointegration during the second stage surgery. One patient developed a moderate infection during the second week postoperative and was treated satisfactory with flap debridement and additional antibiotics. Thirty-seven implants (25%) of 18 patients (41%) had cover screws early exposed and all of them became osseointegrated at the second stage analysis (20 N counter clock torque). All maxillary sinuses, except one, presented full bone healing of the lateral wall when direct inspections were performed. One patient (80 years old) presented a partial bone defect at the upper aspect of the original bone window but also developed a satisfactory osseointegration of the 3 implants placed at that sinus and a good radiographic and clinical control after 42 months (6 implants, 2 bilateral sinus). Five sinuses (8.77%) were victims of perioperative Schneiderian membrane perforations. All perforations could be treated by a modified approach that used a collagen membrane (Colla-Cote, Zimmer Dental) with one extremity covering the hole (direct contact with the membrane) and the other exteriorizing the bone window and resting over the lateral wall. As the grafts were being applied, they could carefully enhance

Table 4. Stage I Evaluation Results

Aspect	Sample	Analyzed	Found	Percentage
Patient with premature cover screw exposure	45	43	18	25
Implants with premature cover screw exposure	160	148	37	41
Fail at the 2nd stage	160	160	0	0
Infection	57	57	1	1.75
Graft fail	57	57	0	0
Lateral wall defect	57	57	1	1.75
Membrane perforation	57	57	5	8.77

Table 5. Stage II MBL Evaluation

MBL Level	Sample	Percentage
0 and 1	129	83.7
2.1	11	7.1
2.2	06	3.8
2.3	03	1.9
2.4	03	1.9
2.5	02	1.2
Total	154	100

the collagen membrane stabilization. There was no statistic correlation between membrane perforations and failures or infections when Fisher's exact test was applied ($P = 0.39/P < 0.05$). There were no correlation between perforations and smokers. Ten patients were smokers and only 1 had a membrane perforation. In the other hand, from 35 nonsmokers, 4 had membrane perforations. The Fisher's exact test also identified no significance ($P = 0.69/P < 0.05$). (Statistical Program BioEstat version 4.0; Mamirauá Maintainable Development Institute, PR, Brazil). Stage I results are summarized in Table 4.

Stage II Evaluation

Fifty-five sinuses with 154 implants of 44 patients satisfied the inclusion criteria for this stage and could be studied. One patient had 1 implant failed during the final prosthetic procedure (final torque adjustment). This patient (male, smoker, and no membrane perforation episode) had 2 more implants in the same conditions (2 mm of subsinus bone). After explantation, the new bone repaired presented stable to receive a new implant in the same area, but the patient declined. The remaining 2 implants received a metal-ceramic prosthesis and presented satisfactory after 2.5 years. All other implants studied could receive functional loading with fixed prostheses and could be evaluated by the research criteria. Marginal bone loss (MBL) results are summarized in Table 5. Five implants (3.2%) lost >3 points in the indexed scale presented. Two of those were in 1 patient that also lost 2 implants after 5 years due the development of a perimplantite infection. Twelve patients (27.2%) representing 17 maxillary sinus (30.3%) and 51 implants (33.1%) accepted to undergo CT scans examinations. All sinus CT scans showed satisfactory bone maintenance and were medical-radiologically diagnosed as healthy.

Stage I and II Results

The cumulative analyses included 154 implants, 55 sinus, and 44 patients. The total period included was 10 years with a mean of 61.7 months when considered the recall date for research evaluation. All sinuses were attested healthy and a 100% success could be concluded for Stage I (primary stabilization and bone reconstruction technique). A total of 3 implants failed where one was before loading and the others were at a same patient 5 years later. Five implants were considered with unsatisfied marginal bone maintenance. As so, a survival rate of 98.05% and a success rate of 94.8% was established.

