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Cone-Beam Computed Tomographic Evaluation of Using Bio-Absorbable Poly-Milk and Poly-Glycol Polymers as Bone Void Filler in Large Mandibular and Maxillary Defects Surgeries

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ABSTRACT

Healing bone defects of odontogenetic aetiology is the most frequent cause of failure in surgical treatment of an ostitic process. Hard tissue augmentation is becoming more common. The previous "gold standard" for bone augmentation is autogenous bone, which is now limited and restricted due availability of many other materials used as Bone substitute materials which are intended to be implanted in a surgical procedure and, over time, become a par t of vital bone. Nano-materials seem to be a very promising system for bone reconstructive or regenerative maxillofacial surgery. This study evaluates the Use Bio-absorbable poly-milk and poly-glycol polymers as augmented material in large mandibular bone voids Surgeries. Recently with the advent of imaging modalities it could be logic to use cone-beam CT for this evaluation because differences in density may permit more accurate evaluation of quality bone healing. Defects were scanned preoperative, within first week post operative and every three months for nine months.

This study evaluated 17 large mandibular and maxillary different defects. The results in this case show that Bio-absorbable poly-milk and poly-glycol polymers particles in the Bone Void are osteoconductive. Significant resorption of Bio-absorbable poly-milk and poly-glycol polymers particles is inspected 3-6 months after placement. At 9 months after void preservation, the small residual amount of augmented graft did not compromise the bone healing.

INTRODUCTION

Deformity of the maxillofacial skeleton may arise from various causes including congenital deformity, trauma or tumors resection. Restoring proper contour and support in maxillofacial region following loss or removal of bone as part of tumor surgeries may be quite challenging. Usually, autologous bone is the method of choice of bone reconstruction and is the high probability of success rate in reconstructing bone in the maxillofacial area because autologous bone provides perfect biocompatibility along with the body's own growth factors and structural proteins. Autograft possesses all of the necessary characteristics such as osteoconductivity, osteogenicity, and osteoinductivity **[1]**. Despite these advantages, it is not always possible to use Autologous bone because the amount of autogenous bone available for grafting is limited and the mechanical characteristics are not always optimal **[2]**. Furthermore, autograft are associated with increased morbidity, increased anesthesia time and blood loss, and post operative donor site complications. This is why bone substitutes are required for certain indications and situations **[3]**. An alternative to autograft is the use of allograft. Allograft offers the advantage of precluding a second surgery and is frequently used during surgical procedures for enhancement of fracture healing, for filling cavities and defects, bridging joints, establishing the continuity of long bone and providing bone blocks **[4-6]**.

The biology of bone grafts and their substitutes is appreciated from an understanding of the bone formation processes of Osteogenesis, Osteoinduction and Osteoconduction **[7-10]**.

Graft osteogenesis: The cellular elements within a donor graft, which survive transplantation and synthesize new bone at the recipient site.

Graft osteoinduction: New bone realized through the active recruitment of host mesenchymal stem cells from the surrounding tissue, which differentiate into bone-forming osteoblasts. This process is facilitated by the presence of growth factors within the graft, principally bone morphogenic proteins (BMPs).

Graft osteoconduction: The facilitation of blood-vessel incursion and new-bone formation into a defined passive trellis structure. All bone

graft and bone-graft-substitute materials can be described through these processes [11].

The advantages of bone allograft recovered from deceased donor sources include its ready availability in various shapes and sizes, avoidance of the need to sacrifice host structures and no donor-site morbidity [12-14]. Still, the grafts are not without controversy, particularly regarding their association with the transmission of infectious agents, a concern virtually eliminated through tissue-processing and sterilization [15,16]. However, uncontrolled and unvalidated processing and irradiation protocols may alter graft biomechanical and biochemical properties) [17]. The use of osteoconductive bone substitutes in this indication is controversial. It has been postulated that their use can lead to a prolonged healing time, inhomogeneous ossification [16].

One of the most osteoconductive bone substitutes used now a days is Fisiograft [18] which is a totally synthetic biomaterial is made from co-polymer of polylactic acid and polyglycolic acid. Fisiograft used to fill bone defects and acts as space maintainer to protect the area and stabilize the coagulum during the formation of new bone. Both a polylactic and polyglycolic co-polymer bone substitution material. The two materials have been used for more than 20 years in the field of dentistry and orthopedics. Fisiograft is completely resorbable, oseo-conductive, non allergic, non inflammatory and remains in position only long enough until the natural healing processes have terminated and until this happens it is penetrated an progressively substituted by trabicular bone. Fisiograft [18].

