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Evaluation of Effectiveness of Concentrated Growth Factors on Osseointegration Around Immediate Dental Implant

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KEYWORDS

Immediate implant; CGF; sticky bone , membrane, stability.

ABSTRACT

Aim: This study was designed to evaluate of using concentrated growth factors membrane (CGF) membrane mixed with concentrated growth factors (CGF) sticky bone around immediate implant versus immediate implant placement without any addition in mandibular molar area. **Subjects and Methods:** Twelve implant fixtures were inserted in 12 patients divided equally into two groups. The patients were selected from those attending outpatient clinic, Oral and Maxillofacial Surgery Department, at the Faculty of Dental Medicine, Cairo, Al-Azhar University (Cairo, Boys). Clinical examination was made to all patients by measuring of primary stability at time of implant placement and 6 months after implant placement as a secondary stability by ossttel device, Preoperative and after 6 months postoperatively cone beam CT for every patient to determine bone density between bony walls and implant surfaces. Data were collected, revised, coded and entered to the Statistical Package for Social Science (IBM SPSS) version 23. **Results:** The mean crestal bone resorption value in mesial and distal side of immediate implant placement with concentrated growth factor CGF membrane with CGF sticky bone around implant was 0.09±0.03mm & 0.43±0.23mm contrary to the immediate implant without any addition after 6 months follow up, which was 0.33±0.14mm & 1.56±0.77mm which was statistically significant. **Conclusion:** Immediate implant placement with CGF membrane/ CGF sticky bone show significant increase in secondary stability after six months.

INTRODUCTION

Immediate implant is defined as placement of the implant immediately into the fresh extraction socket[1,2], it is important to note that with immediate implant placement there is minimal use of surgical drill , because the socket is already found except for slight increase of the socket length in an attempt to improve primary stability.[3] When an implant is placed in a fresh or recent extraction alveolus a gap between the implant surface and the bone walls of the socket may occur, which is called horizontal bone defect or (jumping distance).[4] There are various

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materials available for correction dento-alveolar ridge deformities and augmenting other types of osseous defects. These matrials include autogenous bone, demineralised freeze-dried bone allograft (DFDBA), xenograft, and various resorbable and non-resorbable membranes.[5]

The positive effects of blood products on healing have also triggered the development of products in different concentrations. One of these products, the concentrated growth factor (CGF), was defined by Sacco in 2006 [6] CGF also has its own centrifugal technique in a manner similar to PRF. A longer and denser fibrin matrix with higher growth factor content was obtained by the different centrifugation technique. It has been reported that CGF contains more growth factors than other platelet preparations.[7] Regional CGF administration increases FGF- β or VEGF release, which plays an active role in angiogenesis, as well as enhancing neutrophil migration by performing integrin release It has also been shown that CGF contains such growth factors and CD34- positive cells, It has been reported that CD34-positive cells in the cells also provide angiogenesis, neovascularization, and vascular continuity.[8] The concentrate growth factor (CGF) sticky bone fill the space around the immediate implant and the bony walls of the socket which help in rapid bone formation and the granules act as nexus for starting osseointegration, also the granules helped in primary stability of the implant with good anchorage of the implant in the bone for rapider and increase bone density with 6 months postoperatively.[9]

AIM OF THE STUDY

The aim of this study was to evaluate the effectiveness (both clinically and radiographically) of concentrated growth factors (CGF) membrane mixed with bone graft around immediate dental implant.

PATIENT AND METHODS

This Randomized Controlled Clinical Trial study was conducted on twelve adult patients of both genders. All patients had mandibular single tooth indicated for extraction and immediate implant placement. The patients were selected from the Out Patient Clinic of the Oral & Maxillofacial Surgery Department, Faculty of Dentistry, Al-Azhar University.

Patients were divided into two groups:

All Patients will be randomly allocated into two groups:

The study group included six mandibular posterior molar single tooth were extracted followed by immediate implant placement using implant is placed in extraction socket and the gap between the socket wall and the implant threads was grafted with CGF sticky bone and CGF membrane was positioned and stabilizer over the sticky bone.