DISCUSSION

This study demonstrated a high survival rate for simultaneous implant placement with grafting of the maxillary sinus with SBRG and ABG. Other studies have been advocating the simultaneous approach with other biomaterials.[6,10,12] The ABG has been emphasized as an important factor to be present in association with other biomaterials such as hydroxyapatite (HA) bovine matrix and demineralized freeze-dried bone allograft.[5,12,24,25] In one study, the authors, for the first time, stated that the absence of ABG could be a probable cause for failures when large sinus expansion are considered.[25] They reported that their final success tax was in disagreement to the similar studies with ABG associated.[26,27] Hallman *et al*[16] studied patients treated with an 80:20 percent relationship of HA bovine matrix (BioOss, Geistlich Pharmaceutical, Wolhusen, Switzerland) and ABG in sinus lift treated with staged approaches, also considered that the little resorption found for the BioOss should be a special concern in cases with extensive expanded sinus because the great amount of remaining particles reduce the space for new vital bone regeneration. Another recent study emphasized this concept and strongly recommended the presence of ABG in a composite graft to achieve greater amount of new vital bone.[28] The authors also found this correlation by using histology and histomorphometry observations and considered the distance between the outlying host bone and the center of the graft a crucial factor.

Peleg *et al*[10] reported a pioneer study with 100% success of 55 implants HA coated in a simultaneous sinus lift approach in 20 sinus where only 1 or 2 mm of residual bone was present. They used only cylinders implants (no threads) and extolled a good graft condensation around the implant bodies as to achieve better primary stability and advised about problems with the final position due to the direction changes that the cylinders could suffer during insertion. Other studies also reported nonthreaded cylinders as an important factor to achieve adequate primary stability.[8–25] In our study, the drilling modification earlier described used a modified technique for installing threaded implants simultaneously to sinus-lift procedure in so atrophic conditions with predictable primary stability.[14] As so, all 160 implants could receive preplanned positions and satisfactory primary stabilizations (Fig. 2, A–F).

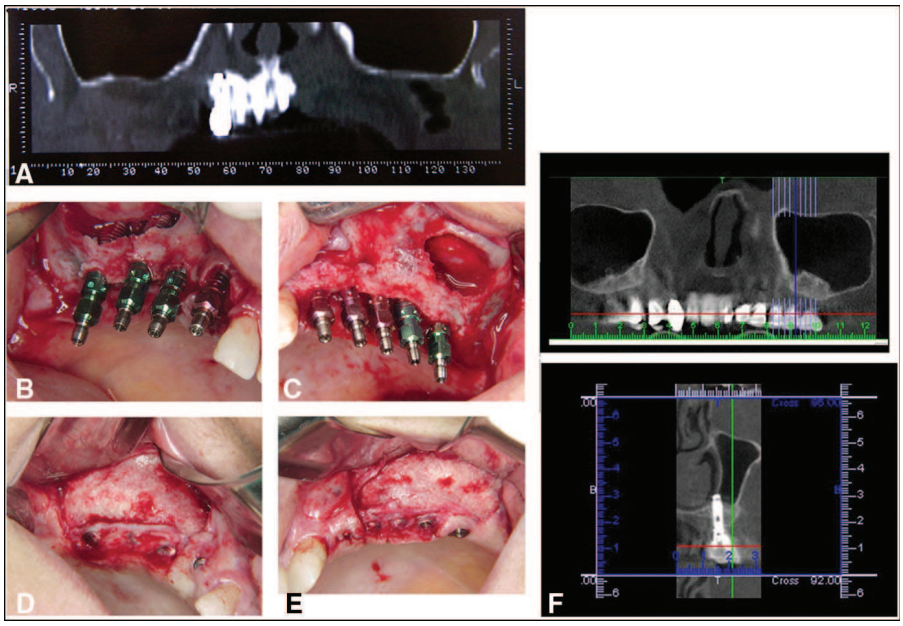

Fig. 2. Bilateral sinus in atrophic maxilla. **A,** CT scan view pre-op – base line subsinus bone; **B,** implants installed right side; **C,** implants installed left side; **D** and **E,** lateral wall aspect (right and left) after 11 months – complete bone heal; **F,** CTs view after 5 years.