Fisiograft (Fisiograft®, Ghimas S.p.A., Italy) is a fully synthetic co-polymer based on poly-milk and poly-glycol acid, Fisiograft is a synthetic material made in the laboratory thereby making it completely risk free, zero risk from cross contamination (BSE, Hepatitis, HIV etc.) and completely free of the risk of cross-contamination with pathological factors such as viral infection and other related diseasesfor this reason it is very recommended to fill bone damages [18]. A polylactide-polyglycolide copolymer was recently used to treat closed bone defects and for sinus floor augmentations. Fisiograft material is manufactured in different forms such as gel, granules or sponge this three different forms are available, which can be joined with each other, which allows to fill any possible type of bone damage. All the available forms of Fisiograft have the same characteristics, which allows the doctor to treat various surgical situations, which can possibly arise. The choice of using one or more forms depends on doctor's evaluation or the clinical arrangement of surgical repair, which is to be performed. Fisiograft has a significantly lower density displays a good handling during the surgery; easy to model and shape degradation occurs through “bulk erosion” by hydrolysis, because its function is only to fill the space in an absorbable manner so that it is permeable for blood and osteocytes [18].

Fisiograft enables a quicker consolidation of a freshly-created bone tissue without causing tissue inflammation at the beginning or during decomposition process. Fisiograft is recommended to enlarge and reconstruct the alveolar process and fill defects after cysts and granulomas, cover defects after root resection and excision, fill a tooth after extraction, sustain alveolar process and increasing bone mass available for filling paradontium defects (as filling the space along with the application [18].

Radiology is important in the diagnostic assessment of the dental patient having dental and maxillofacial disease [19]. One of this diagnostic radiologic techniques being increasingly used for point-of-service head and neck and dentomaxillofacial imaging. Is Cone beam X-ray CT (CBCT imaging). The advantages of CBCT in visualizing the jow bone in 3 dimensions and making precise measurements before surgery are obvious in the field of implant dentistry. Obviously, having this information preoperatively greatly reduces the likelihood of the need to change the treatment approach intraoperatively. This gives the surgeon the ability to anticipate implanted material placement and even to place it in a virtual model in terms of bone height, bone width, nerve position, and even objective measures of bone quality [20]. CBCT technique provides relatively high isotropic spatial resolution of osseous structures with a reduced radiation dose compared with conventional CT scans [19]. Cone-Beam Computed Tomographic (CBCT imaging) provide correlated axial, coronal and sagittal images. Basic enhancements include zoom or magnification and visual adjustments to narrow the range of displayed grey-scales (window) and contrast level within this window, the capability to add annotation and cursor-driven measurement. The value of CBCT imaging in implant material planning [21,22]. Surgical assessment of pathology, TMJ assessment [22]. In the assessment of growth and development [23,24] and Perhaps the greatest practical advantage of CBCT in maxillofacial imaging is the ability it provides to interact with the data and generate images replicating those commonly used in clinical practice. All proprietary

software is capable of various real-time advanced image display techniques, easily derived from the volumetric data set **[21]**. Treatment planning for patients with cleft lip and palate entails many unique considerations. Due to the young age of the patients and concerns about radiation exposure CBCT should allow better evaluation of dental age, arch segment positioning, and defect size compared with traditional radiography (Volumetric analysis promises to offer better prediction in terms of the mor-phology of the defect, as well as the volume of graft material necessary for repair **[25]**.

In the past two decades 3-D medical imaging has gone a long way from standard Computed Tomography (CT) with X-ray doses that were far too high to justify its regular for normal orthodontic situations. It has been shown by Roberts et al. **[25]** that new Cone Beam CT (CBCT) doses are in general an order of magnitude or more lower than conventional CT making it safer for normal situations. As discussed Roberts **[25]**. As CBCT imaging systems have become more widely available, interest in the intraoperative and diagnostic CBCT applications in the extracranial head and neck regions has intensified. The reported high isotropic spatial resolution and relatively low dose requirements of CBCT are characteristics that have made it particularly attractive. In the head and neck region, a premium is placed on discriminating fine anatomic detail in territories where the vascular and bony structural anatomy is particularly complex **[23]**.

The aim of the study:

This study aimed to determine the pure descriptive radiographic evaluation of Bio-absorbable poly-milk and poly-glycol polymers after restoration of mandibular and maxillary defects secondary to tumorectomy as part of management of cancer patients in the department of surgical oncology, National Cancer Institute (NCI), Cairo University.

This study is also intended to provide surgeons who use bone regenerative materials with some information about Bio-absorbable poly-milk and poly-glycol polymers so they can compare materials and select the most suitable one using technical data, current scientific documentation, and clinical examples.

