Immediate Function and graftless solution for complete loss of alveolar ridge in the molar region with an Individualisable New Implant Type and the New Implant Material PEEK: A Case Description

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Purpose: In edentulous edentulous maxillae, when posterior alveolar atrophy or other reasons for total alveolar ridge loss makes normal implant procedures impossible because of lack of bone substance, commonly there is a call for bone grafting. But the patient treatment acceptance is bad when all the disadvantages of the procedures are explained and understood. (1, 2, 3)

The purpose of this study was to evaluate the feasibility of a protocol for immediate function (within 2 hours) of a standard basal implant in the material PEEK (poly-ether-ether-ketone) supporting a fixed PEEK-prosthesis in the partially edentulous maxilla. PEEK is a bone isoeelastic thermoplastic with sufficient physical properties to replace titanium in the jaws which makes comfortable to wear light and small structures in maxillo-facial surgery. (4, 5)

Materials and Methods: This clinical study of one case concerns the surgical and prosthetical procedures with one basal PEEK implant. Within 2 hours and the CEREC-system we fabricated a new fixed ceramic bridge.

Results: The male patient treated with immediate loading of PEEK-implants was followed for, in first instance, 12 months and now up to 18 months. The patient reported supportable to negligible post-operative pain and a slight tumefaction concerning his left mid-face developing after the first post-operation day. He reported security during speech and mastication. Further he mentioned that he continued working at his working place the same day, 2 hours post-op. The implant is in good function even after 18 months.

Discussion: The patient could have been candidate for sinus grafting prior to receive fixed prostheses for his left side maxilla. With our concept, the new PEEK material and the new crestal and basal implant design this patient benefited from a less invasive procedure (one surgical procedure and no grafting), the best exploitation of the individual anatomical situation, the incorporation of osteoconductive material PEEK and immediate extremely light and small rehabilitation (prosthesis incorporated directly after surgery).

Conclusion: The highest possible survival rate, increase in patient’s immediate functional ability and reduction of morbidity following the surgical procedure render this procedure a viable and feasible treatment option for the partially or as our other in the meantime finalized cases show completely edentulous maxilla.

Keywords: atrophied maxilla, edentulous maxilla, fixed maxillary prostheses, immediate loading, pterygoidian, PEEK in maxillo-facial surgery, PEEK implants, CEREC
The partial to complete resorption of the alveolar ridge is an inevitable consequence of tooth loss and as well denture wearing as renouncement on denture wearing. Intraosseous stimulation of bone by implants and mastication lower the risk of loosing the complete alveolar ridge. The dogma of the preservation of the traditional healing period of 3 to 6 months in which loading of implants was forbidden (6), is nowadays not of actuality. To safeguard bone structure and to initiate bone reconstruction the immediate loading of implants placed in edentulous jaws with a stable fixed prosthesis at the time of implant placement has been studied (2). For titanium implantology where is a discrepancy between the elasticity of the metal and bone, the main advantage in providing the edentulous patient with a stable, fixed, provisional prosthesis is an immediate improvement in the patient’s ability to function and a positive boost of patients’ self-esteem (2).

Restoration of edentulous or partially edentulous mandibula with at least one region of total absence of alveolar ridge and of strategic importance needing an implant insertion in this same region, with PEEK, basal implants has been shown to be a viable treatment plan. (7)

The ability to rehabilitate the edentulous maxilla with fixed prosthesis has been difficult in patients where large existing sinuses or loss of bone after inflammation processes or tumour ablation in the canine or premolar region or even after missed implant incorporations formerly have required adjunct procedures such as bone grafting prior to implant placement. The need to harvest autogenous bone out of a second operation site or the use of bovine bone and all the explanations necessary to give to the patients including the high rate of lack of success contributed to these procedures has deterred patients from accepting those treatments.

Even the use of tilted implants, the all-on-four- technique and others using zygomatic approach (8) cannot convince because of the uncomfortable voluminosity of the implanted material, the often ectopic emerging posts deranging the patient in speech and buccal hygiene and also the voluminous attached intrabuccal prosthetics; one further important point is the incompatibility to join these implants to residual teeth.

The hypothesis tested in this study was that the immediate function protocol with one PEEK basal implant in the with normal implant procedures and without grafting not treatable maxilla would give better results compared with the grafting alternatives where the failure rate is proved to be higher than 25 % and following some publications even higher than 50% (IMG 1).