Recently, Peleg *et al*[12] evaluated atrophic posterior maxillas where only the simultaneous approach was instituted. The research represented a 9 years longitudinal study with a total of 2132 osseointegrated implants installed in a multicentric group of patients and surgeons. The authors reported a cumulative survival rate higher than 97% (44 implants failed) using several biomaterials strategies and considered the amount of remaining subsinus bone as an important factor to failures. An important aspect was the moment and etiology of the failures. Of 44 implants failed, 33 (75%) were diagnosed as infection and lack of osseointegration denoting early and preloading failures. In this study, these aspects were included on Stage I where no failures occurred (100% success) what could be directly correlated to surgical technique, biomaterial acting and/or implant surface behavior. The waiting time between the first and the second stage surgeries was 11 months to allow enough SBRG resorption with new bone deposition and mineralization. A direct inspection of the lateral wall was performed in all cases, and only 1 patient showed partial unsatisfactory bone heal with no implant failure. The direct bone wall inspection is a concept first presented by Avera *et al*[28] and is based on the centrifugal mediolateral ossification of the grafts as so a centripetal anterior-posterior healing of the lateral wall of the maxilla, resulting in the center of this bone wall as the last area to be healed.

The MBL around the implants is another consideration. Herzberg *et al*[29] confronted simultaneous and staged sinus lift approaches, among others factors, measuring periodically the threads exteriorized from the bone in normal radiographs by Haas methodology.[30] The authors found a better MBL behavior for implants in simultaneous approach than for staged and also could present and confront the survival rate (95.5%) with the success rate (83.8%) based on Albrektsson *et al*[23] patterns. In our study, we developed the Haas concept and digitally mapped each implant used. Using real measurements of several segments of the implants, we could identify the exact MBL. Eighty-three percent of the totality of implants were classified with level 1 and were considered with a superb behavior. A progressive fall of the percentages were registered for each sublevel denoting a favorable proportion (Table 5). Another relevant aspect in this segment analysis is that some implants presented an apical bone level since the beginning due to technical aspects, healing reasons or even a surgical option. Therefore, the MBL diagnose should consider this important delta relationship. This concept was well discussed and introduced by Roos *et al* as an implement to Albrektsson *et al* patterns.[23–31] Misch *et al*[22] presented further aspects to be considered for success or failure diagnose and proposed an implant quality scale with 4 levels. In our study, a total of 5 implants were considered with unsatisfactory MBL behavior and out of level 1 and 2 (where no intervention is needed) of the authors scale and also in agreement with Albrektsson *et al* patterns.[23] As CT analyses were a patient option, only part of the population was studied (30.3% of the sinuses and 33% of the implants). This aspect agrees with other studies[12–32] and was considered satisfactory.

The premature exposure of the implants cover screws was a frequent occurrence (25%). However, no difference was registered when both groups were compared after a minimum prosthetic loading time. The premature exposure is considered to act as premature stimulus to biologic perimplant space organization.[33] Also, no correlation between the premature exposure and loss of osseointegration due to micromovements was found.

Finally, membrane perforation was also studied and 8.77% of the sinuses (N = 5) were victims of this kind of incident. However, no correlation could be found with implant failures or infection (Fisher's exact statistical test). Other studies showed higher prevalence and also exceptional results.[16,34,35] One of them related 58% of perforations with no correlation to failures when only single implants with simultaneous approach were considered. Herzberg *et al*[29] reported 46% of occurrence and no correlation with implant failures, but considered a strong correlation to postoperatory complications.