MATERIAL AND METHODS

The present clinical study was conducted at the department of oral and maxillofacial surgery at National Cancer Institute, Cairo University, Egypt. The biologically absorbable polymers called Fisiograft (invented and used by GHIMAS Company, Ghimas S.p.A., Italy) is the commercial name of Bio-absorbable poly-milk and poly-glycol polymers was used in clinical applications in this study. The study comprises 17 patients (7 male, 10 female) of an average age of 39.3 years, who were treated with the bone augmentation material during a time period of June 2009 to December 2010, 11 patients had cystic bone defects and 6 patients with cleft palate defects. Radiographic examination was performed using Cone-Beam Computed Tomographic radiograph controls (once every three month post-operative for minimum nine months post- operative) for following up the clinical healing process. After administration of general anesthesia, the surgical approach was determined with minimal trauma, the flap was elevated to allow visualization and evaluation of the affected bone. The bone was thoroughly curetted. The void was lavaged with normal saline (Irrigated and aspirated to clear the injection path) and visually inspected to ensure complete removal of the lesion and void from hematoma and loose bone fragments. Prepare the void by compacting the surrounding cancellous bone with a curette, elevator or similar instrument. Injection needle was inserted into the formed void probing the depths of the cavity Preplan to receive Bio-absorbable poly-milk and poly-glycol polymers. Fisiograft (Bio-absorbable poly-milk and poly-glycol polymers) was placed in the formed bony void (Fig. 1) occupying the space. It was important to be certain of the backfill injection path since the 2-minute Implantation time begins as soon as the filler contacts the void. The bony void was filled with the alloplastic material Without any barrier membrane covered in cystic bone defects (Fig. 2) and with barrier membrane covered in cleft palate defects (Fig. 3). Followed by closure of surgical field. The patient was prescribed a course of antibiotic and pain medications with postoperative instructions for 7 days, at which point the suture was removed. The patient was examined at 3, 5 and 7 days, then once every month for one year Post-operative. Post-surgical care included 0.2% Chlorhexidin mouth rinses, four times a day, for the following two weeks, as gentle debridement of the operated area every second week, during two months. Postoperatively, Radiographs (panoramic radiographic view and cone-beam computed tomography) were taken at week one, every three months during the whole period of follow-up (Fig. 4). During healing period which extended for nine month (the period of follow-up) radiographic examination using cone-beam computed tomography was used to evaluate the change

of bone density for each patient in two areas one area is non surgical side while the other area was the area of bone defect. The Wilcoxon paired-samples test was used to compare the differences between baseline values and the values measured nine months after. Charts were reviewed for clinical outcome, graft-related complications, activity-related pain, and return to full activities. Patients were asked to rate their postoperative pain at the aspiration site from 1 to 10 (0 = no pain), and radiographs were reviewed to evaluate the presence of lucency, graft resorption, trabeculation within the defect and he change of bone density was measured by determine a conversion coefficient for Hounsfield Units (HU) to material density (g cm-3) (Fig. 5). The measured value was taken into account and the mean and standard of deviation (SD) were calculated.

The evaluation included to compare change of the average rang of coefficient for Hounsfield Units (HU) and the differences between baseline values (Average of Normal (control) bone (non-surgical site) and pre-operative value of surgical site) (Table 1) the values measured nine months after one, three, six and nine months postoperative. The evaluation did not include the consideration of the change of defect size space of bone regeneration change.

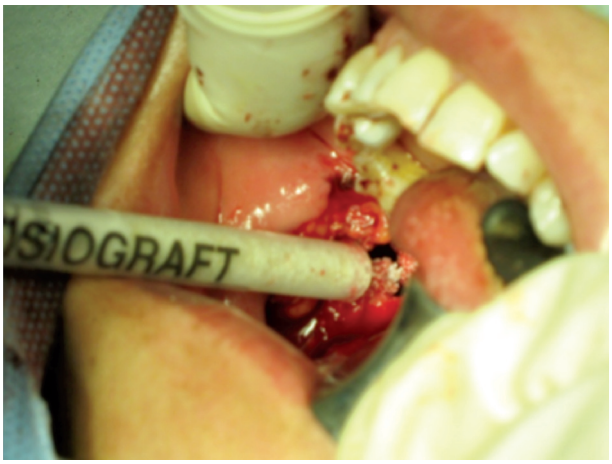


Fig. (1): Inserting Bio-absorbable poly-milk and poly-glycol polymers (Fisiograft) needle into the void.