The control group included six mandibular posterior molar single tooth were extracted followed by the implant is placed in socket without any additional procedure. The inclusion criteria of this study were Healthy patients (free from any systemic diseases), from both sexes, good oral hygiene,the need for replacement of non-restorable lower teeth in posterior molar area,a dequate width and height of the alveolar bone, presence of sufficient mesiodistal space for implant placement, presence of sufficient vertical inter-arch space to accommodate the available restorative component, the recipient site of the implant should be free from any pathologic conditions. Presence of adequate bone at least 3-4 mm beyond the apex of the tooth and below any vital structure at the site of implant insertion to achieve primary stability.

While the exclusion criteria were; Presence of any systemic diseases that affect osseointegration. Reduced quantity and quality of the alveolar bone, presence of occlusion discrepancies (cross biteand deep bite) and parafunctional habits (clenching

and bruxsim),presence of any periapical pathosis, Insufficient mouth opening to accommodate surgical instruments, Heavy smokers and alcohol abuse, post head and neck radiation therapy, pregnancy, haematogical disease.

The Implant system:-

Implant (Two-stage screw Neobiotic Implant System) is mounted on a color-coded fixure mount, designed for use as a transfer, or shortened for use as a straight abutment.

A -Preoperative phase

All patients underwent pre-operative clinical examination: Patients' data were collected; name, gender and age, medical and dental histories were taken,all patients underwent standardized periapical radiography to detect any periapical pathology and a pre-operative CBCT radiograph examination to select the proper size of the implants to be installed.

B -Operative phase

All patients were instructed to rinse with chlorhexidine mouth wash (Listermix plus, SIGMA Pharmaceutical Industries, Egypt) immediately before operation for 2 minutes.

All patients were treated using local anesthesia, articaine HCL and epinephrine 1:20.000 (Septodont, by Novocol Pharmaceutical of Canada, Inc.)

In the study group atraumatic extraction using periotome and forceps was performed to preserve the available alveolar bone and the socket was debrided gently after tooth extraction using curettes, and irrigation by physiologic saline solution. The initial marking and preparation of the implant bed was done with a pilot drill of 2.2 mm, the osteotomy was then widened using an intermediate drill and the final drill according to the diameter of the implant, the implant was then inserted into the bone using a Ratchet.

In all patients the SmartPeg™ was then attached to the implant fixture to measure the implant stability using Osstell ISQ (Osstell AB, Göteborg, Sweden). The healing cap was then placed.

CGF Preparation: Aconvenient blood sample was withdrawn from a peripheral venous blood from the patient using a specialized vacutaine. A standard, disposable, 10-ml non-anticoagulant tube and a matching centrifuge device (MiniSpin,Korean) were used.

Patient and Methods The preparation of CGF Membrane and CGF sticky bone is prepared at same time, 20-60 CC of patient venous blood is taken from patients vein.

The blood in test tube is centrifuged at 2400-2700 rpm at 2 minutes centrifugation and take AFG tube out of the centrifuge, first the tube have two layers upper layer is AFG (autologous fibrin glue) and red blood cell in bottom layer which will be is discarded, Continued Centrifugation for 12 minute at 2400-2700 rpm and glass tube show three different layers, the most upper layer is platelet poor plasma, and the middle layer is (fibrin buffy coat layer) represent by a very large dense polymerization fibrin block containing the concentrated factor, The bottom layer is red blood cell layer .The upper AFG is obtained with syringe and mixed with particular bone powder and allow for 5-10 minutes for polymerization in order to produce sticky bone which is called CGF sticky bone .The layer in the form of a membrane containing the concentrated growth membrane was held with the aid of a hemostatic clamp, separated from the red blood cell layer by cutting with a pair of scissors and then pressed to form a membrane. CGF sticky bone material was gently applied and condensed around the dental implant, filling any gap between the walls of the socket and the implant, and covering any exposed surface of the threaded part of the implant .CGF membrane was positioned and stabilized over the graft.The socket was repositioned and primary closure was achieved using (3-0) vicryl suture.