CONCLUSIONS

With data collected in this study, we could conclude the following:

- Patients presenting extensive posterior edentulism, associated with advanced posterior maxillary re-

sorption and severe sinus expansion, can be treated by a simultaneous sinus lift approach and implant placement in accordance with the technical protocol described.
- A 1:1 ratio of a composite graft, with ABG and a SBRG (OsteoGen), can satisfactorily treat many serious maxillary atrophies by performing simultaneous implant placements and sinus lift approach, without using extraoral donor sites.
- The technical protocol and biomaterials studied showed a satisfactory success rate that complied with acceptable international criteria.

DISCLOSURE

The authors claim to have no financial interest, directly or indirectly, in any entity that is commercially related to the products mentioned in this article.

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ID Abstract Translations

GERMAN / DEUTSCH

AUTOR(EN): Marcelo C. Manso, DDS, MScD, PhD, Thomas Wassal, DDS, MSc, PhD

Eine 10-Jahresstudie im Längsverlauf an 160 gleichzeitig in schwer atrophische hintere Oberkiefer eingesetzten Implantaten mit vorheriger Transplantierung mit autogenem Knochengewebe und einem synthetischen bioaktiven resorbierbaren Transplantat

ABSTRACT: Zielsetzung: Die vorliegende Studie zielte darauf ab, die langfristige Zuverlässigkeit Knochengewebsintegrierender Implantate mittels klinischer und Bildgebender Parameter zu beurteilen. Die Implantate wurden mit einer speziellen gleichzeitigen Sinusanhebungsmethode in sehr atrophischen hinteren Oberkiefern unter Verwendung eines synthetischen bioaktiven resorbierbaren Transplantats (SBRG) sowie einem autogenen Knochentransplantat eingepflanzt. ***Materialien und Methoden:*** Insgesamt 160 Implantate wurden in den Oberkiefersinus von 45 aufeinander folgenden Patienten (16 männlich, 29 weiblich) eingepflanzt. Dabei herrschten Höhen von 4 mm oder weniger an verbleibenden Untersinusknochen vor und die Behandlung wurde gleichzeitig mit der Sinusanhebung durchgeführt. Alle Patienten wurden vom gleichen Chirurgen operiert und alle wurden unter Beibehaltung des gleichen veränderten Technik- und Biomaterialprotokoll mit einem zusammengesetzten Transplantat aus autogenem Knochengewebe (ABG) und einem synthetischen bioaktiven resorbierbaren Transplantat-SBRG (OsteoGen, Impladent, Holyswood, NY/USA) in einem Verhältnis von 1:1 behandelt. Zu den Einschlusskriterien gehörte eine minimale Belastungszeit von 6 Monaten, um die Knochengewebsreaktionsaktivität zu gewährleisten. Alle Patienten mussten sich durchschnittlich in einem Zeitraum von 61,7 Monaten (zwischen 20 bis 132 Monaten) Nachuntersuchungen unterziehen. Dabei wurden klinische, digitale Aufnahmen sowie Röntgenbilder gemacht. In besonderen Fällen wurde zusätzlich ein CT-Scan (27,2%) gemacht. Hierzu unterzeichnete der Patient vorher die entsprechende Einverständniserklärung. ***Ergebnisse:*** Die Überlebens- und Erfolgsraten wurden entsprechend auf 98,05% und 94,85% berechnet. ***Schlussfolgerung:*** Eine fortgeschrittene Resorption im hinteren Oberkiefer mit einem massiv erweiterten Sinus (SA-4-Zustand) kann auf sichere Art und Weise durch eine gleichzeitige Sinusanhebung und Implantateinpflanzung unter Anwendung des in der Studie aufgeführten technischen Protokolls und der Biomaterialien behandelt werden.