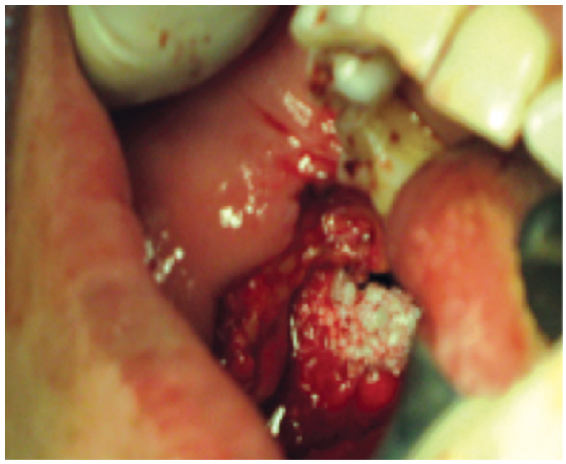
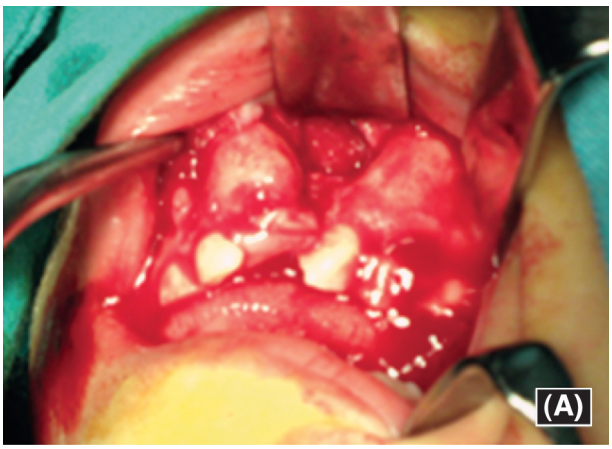


Fig. (2): Bony void was filled with Bio-absorbable poly-milk and poly-glycol polymers Without any barrier membrane covered in cystic bone defects.



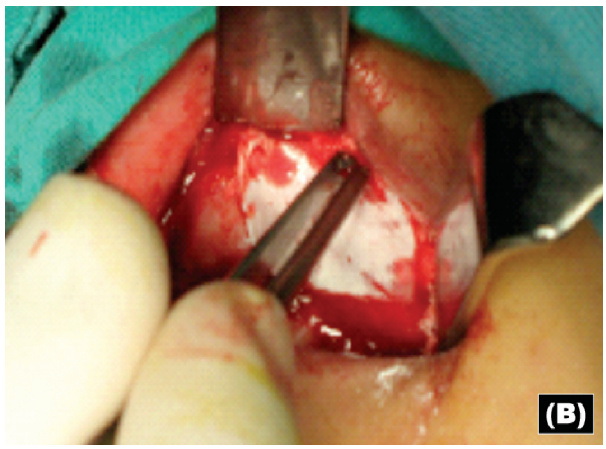


Fig. (3): Bony void was filled with Bio-absorbable poly-milk and poly-glycol polymers (A) with barrier membrane covered in cleft palate defects (B).

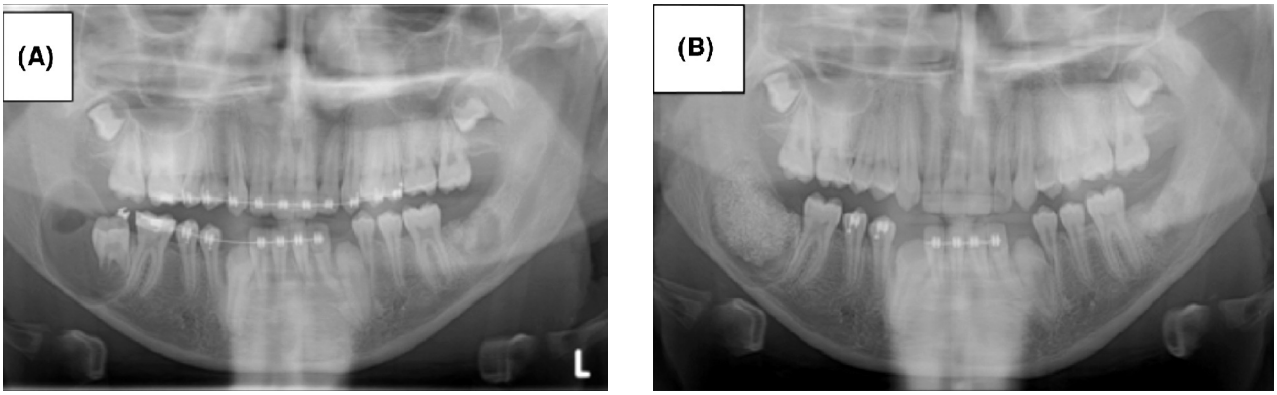


Fig. (4): Pre-operative panoramic radiographic view (a). 6month post-operative panoramic radiographic view (b) shows area of radio-opacity representing Fisiograft grafted materials s surrounded by radiolucent zones.