In the control group, atraumatic extraction using periotome and forceps was performed to preserve the available alveolar bone and the socket was debrided gently after tooth extraction using curettes, and irrigation by physiologic saline solution. The initial marking and preparation of the implant bed was done with a pilot drill of 2.2 mm, the osteotomy was then widened using an intermediate drill and the final drill according to the diameter of the implant, the implant was then inserted into the bone using a Ratchet.

In all patients the SmartPeg™ was then attached to the implant fixture to measure the implant stability using Osstell ISQ (Osstell AB, Göteborg, Sweden). The healing cap was then placed. Then Adaptive sutures were done mesial and distal to the implant with 3/0 black silk.

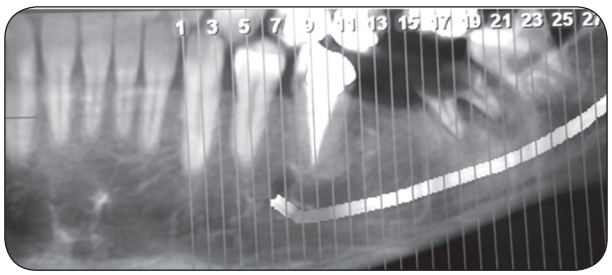

Fig. (1) Preoperative photograph showing lower left (7) will be extracted

C-Postoperative phase

All patients were advised to apply cold packs extra orally intermittently every 10 minutes for 2 hours on the first day. Chlorohexidine mouth wash was started on the 2nd post-operative day for one week and the sutures were removed after one week post surgically. Amoxicillin 875 mg /claviulanic acid 125 mg antibiotic tablet (Augmentin 1 gm, Glaxosmithkline, Australia), one tablet every 12 hours for 5 days postoperatively. Diclofenac sodium non-steroidal anti-inflammatory drugs 50 mg tabs (Cataflam, Novartis pharma, Basel, Switzerland) one tablet every 8 hours for five days. Chymotrypsin + trypsin ® tablets (Alphintern, Kahira. pharm & chem. Ind. co., Cairo, Egypt), was administrated half an hour before meals 3 times for 7 days.

D- Follow up phase

Clinical evaluation

Early follow up: was performed daily for the first week after implant placement, then weekly for the first month for any signs of infection, pain, swelling or any post-operative complications

Patients were evaluated clinically for:

Post-operative complications were evaluated as the presence of pain, tenderness, infection or swelling that may indicate the presence of peri-implant disease and possible accelerated bone loss. Any post-operative complications were recorded.

Long term follows up were performed at 6 months after surgery regarding ginigival and periodontal condition and implant stability. Peri-implant probing depth: measuring the distance from the gingival margin buccal, palatal, mesial and distal crestal bone margins. Mesial and distal pockets were measured from the buccal aspect as close as possible to contact points while facial and lingual pockets were measured at the midline of the implant. Measurement of implant secondary stability was performed by Osstell ™. After 6 months from implant placement.

Radiographic evaluation:

All implants involved in this study were followed up radiographically by Cone beam computed tomography (CBCT) to evaluate horizontal and vertical dimensional changes of bone following mandibular posterior molar single immediate implant placement. It was done immediately after implant placement 6 months.

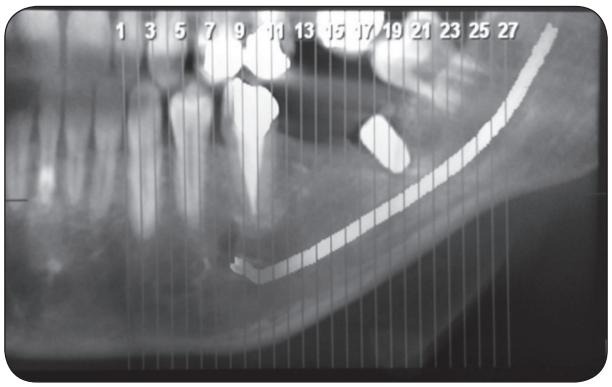

Fig. (2) Photograph showing CBCT for implant placement after 6 months.

Statistical analysis:

The comparison between two paired groups with quantitative data and parametric distribution was done by using Paired t-test. The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant as the following:P-value > 0.05: Non significant (NS).P-value < 0.05: Significant (S).P-value < 0.01: Highly significant (HS).