SCHLÜSSELWÖRTER: atrophischer Oberkiefer; Sinusanhebung, synthetisches bioaktives Transplantat; Knochentransplantat

SPANISH / ESPAÑOL

AUTOR(ES): Marcelo C. Manso, DDS, MScD, PhD, Thomas Wassal, DDS, MSc, PhD

Un estudio longitudinal de diez años de 160 implantes colocados simultáneamente en maxilares posteriores severamente atrofiados injertados con hueso autógeno y un injerto reabsorvible bioactivo sintético

ABSTRACTO: Propósito: Este estudio tuvo la intención de evaluar, usando parámetros clínicos y de imágenes, la previsibilidad de largo plazo de implantes oseointegrados colocados con un método específico de elevación simultánea del seno en maxilares posteriores muy atrofiados usando un injerto reabsorvible bioactivo sintético (SBRG por sus siglas en inglés) y un injerto de hueso autógeno. ***Materiales y métodos:*** Se colocaron un total de 160 implantes en 57 senos maxilares de 45 pacientes consecutivos (16 hombres, 29 mujeres) que presentaban un hueso en el subseno residual de 4 mm o menos en un método simultáneo con el procedimiento de elevación del seno. Todos los pacientes fueron tratados quirúrgicamente por el mismo cirujano y recibieron el mismo protocolo técnico y de biomaterial con un injerto de aleación hecha por hueso autógeno (ABG por sus siglas en inglés) y un injerto reabsorvible bioactivo sintético, SBRG (OsteoGen, Implandent, Holyswood, NY/EE.UU.) en una relación uno a uno. Entre los criterios de inclusión se incluyó un período mínimo de carga de 6 meses para asegurar una actividad de respuesta del hueso. Todos los pacientes fueron seguidos durante un período medio de 61,7 meses (rango de 20 a 132 meses) con imágenes clínicas y digitales y aspectos radiográficos. Los casos específicos fueron seguidos con tomografías computadas (27,2%) con formulario de consentimiento firmado. ***Resultados:*** Se calcularon las tasas de supervivencia y de éxito en 98,05% y 94,85% respectivamente. ***Conclusión:*** La reabsorción avanzada del maxilar posterior con extensa expansión del seno (condición SA-4) puede tratarse sin problemas usando un método de elevación simultánea del seno y colocación del implante usando el protocolo técnico y los biomateriales estudiados.

PALABRAS CLAVES: Maxilar atrofiado; elevación del seno; injerto bioactivo sintético; injerto de hueso

PORTUGUESE / PORTUGUÊS

AUTOR(ES): Marcelo C. Manso, Cirurgião-Dentista, Mestre em Odontologia, PhD, Thomas Wassal, Cirurgião-Dentista, Mestre em Ciência, PhD

Estudo longitudinal de dez anos de 160 implantes instalados simultaneamente em maxilas posteriores gravemente atróficas enxertadas com osso autógeno e enxerto reabsorvível bioativo sintético

RESUMO: Objetivo: Este estudo pretendia avaliar por parâmetros clínicos e de imageamento a previsibilidade de longo prazo de implantes osseointegrados inseridos com abordagem específica simultânea de elevação da cavidade em maxilas posteriores atróficas usando enxerto reabsorvível bioativo sintético (SBRG) e enxerto de osso autógeno. ***Métodos:*** Um total de 160 implantes foi inserido em 57 cavidades maxilares de 45 pacientes consecutivos (16 masculinos, 29 femininos) apresentando 4 mm ou menos de osso da subcavidade residual numa abordagem simultânea ao procedimento de elevação da cavidade. Todos os pacientes foram tratados cirurgicamente pelo mesmo cirurgião e receberam o mesmo protocolo de biomaterial técnico modificado com um enxerto composto feito de osso autógeno (ABG) e um enxerto reabsorvível bioativo sintético – SBRG (OsteoGen, Impladent, Holyswood, Nova York/Estados Unidos) numa taxa de 1:1. Entre os critérios de inclusão estava um tempo de carregamento mínimo de 06 meses para garantir a atividade de resposta do osso. Todos os pacientes foram acompanhados por um período médio de 61,7 meses (intervalo de 20 a 132 meses) com fotografias clínicas e digitais e aspectos radiográficos. Casos específicos foram acompanhados de mapeamentos por tomografia computadorizada (27,2%) com formulário de consentimento assinado. ***Resultados:*** As taxas de sobrevivência e sucesso foram calculadas em 98,05% e 94,85%, respectivamente. ***Conclusão:*** A reabsorção maxilar posterior avançada com extensa cavidade expandida (condição SA-4) pode ser tratada com segurança por uma abordagem simultânea de elevação da cavidade e inserção de implante usando o protocolo técnico e os biomateriais estudados.