The purpose of this article was to present the clinical case and the one year result achieved using the immediate PEEK loading concept as a test before starting treatments of more importance.

Materials and Methods

The retrospective study was performed in an Implant Center in St. Petersburg and supervised by the same maxillo-facial surgeon. The male patient, 69 years, was operated in January 2010 and controlled up to January 2012 in 6-months-interval. He fulfilled the requirements of this study and gave his written consent to participate in the study:

- need for an additional graft procedure if implanted with titanium classical implants in the sinus, canine or premolar regions
Bone height ranging from 1 to 3mm in at least one for strategic implantation necessary region of the maxilla.

-healthy looking sinuses or known conditions of sinusitis without interference to dental implantation

The quality of residual bone was without importance for the inclusion criteria. (Bedrossian)

Opposing jaws:

At the time of insertions of the PEEK implants, the patient had a removable prosthesis in good occlusal conditions in the opposite mandibula.

Implant components

The patients received a PERSO-B implant in PEEK Optima in the dimension 71219, that is to say an implant with a base diameter of 7 mm, the breadth of the base of 12 mm and the total length 19mm (IMG 2).

The basal implant was inserted in the region 27. The dimension of abutments had been diminished by shaping with a special rotatif instrument (IMG 4) to the following measurements:

By the manner of shaping the base of the basal implant more or less on the palatinal side the threaded post of the implant has been positioned just in an antagoniste position to the lower teeth 36/37. (IMG 5) This procedure happened immediately.

However we were prepared to the possibility that a initially prepared implant showed its post too far to the palatinal side; by this the good antagonist contact should have been in a danger; we should have feared too much scissor forces which shall be avoided by this personalizing concept of implants. (IMG 6) For that presumed case which did not happen, we should have remodeled in the place of this wrongly shaped implants, another one till we then found the good emerging point for the post just opposite to the lower jaw tooth.

By shaping we correct the direction which had to be corrected by 10° to be in a correct position opposite to tooth 36. (IMG 4)

Surgical protocol

The patient had his maxillary teeth 26 and 27 removed 16 days before implant procedure. (IMG 7)

Preoperative planning included a cone beam scanner pantomography and a clinical and model analysis including as well a functional analysis of mastication and articulation. The vertical dimension of occlusion (VDO) was almost ideally reestablished.

In the case the initial VDO was not correct, we should have first installed the correct VDO within the rest of the dentition.
We did not give any premedication before intervention.

Immediately prior to the surgery, patients had to rinse with 2% Chlorhexetidin for 1 min.

No sedation was given to the patient; just the necessary local anesthesia utilizing Ultracaine 2% with Noradrenaline 1/200000. Circumvestibular injection and a block of infraorbital and retromaxillary innervation has been done. No inferior alveolar bloc has been necessary. Also there was no necessity to give any extraoral injection.

The surgical procedure is illustrated in IMG 5. The PERSO-B implant been inserted with smooth impactation in the by LASER-Waterlase shaped insertion channels. A form cutter number 10 for the basal (IMG 5) gave the last form before smooth insertion of the implant by finger pressure. The drilling equipment was the standardized SisoMM-equipment for PERSO-B implants. (11)

There was no precaution for overheating the site in the insertion procedure because of the smooth impactation protocol, no need of torque settings and changes of that.

Once positioned the implant has been evaluated for angulation and tissue depth. The basal implant was topped by an 8mm standard abutment (SisoMM). This abutment was corrected for highness (diminution to 5mm) and parallellity to tooth 14. The insertion guide was placed to evaluate the parallellity of the posts and their length. Corrections have been done by shaping the PEEK with rotatif instruments. There was no need to correct the position by other than the choosen abutment. Then the wounds have been closed with 3-0 Vicryl sutures after, installing penetration points in the mucoperiost to easily pull-over it on the abutments for better initial fixation of the tissues.

Prosthetic protocol

The prosthetic procedure by CEREC is illustrated in IMG 9.

The patient was guided into good centric occlusion. This has been caught by the CEREC 3D-camera. By the CAD/CAM-technic the shaping unit of CEREC has fabricated a bridge from 25 to 27. (IMG 10)

Eventually existing precontacts have been corrected. The occlusal contact has been harmonized and equilibrated from 27 to 24 on the palatinal side. Obstacle contacts on lateral deviation have been corrected to permit a smooth mastication with minimalized lateral scissor forces. (IMG 11)

Implant survival criteria

12 month following implant procedure, the implant was classified as surviving because it fulfilled its supportive function and was stable when tested individually after removal of the provisional prosthesis. Absence of pain upon pressure and percussion with no sign of peri-implant pathology were also survival criteria.