RESULTS

Twelve implant fixtures were inserted in 12 patients divided equally into two groups. The implants placed in the mandibular molar area (6 implant in each group). The male patients was 6(50%) and female patients was 6(50%).Each patient received one implant, one of them was immediate implant with concentrated growth factor membrane and concentrated growth factor sticky bone versus immediate implant without any addition,. The age ranged from 20 to 35, with a mean value of 29.8 ± 5.3.

All patients under local anesthesia and no complications had been recorded during the operation.

The previous chart show that there was no statistically significant difference found between group 1 and group 2 regarding initial stability while there was statistically significant increase in secondary stability after six months in group I with mean difference (19.0 ±3.94) than group II with mean difference (10.8 ±3.77) which was highly statistically significant difference between them.

Periodontal probing depth:

There was no statistically significant difference found between the two studied groups regarding PD baseline, at 3 and 6 months with p-value = 0.402, 0.312 and 0.511 respectively.

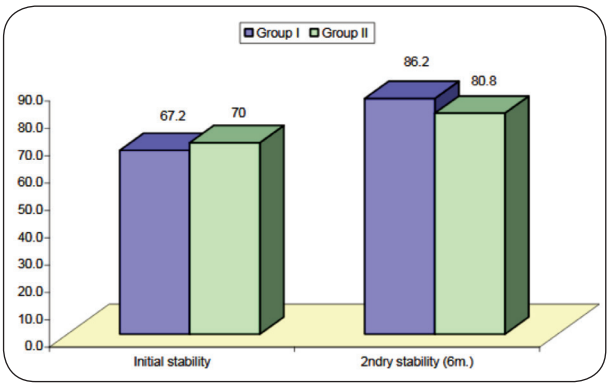

Fig. (3) Bar chart representing Comparison between group I and group II regarding initial and secondary stability.

DISCUSSION

Immediate implant in mandibular molar has been proven to be a successful time saving, low risk, predictable treatment modality in which non-restorable mandibular molars can be replaced by a prosthetically functional implant .The purpose of this study is to evaluate the effectiveness (both clinically and radiographically) of concentrated growth factors (CGF) mixed with bone graft around immediate dental implant. The immediately placed implants have many advantages including reduction of number of surgeries performed, preservation of hard and soft supporting tissues,preventing of bone loss, decreased expense.however, immediate implant placement in mandibular molar sites have been a subject of debate due to the difficulty in achieving primary stability, poor bone quality, possibility of loos of the interseptal/ interradicular bone during the extraction in addition to the increase in dimension of extracted socket.[10]

Concentrated Growth Factor (CGF)membrane +(CGF)sticky bone was prepared from patient own blood before insertion of the implant in the socket. The preparation of CGF was completely under aseptic condition, mixture of CGF+ bone graft was done in sterilize container and are placed around the placement implant this direct preparation helped with blood clot after fixed implant with primary stability to rapid healing, the(CGF)sticky bone fill the space around the implant and the bony walls of the socket which help in rapid bone formation and the granules act as nexus for starting osseointegration. Also the granules helped in primary stability of the implant with good anchorage of the implant in the bone for rapider and increase bone density with 6 months postoperatively.

In this study will be show the implant stability which is acritical factor in predictable treatment outcome .first lets define implant stability.Implant stability can be seen as acombinationof :Mechanical stability which is the result of compressed bone holding the implant tightly in place. Mechanical stability is normally referred to as primary stability,the initial resistance to micro motion and micro mobility of a dental implant immediately upon its placement in the bone. Biological stability or secondary stability is the result of new bone forming around the implant and integrating the implant into the bone. Biological stability is the result of osseointegration. Mechanical stability or (primary stability) is generally high immediately after implant placement,in the presence of sufficient quality and quantity ofbone .This is among else due to mechanical compression of the bone when the implant is placed ,and itoften decreases in short term.Implant stability quotient (ISQ) is anobjective industry standard for measuring implant stability. It is based on Resonance Frequency Analysis(RFA)the result is presented as an ISQ value of 1-100. The higher theISQ,the high of stability of implant. The measurement is done by using (the OSSTELL device) since the technology is based on the tuning fork principle, a sterile and disposable (Smart-Peg) is attached to the implant and made to vibrate, just like a tuning fork,the purpose is to find the resonance frequency i.e.the frequency with the strongest vibration. The higher the resonance frequency, the higher the ISQ value and the more stable the implant. This measurement is done quickly; its takes only a few seconds and is non-invasive. The result is presented as an ISQ between 1-100[11].