PALAVRAS-CHAVE: maxila atrófica; elevação da cavidade, enxerto bioativo sintético; enxerto de osso

RUSSIAN / РУССКИЙ

АВТОРЫ: Marcelo C Manso, доктор хирургической стоматологии, магистр естественных наук в области стоматологии, доктор философии, Thomas Wassal, доктор хирургической стоматологии, магистр естественных наук в области медицины, доктор философии

Десятилетнее долгосрочное исследование 160 имплантатов, одновременно установленных в сильно атрофической дистальной части верхней челюсти с пересаженным костным аутотрансплантатом и синтетическим биоактивным рассасывающимся трансплантатом

РЕЗЮМЕ: **Цель.** Данное исследование имеет целью оценить клинические параметры и параметры визуализации долгосрочной прогнозируемости остеоинтегрированных имплантатов, установленных с использованием специфического подхода, предусматривающего одновременное поднятие дна пазухи в дистальной части верхней челюсти с высокой степенью атрофии костной ткани с помощью пересаженного костного аутотрансплантата и синтетического биоактивного рассасывающегося трансплантата (SBRG). **Материалы и методы.** Всего было установлено 160 имплантатов в 57 верхнечелюстных пазухах 45 произвольно отобранных пациентов (16 мужчин, 29 женщин), у которых имелось 4 мм или менее остаточной толщины кости под дном пазухи. При этом использовался одновременный подход с процедурой поднятия дна пазухи. Всем пациентам операцию проводил один и тот же хирург, соблюдался один и тот же измененный технический протокол и протокол использования биоматериалов — сложный трансплантат, состоящий из костного аутотрансплантата (ABG) и синтетического биоактивного рассасывающегося трансплантата — SBRG (OsteoGen, Impladent, Holyswood, NY/USA) в соотношении 1:1. В числе критериев включения пациента в исследование было время нагрузки имплантата, которое должно было составлять не менее 6 месяцев, чтобы гарантировать активную реакцию кости. Все пациенты проходили последующее наблюдение в течение в среднем 61,7 месяцев (срок наблюдения колебался от 20 до 132 месяцев), включавшее клинические обследования, цифровые снимки и рентгенологические данные. В особых случаях применялась компьютерная томография (27,2%) с подписанием формы заявления о согласии. **Результаты.** Приживаемость и процент успешной имплантации были подсчитаны и составили 98,05% и 94,85% соответственно. **Вывод.** Случаи высокой степени дистальной резорбции верхней челюсти с сильно расширенным дном пазухи (состояние SA-4) можно безопасно лечить при помощи метода одновременного поднятия дна пазухи и установки имплантата с использованием технического протокола и биоматериалов, описанных в исследовании.

КЛЮЧЕВЫЕ СЛОВА: верхняя челюсть с атрофией костной ткани, поднятие дна пазухи, синтетический биоактивный трансплантат, костный трансплантат

TURKISH / TÜRKÇE

YAZARLAR: Marcelo C. Manso, DDS, MScD, PhD, Thomas Wassal, DDS, MSc, PhD

Otojen kemik ve sentetik bir biyo-aktif rezorbabl greft ile greftlenen ciddi şekilde atrofiye uğramış posterior maksillada eşzamanlı olarak yerleştirilen 160 implantın on yıllık çalışması