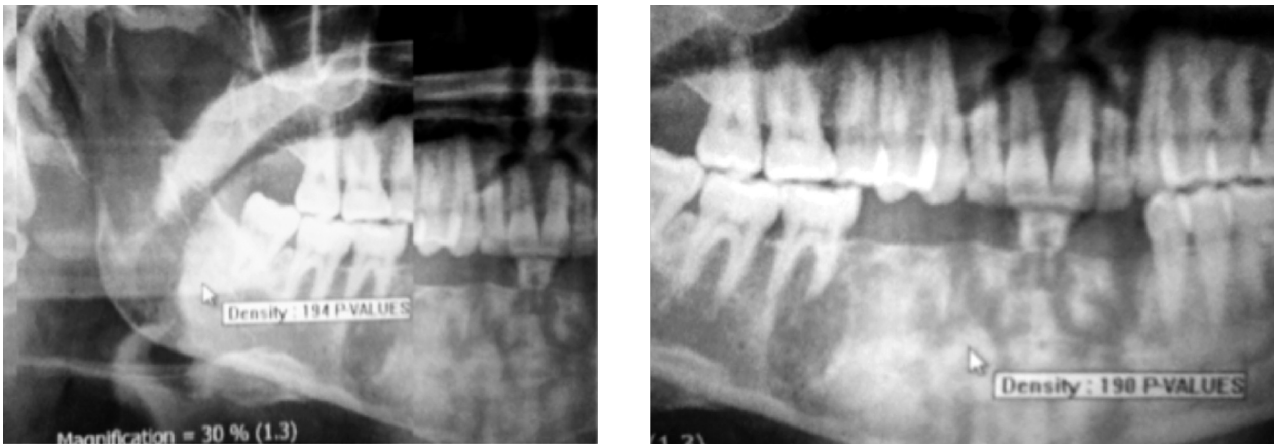


Fig. (5): Value of conversion coefficient for Hounsfield Units (HU) to material density (g cm-3).

Table (1): Average clinical results of treatment. ["a" cystic bone defects and "b" cleft palate defects].

Patient No.	Average Normal (control)	Average Pre-operative	Average within first week Post operative	Average after1 months	Average after 3 months	Average after 6 months	Average after 9 months post operative
1a	136	98	201	185	169	149	135
2a	134	98	199	198	164	147	135
3a	132	93	210	194	158	145	137
4a	138	94	204	189	172	150	137
5a	129	99	207	185	174	154	131
6a	136	92	198	193	168	156	138
7a	134	88	213	191	177	155	139
8a	131	95	207	195	166	143	138
9a	137	94	209	198	157	159	139
10a	139	96	214	186	167	157	143
11a	135	95	203	195	163	155	134
Mean (a)	134.63	94.72	205.91	191.72	166.81	151.81	136.90
12b	134	87	204	189	174	156	137
13b	138	85	203	197	168	150	143
14b	134	97	209	194	163	153	137
15b	137	92	208	191	158	154	139
16b	128	97	209	195	172	149	136
17b	139	96	198	189	168	156	143
Mean (b)	134.50	92.33	205.16	192.50	167.16	153.00	139.61
Mean	134.56	93.52	205.53	192.11	166.98	153.40	138.25

RESULTS

Surgical sites were inspected clinically and radiographically throughout the period of follow-up in the 17 implantation site. No patients were lost to follow-up. The healing phase progressed uneventful with no signs of inflammation, infection; allergy, severe pain and morbidity were observed over the entire postoperative period. There were no postoperative complications there was no evidence of adverse responses or clinical signs of implant reaction in any of the patient throughout the study. All patients progressed to unrestricted activities by one week, and by fourth weeks all the patients had returned to activities of daily living, school, or work-related activities.

Postoperative cone-beam computed tomography (CT) scan imaging was available for review on 17 patients. At 9 months postoperative, all areas of implanted Bio-absorbable poly-milk and poly-glycol polymers exhibited intensity that was nearly identical to surrounding cancellous bone. Cortical windows were filled with new bone and there was no evidence of heterotopic ossification. At 1-year follow-up, nine of the patients (visited the department of oral and maxillofacial surgery at National Cancer Institute, Cairo University, for routine dental work) were asymptomatic, with radiographic evidence of graft incorporation.

Radiographically, resorption and trabeculation increased steadily with time, with a small differential observed between trabeculation and resorption. This differential was slightly more noticeable in large defects with a central trabeculation occurring in advance of the peripheral region. It was found that smaller lesions healed faster than large lesions. Postoperative radiographs demonstrated radiolucent zones between implanted Bio-absorbable poly-milk and poly-glycol polymers and the surrounding bone (Fig. 4b) immediately after surgery, which gradually disappeared in all 17 patients.

The detailed value of pre- and postoperative mean values of the normal (control), pre-operative within first week post operative and After after one, three, six and nine months postoperative for all patients were displayed in the Table (1) ["a" cystic bone defects and "b" cleft palate defects].