Follow-up

Panoramic cone-beam tomography was performed after 6 weeks, 6 months and 1 year. The last tomography is taken after 18 months and only renewed if there should be complaints by the patient. There was no complaint of the patient in the meantime. (IMG 11)

In this time interval the hygienic examination and treatments have been performed, as well.

Results
1 year post-operation the treatment is a full success for the patient and even unchanged after 3 years.

Marginal bone level

Clinically and radiographic measurements showed that the bone and gingiva remodelling showed a loss in the premolar region between 0 and 1 mm, and in molar region there was no loss but a augmentation of theses structure in a dimension of 0 to one millimeter.

Mechanical complications

No fractures or loosening of abutments or prosthetic screws were observed during the study, once the definite prostheses were incorporated.

Patients satisfaction

The patient reported supportable to negligible post-operative pain, there was a slight tumefaction; patient had analgesic medicaments at his disposition and he reported that he managed the little pain by taking one or two analgesic tablets per day in the first two days; the patient reported security during speech and mastication. He had more than enough space for his tongue movements. No palatinal side emerging implant posts, even not in the premolar or molar region could have been irritating because implants had been positioned opposite to the lower teeth on the vestibulary side. The patient was allowed for maintenance of a soft diet that required little chewing. Patient had to be aware of only taking nutrition that was easy to chew and without forces to prevent scissor forces in the first 40 days. Afterwards the patient was allowed to successively change to normal and even very hard nutrition like nuts and all sort of meat and bread. After one year the patient did not worry about what he eats and how to attack harder substances.

Discussion

The survival rate of the immediately loaded PEEK implants after 1 year (100%) compares favorably to the 1 and 2-stage approaches favorably described by Bedrossian and Malevez (12). Our results seem to be more favourable for the patient because the surgical procedure circumstances are less invasive and the comfort of chewing with those finer prostheses is evident. Furthermore there is almost no loss of tissues with the PEEK material, even augmentation which we explain by the osteoconductive reaction of the material and osteoinductivity which lies in the similar physical behavior of bone and PEEK (13) and by this a constant initializing and stimulation to react on the bone.

There was almost no early bone resorption as to find in other studies for maxillary resorption. The patient was accepted for the study because he showed a posterior maxillary bone height ranging from 1 to 3 mm in the first molar to second molar region. We find one other study about implantation zygomatic implants and one about all-on-four-concept. We state that the prostheses shown in these publications are rather surdimensionated and not easy to wear for the patient. We think that the 100 % result we proved with the PEEK material is a more comfortable solution for the patient, shows less risks in the peri-interventional interval in what is concerning the needs of anesthesia-protocols and shows less risks as well for the surgeon who can better and easier adapt the PEEK material to the prosthodontic needs than metal material. The implanted structure is now more than 1 year in function; so we started further clinical studies to investigate on the application of this new well-performing material.
Conclusion

Within the limits of this study, it can be concluded that the use of PEEK implants in a combination of basal PEEK implants with natural teeth is a promising technique for the restoration of maxillae with advanced to severe atrophy avoiding heavier surgery with grafting and permitting immediate prosthetical rehabilitation and function.

Tables, images, graphs

Img 1

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IMG 2: PEEK implant P-BIS 7-12-19

IMG 4: Bellform instrument (on the right) for angled hand-piece to reduce PEEK abutments to the individually indicated angle and volume
IMG 5: Direction to the antagonist and volume of the abutment by shaping. Lateral Insertion of basal implants by using a serie of cutters

IMG 6: Different forms given to the palatinal side of the implant which makes an effect on the position of the prosthetical post

IMG 7: Situation before treatment
IMG 7B: After extraction of 26 and 27
IMG 9: The CEREC CAD/CAM procedure for impression and design of the bridge 25-28

IMG 10: Bridge 25-28 ready for milling in the Inlab-machine
IMG 11: Bridge in function with occlusal controls

IMG 12: After 1 year: good osseus incorporation of the implant 27 without any sign of periimplant bone resorption. In comparison with 7c the sinus membrane reaction is recovering.
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