ÖZET: Amaç: Bu çalışmanın amacı, büyük ölçüde atrofiye uğramış posterior maksillada, sinüs kaldırma yaklaşımı ile eşzamanlı olarak yerleştirilen osseo-entegre implantların uzun vadedeki başarısını klinik ve görüntüleme parametreleri kullanarak

değerlendirmekti. ***Gereç ve Yöntem:*** Bir sinüs kaldırma prosedürü ile eş zamanlı olarak rezidüel subsinüs kemiği 4 mm veya daha az olan ard ardına 45 hastanın (16 erkek, 29 kadın) 57 maksiller sinüsünde toplam 160 adet implant yerleştirildi. Hastaların tümü aynı cerrah tarafından tedavi edildi ve olgulara, otojen kemik ve sentetik bir biyo-aktif rezorbabl greftten (OsteoGen, Impladent, Holyswood, NY/USA) oluşan kompozit bir greft 1:1 oranında aynı modifiye teknik ve biyo-materyal protokolü ile uygulandı. Çalışmaya dahil edilme kriterlerinden biri de, kemik yanıt aktivitesini sağlamak için minimum 6 aylık yükleme süresiydi. Hastaların tümü ortalama 61.7 ay (20 ila 132 ay) boyunca hem klinik açıdan, hem de dijital resimler ve radyografi ile takip edildi. Bazı olgulara, olur formu imzalandıktan sonra BT (%27.2) uygulandı. ***Bulgular:*** Sağkalım ve başarı oranları sırasıyla %98.05 ve %94.85 idi. ***Sonuç:*** Posterior maksillada ileri derecede rezorpsiyon ile genişlemiş sinüs (SA-4) durumu, eşzamanlı sinüs kaldırma ve implant yerleştirme yaklaşımı ile burada çalışılan teknik protokol ve biyo-materyaller kullanılarak güvenli bir şekilde tedavi edilebilir.

ANAHTAR KELİMELER: Atrofik maksilla, sinüs kaldırma, sentetik biyo-aktif greft, kemik grefti

JAPANESE / 日本語

自家骨と生体親和性合成骨補填材を用いた上顎後部重度骨萎縮部位の骨移植、また同時埋入したインプラント160本の10年間にわたる縦断的研究

共同研究者氏名: マルチェロ•C•マンソ（Marcelo C Manso）DDS, MScD, PhD, トマス•ワッサル（Thomas Wassal）DDS, MSc, PhD

研究概要:

目的: 当研究は上顎後部重度骨萎縮部位に合成生体親和性骨補填材(SBRG)と自家骨を用い、特別に上顎洞底挙上アプローチと同時埋入したインプラントのオッセオインテグレーション長期予知性を臨床と画像パラメータで評価した。

素材と方法: 副鼻腔洞下残余骨4mm以下を示す一貫患者45名（内訳：男性16名、女性29名）の副鼻腔洞57部位に上顎洞底挙上術をおこない、合計160本のインプラントを同時埋入した。同一外科医が患者全員の手術を担当し、同一最新技術により、自家骨(ABG)と合成生体親和性移植補填材SBRG (OsteoGen, Impladent, Holyswood,NY/USA) を1:1の割合で合成したコンポジット骨補填材バイオマテリアルプロトコールで治療した。取込み基準は骨組織反応確立に要する最低6ヶ月の負荷時間も包括する。患者全員を臨床とデジタル画像そしてレントゲンで平均61.7ヶ月（20から132ヶ月範囲）フォローアップした。署名同意を得た特殊ケース(27.2%) はCTスキャンでフォローした。

結果: 生存率成功率はそれぞれ98.05%と94.85%となっている。

結論：広範囲に拡大した上顎洞（SA−4コンディション）が確認される上顎後部進行性骨吸収は、当研究対象の技術プロトコールとバイオマテリアルを用い上顎洞底挙上インプラント同時埋入法で安全に治療できる。