The average rang of coefficient for Hounsfield Units (HU) in normal (control) (non surgical site) ranged from 128 to 139 (average 134.56). The average rang of coefficient for Hounsfield Units (HU) in pre-operative site ranged from 58 to 99 (average 93.52). At 6 weeks postoperative, the percentage of graft incorporation ranged from 15% to 35% (average, 26%). Within first week post operative the average range of coefficient for Hounsfield Units (HU) in pre-operative site ranged from 198 to 214 (average 205.53) and after 9 months post operative the average rang of coefficient for Hounsfield Units (HU) in pre-operative site ranged from 131 to 143 (average 138.25).

DISCUSSION

Every day thousands of clinical procedures are performed to replace or repair boney tissues in the human body that have been damaged through disease or trauma. Autogenous bone satisfies most of these criteria of the most ideal biologically viable material and is considered the standard by which other substances are measured. Unfortunately, autogenous bone is limited used because **[7,11]** some postoperative recovery periods unacceptable to the some patient **[26,27]**. Although autogenous bone graft remains the gold standard graft material, it is associated with an unacceptably high incidence of morbidity **[7,11]**. Furthermore, operative time, blood loss, and length of hospitalization is often increased **[28]**. The most common complications associated at the donor harvest site include chronic pain, hematoma, neuropathic pain, and infection.

The demand for a bone graft substitute is evident in the decrease in autogenous graft procedures being performed, the increase in funding of research and development of graft substitutes, and the rapid introduction of new products by manufacturers **[28]**. In order for a graft substitute to replicate the optimal bone healing properties of autogenous graft, 3 essential elements must be present: Scaffolding for osteoconduction, growth factors for osteoinduction, and progenitor cells for osteogenesis **[26,27]**. One of the primary barriers to developing an ideal composite graft has been finding the optimal scaffold vehicle for delivering osteogenic cells and osteoinductive growth factors. The carrier must have the appropriate 3-dimensional structure to serve as an osteoconductive matrix for bone-forming cells.

An ideal material for use in craniofacial reconstruction would have the following properties: unlimited availability, biocompatibility, to minimize interference with bone induction from an inflammatory reaction, it must be biodegradable to minimize the effects of residual carrier on the biomechanical properties of the repair, proper mechanical strength to with stand the applied fo, low risk for infection to must persist in vivo long enough to

maintain bioactive elements at the site of implantation and optimize their release profile, replacement by normal bone, easy incorporation into the defect, and radiopacity **[26,28-30]**.

Current study is focused on the replacement of the damaged tissue by using co-polymer of polylactic acid and polyglycolic acid (Fisiograft) which were been used as substitution materials for more than 20 years in the field of dentistry and orthopaedics for bone repair. Fisiograft is made from co-polymer of polylactic acid and polyglycolic acid that is bioresorbable osteoconductive compositions, and the scaffolds formed for bone repair containing micro or nano fillers and pore forming agents for oral reconstruction such as repair of bony maxillofacial defects and palatal repair **[31]**. It is non allergic, non inflammatory and remains in position only long enough until the natural healing processes have terminated and until this happens it is penetrated an progressively substituted by trabicular bone. unlimited availability, incorporation into the defect, its radiopacity that facilitate radiographic follow-up and regenerate damaged tissues instead of replacing them (with grafts) by developing biological substitutes that restore, maintain or improve tissue function **[5,6]**.

The study showed that Handling characteristics of Fisiograft were easy as this material is can be easily injectable, mouldable and shaped into vireos bony defects with reasonable working and setting time. Temenoff JS and Mikos AG **[32]** described the handling characteristics of this material are unbelievable as it is very easy moldable and very easy shaped an that the Ease of handling is of utmost importance for clinical use of any biomaterial **[32]**. The injectability of a scaffold is generally related to the rheological properties of the formulations **[33]**, Fisiograft has a significantly lower density displays a good handling during the surgery and added that the easy to model and shape degradation occurs through "bulk erosion" by hydrolysis, because its function is only to fill the space in an absorbable manner so that it is permeable for blood and osteocytes **[18]**.

One of the essential advantage of Fisiograft is it is usually supplied in Three different forms are available in powder or in the form of a sponge or gel which can be joined with each other, which allows to fill any possible type of bone damage. The choice of using one or more forms depends on doctor's evaluation or the clinical arrangement of surgical repair, which is to be performed. And the Ease of handling is of utmost importance for clinical use of any biomaterial **[32]**. The precursor or macromonomer formulations should be injectable before solidification. The injectability of a scaffold is generally related to the rheological properties of the formulations **[33]**.