The radiographic parameters of this study include measuring the crestal bone resorption around the implants of two groups after 6 months on the mesial and distal side around implant placement, In both groups the increase in the crestal bone resorption from the baseline till 6months throughout the study was considered normal that there was no statistically significant difference found between group I and group II regardingp-value =0.155for the crestal bone resorption on mesial side of two groups and p-value =0.486for the crestal bone resorption on distal side of two groups. In both the test and control sides of all implants, the increase in crestal bone resorption from baseline till six months throughout the study was considered normal and met with the results of many studies done by Dragoand lazzara and Jaffin et al. 2007.

CONCLUSIONS

Within the context of the present study, the following conclusions can be listed as follow;

1. Immediate implant placement with CGF membrane/ CGF sticky bone show significant increase in secondary stability after six months.
2. Immediate implant placement without any addition have a high success rate if apply with ahigh primary stability and sufficient thikness of intact buccal plate.
3. CGF membrane and sticky bone are easy to make and they are very effective materials for the recon-struction of edentulous alveolar defects, sinus elevation, dimension pocket depth, treatment of furcation involvements, socket preserva-tion and guided bone regeneration.

4. More histo-logical and clinical studies with larger samples and long duration offollow up periods are needed to confirm these results.

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تقييم فاعلية عوامل النمو المركزه على التعظم حول الغرسات الفوريه

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الملخص :

الهدف: تم تصميم هذه الدراسة لتقييم استخدام غشاء عوامل النمو المركزة المزوج بعوامل النمو المركزة والعظم كعظم لزج حول الغرسات الفوريه مقارنتا بوضع الغرسه الفوري دون أي إضافة في منطقة الضروس الخلفية من الفك السفلي.

المواد والأساليب: تم إدراج اثني عشر زرع في 12 مريضا مقسمة بالتساوي إلى مجموعتين. تم اختيار المرضى من أولئك الذين حضروا العيادة الخارجية، قسم جراحة الفم والوجه والفكين، في كلية طب الأسنان، بنين، القاهرة، جامعة الأزهر.تم إجراء الفحص السريري لجميع المرضى عن طريق قياس الثبات المبدئى في وقت وضع الزرع و 6 أشهر بعد وضع الزرع كثبات ثانوي بواسطة جهاز الموجات الصوتيه . وعمل اشعه المقطعيه المخروطيه قبل الجراحة وبعد 6 أشهر بعد الجراحة لكل مريض لتحديد كثافة العظام بين الجدران العظمية للضرس الخلفى والجدران المزروعه. ثم تم جمع البيانات ومراجعتها وترميزها وإدخالها في الحزمة الإحصائية للعلوم الاجتماعية الإصدار 23.

النتائج: لقد كان متوسط قيمة التآكل العظمى في الجانب المتوسط والبعيدة لوضع الغشاء الفوري مع غشاء عامل النمو المركزة مع عظم لزجة حول الغرسه +0,09 0,03و 0.43 ± 0.23ملى خلافا للزرع الفوري دون أي إضافة بعد 6 أشهر من المتابعة . التي كانت 0.33 ± 0.14 ملى و 1.56 ± 0.77ملى والتي كانت ذات دلالة إحصائية. الخلاصه: اظهرت نتائج البحث ان وضع الغرسه الفوري المزوَّد بغشاء عوامل النمو المركزة المزوج بالعظم اللزج زيادة كبيرة في الثبات الثانوي بعد ستة أشهر

الكلمات المفتاحيه: الغرسه الفوريه, عوامل النمو المركزة ,العظم اللزج, غشاء ,الثبات.