キーワード: 上顎骨萎縮；上顎洞底挙上術、生体親和性合成骨補填材；骨移植

CHINESE / 中国語

使用自體骨和合成生物活性可吸收移植物在嚴重萎縮後上頜同步安裝 160個植體的十年縱貫性研究

作者：Marcelo C. Manso, DDS, MScD, PhD、Thomas Wassal, DDS, MSc, PhD

摘要：
目的：本研究旨在以臨床和造影參數，評估使用合成生物活性可吸收移植物 (SBRG) 和自體骨移植物，在非常萎縮的後上頜安裝骨整合植體時同步使用特定竇升高法的長期可預測性。

資料與方法：為連續45位殘餘副竇骨最多剩 4 公厘的患者 (16 位男性、29 位女性)，使用竇升高術同步法在共57 個上頜竇置入 160 個植體。所有患者皆由同一個外科醫師以外科手術方式進行治療，並使用自體骨 (ABG) 和合成生物活性可吸收移植物 – SBRG (OsteoGen, Impladent, Holyswood, NY/USA) 以 1: 1 比例製成的複合移植物，接受相同的修正技術和生物材料治療方法。選擇標準是植體載入時間至少 6 個月，確保有骨反應活動。以臨床、數位照片和 X 光為所有患者追蹤，平均期間61.7個月 (範圍從20到132個月)。特定病例則在簽署同意書後進行電腦斷層掃描 (27.2%)。

結果：計算的存活率和成功率分別為98.05 % 和 94.85 %。

結論：使用本研究中的技術治療方法和生物材料進行竇增高和植體安裝同步法，可使大範圍擴大竇之晚期後上頜骨吸收 (SA-4 情況) 獲得安全的治療。

關鍵字：萎縮上頜、竇增高、合成生物活性移植物、骨移植物

KOREAN / 한국어

심한 상악동 후방 위축에서 자가골 및 합성 생활성 재흡수 이식편으로 이식된 임플란트 160개에 대한 10년간의 추적 관찰 연구

저자: 마르첼로 C. 만소 (Marcelo C. Manso), DDS, MScD, PhD, 토마스 바잘 (Thomas Wassal), DDS, MSc, PhD

요약:
목적: 본 연구는 심하게 위축된 상악 전방에 합성 생활성 재흡수성 이식편(SBRG)과 자가골이식편을 이용하여 동시 상악동 거상 접근법으로 식립한 골유합 임플란트의 장기 예측성을 임상 및 영상 변수로 평가하기 위해 시도되었다.

재료 및 방법: 상악동 하부 잔존골 높이가 4mm 이하인 환자 45명 (남성 16명, 여성 29명)의 상악동 57곳에 상악동 거상술과 동시에 총 160개의 임플란트를 식립하였다. 모든 환자들은 동일한 자가골(ABG)과 합성 재흡수성 생활성 이식편-SBRG (OsteoGen, Impladent, Holyswood, NY/USA)을 1:1의 비율로 제작된 복합이식체와 동일한 수정 기법으로 동일 의사의 시술을 받았다. 골반응 활성을 확실히 하기 위해 최소 부하기간을 6개월로 하였다. 모든 환자들을 평균 61.7개월 (20개월 ~ 132개월 범위) 기간 동안 임상, 디지털 영상 및 방사선 촬영을 하여 추적 검사하였고, 일부 특정한 경우는 서명을 통해 동의를 받은 후 CT 스캔 (27.2%)을 시행하였다.

결과: 생존 및 성공률은 각각 98.05 %와 94.85 %로 산출되었다.

결론: 광범위한 상악동 확장(SA-4 상태)과 상악동 후방에서 진행된 재흡수는 본 연구의 기술적 프로토콜과 생체적합 물질을 이용한 동시적 상악동 거상법과 임플란트 식립으로 안전하게 치료될 수 있다.

키워드: 상악 위축, 상악동 거상, 합성 생활성 이식편, 골이식.