The Absence of infections in any case of the present study can be explained by what had been reported **[18]** that Fisiograft is a fully synthetic, made in the laboratory co-polymer based on poly-milk and poly-glycol acid, completely zero risk of cross-contamination with pathological factors such viral hepatitis, AIDS and other related diseases **[26]**. Co-polymer based on poly-milk and poly-glycol acid is not like cow bone products or other products harvested from cadaveric donors, where occasional concerns arise about the documentation and procurement of the donated materials. There can be residual immunological risks as well as the risk of the host obtaining a graft-transmitted infection, e.g. HIV or hepatitis **[13,14]**. Although immunological risks is very-very small it is still greater than zero and the patient must be informed of these potential risks. Some of these products cannot be surgically implanted in patients in a number of countries around the world due to regulations by the health depar tments in those countries.

Patients with cavitary defects treated with Absorbable Poly-Milk And Poly-Glycol Polymers found smaller lesions to heal faster than large lesions. This discrepancy between small and large lesions was not appreciated in the present study, In addition, found a low rate of complications and satisfactory clinical results in all patients. Fisiograft is a bio-compatible and well-tolerated material due to the fact, that it is re-absorbed and decomposed in the Krebbs cycle. Some authors **[34,35]** reported that the main driving force behind the use of Absorbable Poly-Milk And Poly-Glycol Polymers as bone substitute materials is their chemical similarity to the mineral component of mammalian bones and teeth. In An animal histological study **[36]** conducted to evaluate the effect of locally implanted polylactic polyglycolic acid (Fisiograft) on bone repair in induced bone defects. The result showed There was no evidence of adverse responses in any of the animals throughout the study.

In this study comprehensive clinical examination and Detailed Description of cone-beam computed tomographic pictures during healing period showed polylactic & polyglycolic co-polymer bone substitution material that is gradually resorbable, oseo-conductive, non allergic, non inflammatory and remains in position only long enough until the

natural healing processes have terminated and untill this happens it is penetrated an progressively substituted by trabicular bone, (Fig. 4) the successfulness of healing of bone defects occurred between two to three months after implantation of a new alloplastic copolymer-polyglycol bone implant (Fisiograft) (Table 1) which confirmed the pilot study carrid out by Weiner and Wagner **[37]** evaluated the healing of a large defects in the human jawbone filled with a Poly-Lactide-co-Glycolide (PLG) polymer (Fisiograft®) by means of clinical, radiological and histological methods and conclouded that healing occurred at six months after the surgery. In addition to be non-toxic, they are biocompatible, not recognized as foreign materials in the body and, most importantly, both exhibit bioactive behavior and integrate into living tissue by the same processes active in remodeling healthy bone. This leads to an intimate physicochemical bond between the implants and bone, termed osteointegration **[38]**.

Bioceramics of micron dimensions have been used in dentistry, orthopedics and surgery for over 30 years because of their chemical similarity to calcified tissues of mammals and, therefore, excellent biocompatibility **[37,38]**. Due to a rapid development of nanotechnology, the potential of nanodimensional and nanocrystalline calcium orthophosphates has received a considerable attention **[39]** because they produce favorable results in repair of bone defects **[54]**. As Fisiograft are characterized by a high mass density indicated that such biocomposites exhibited a good biocompatibility and an extensive osteoconductivity with host bone in vitro and in vivo and proved that nanosized HA/polyamide scaffolds had a potential to be used in orthopedic, reconstructive and maxillofacial surgery **[41,42]**. The present study showed that Bio-Absorbable Poly-Milk and Poly-Glycol Polymers is bioinert. It does not cause any reaction that interferes with the functions of the body following implantation. It enables a quicker consolidation of a freshly-created bone tissue without causing tissue inflammation, signs infection, allergy or severe pain at the beginning or during decomposition process. This The present study also documented that Bio-absorbable poly-milk and poly-glycol polymers is highly bio-compatible, well-tolerated material and enables a quicker consolidation of a freshly-created bone tissue without causing tissue inflammation at the beginning or during decomposition process. Recent advances suggest that this is a natural selection, since the nanostructure materials provide a better capability for the specific interactions with proteins **[42]**.

There is little doubt that cone-beam technology will become an important tool in dental and maxillofacial imaging over the next decade **[19]** CBCT is an emerging CT technology, was chosen as radiographic tool in the present study because CBCT allows images to be displayed in a variety of formats, the interpretation of the volumetric data set, particularly when it comprises large areas, involves more than the generation of 3D representations or application of clinical protocols providing specific images **[19]**. Reported that CBCT is an emerging CT technology, which has potential applications for imaging of high-contrast structures in the head and neck as well as dentomaxillofacial regions. Preliminary research suggests that high-spatial-resolution images can be obtained with comparatively low patient dose. To date, the most researched applications for head and neck CBCT are in sinus, middle and inner ear implant, and dentomaxillofacial imaging. This technology is not without controversy, and further research is required to establish informed recommendations about its appropriate use in a clinical setting. Using CBCT to locate and evaluate impanted materials seem to make the surgical procedure more efficient and less invasive (Fig. 7) **[19]**. Because the anatomic structures adjacent to the region of interest can be seen in 3 dimensions, this additional information may reduce the morbidity and potential complications during surgery, contributing to a better outcome **[49]**.

In this study detailed Description of cone-beam computed tomographic pictures during healing period which extended for nine month (the period of follow-up) illustrated that-absorbable poly-milk and poly-glycol polymers fill bone defects and acts as space maintainer to protect the area and stabilize the coagulum during the formation of new bone. Nearly same observation was recorded by Stratul, et al. **[43]** who compare clinically the treatment of deep intrabony defects with the combination of flap surgery with Fisiograft to the Fisiograft alone and reported that it is completely resorbable, oseoconductive non allergic, non inflammatory and remains in position only long enough untill the natural healing processes have terminated and untill this happens it is penetrated an progressively substituted by trabicular bone.

During the period of follow-up of the present study also describes beyond reasonable doubt that Bio-absorbable poly-milk and poly-glycol polymers are characterized by a high mass density (205.53) immediately after insertion which decreased gradually till reach reach (138.25 nearly same density

value of normal bone (134.56) by the end of follow-up period after 9 months Post operative. Due to the fact, that tens to hundreds of nanometer-sized apatite crystals in a collagen matrix are combined into self-assembled structures during bone formation **[44]**. Current biomedical questions of persistent physiological mineralization in the body force scientist to focus on the processes, including the occurrence, formation and degradation of calcium orthophosphates in living organisms **[38]**. Biological mineralization (or biomineralization) is a process of in vivo formation of inorganic minerals **[45]** approved and confirmed the results obtained by. Bacila A **[18]** that theoretical decomposition period of milk or glycol polymers ranges from 5-7 weeks to 2-3 years. He **[18]** was also documented that the biological decomposition of the product is influenced by many factors - the place of implantation, patient's age, the condition of his immunity system and the tolerance of the tissues. There are also internal biological factors related to the implanted material, e.g. chemical structure, chemical composition, mass density, presence of short chains, conFigureuration of open surface, morphology and the placement of implantation. The final semi-products of polymer decomposition are carbon dioxide and water, and their decomposition largely depends on the capacity of the material enabling diffusion, thanks to which polymers are hydrated and undergo enzymatic decomposition. In An animal histological study **[46]** conducted to evaluate the effect of locally implanted polylactic polyglycolic acid (Fisiograft) on bone repair in induced bone defects. The result showed There was no evidence of adverse responses in any of the animals throughout the study. At 2 and 6 weeks, histological examination revealed that gradual new bone formation took place at the experimental sides in a more rapid rate than that which occurred at the control sides. At 12 weeks, the level of reossification had adjusted similarly in both study and control sides. More to the point, calcium orthophosphates products are also known to support osteoblast adhesion and proliferation **[46]** Many authors **[37]**. **[44,47,48]** expaned that In the biomineralization processes, organized assemblies of organic macromolecules regulate nucleation, growth, morphology and assembly of inorganic crystals. Biologically formed calcium orthophosphates (biological apatite) are always nanodimensional and nanocrystalline, which have been formed in vivo under mild conditions. According to many reports **[37,47]**. Dimensions of biological apatite in the calcified tissues always possess a range of a few to hundreds of nanometers with the smallest building blocks on the nanometer size scale. since human tissues are composed of nano components (i.e. proteins and inorganics). Natural bone is comprised of nano-structured hydroxyapatite and collagen fibres **[39]**. It seems that Nanophase materials are promising materials for various bioapplications because it allows fibro-vascular tissue ingrowth, permitting bone healing in a more rapid rate, it is completely reabsorbed, and does not cause foreign body reactions.

Conclusion:

The coming decade will bring new and even more complex advances that will transform oral and maxillofacial surgery practice if the specialty is capable of transferring the advances of basic science into clinical practice. Such advances include those in tissue engineering (organ/system engineering), proteomics (eg salivary biomarkers for early detection of cancer), nanotechnology (smart multifunctional surfaces/structures), robotics (image-guided robotic surgery), and information technology (diagnostic systems linked to treatment recommendations/parameters of care).

Bio-Absorbable Poly-Milk And Poly-Glycol Polymers clearly represent a promising class of orthopedic and dental implant formulations with improved biological and biomechanical properties. The results obtained indicate that Bio-Absorbable Poly-Milk And Poly-Glycol Polymers be successfully used in the treatment of bone defects, in enlargement and reconstruction of the alveolar process and in fillin defects after cysts and granulomas.

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