EVALUATION OF RESORBABLE BLAST MEDIA SURFACE IN IMMEDIATE DENTAL IMPLANT

Algitta M[1], Shaaban R[2], Hommos A[3], EL Ashwah A[4]

ABSTRACT

INTRODUCTION: Ten adult patients with age ranged from 20-40 years having maxillary anterior tooth indicated for extraction. After extraction was done installation of immediate dental implant into fresh extraction socket using RBM surface treated dental implant. The patients were evaluated clinically and radiographically by using periapical radiograph and cone beam CT (CBCT).
OBJECTIVE: This study aimed to evaluate the outcome of Resorbable Blast Media (RBM) surface treated dental implant placed into fresh extraction socket.
MATERIALS AND METHODS: Ten adult patients with age ranged from 20-40 years having maxillary anterior tooth indicated for extraction. After extraction was done installation of immediate dental implant into fresh extraction socket using RBM surface treated dental implant. The patients were evaluated clinically and radiographically by using periapical radiograph and cone beam CT (CBCT).
RESULTS: In this study no severe pain was recorded postoperatively. No signs of infection or swelling were observed in our patients along the follow up period. The Mean value of the primary stability was 64.10 ± 4.79 ISQ and the mean value of secondary stability (after 6 months) was 66.10 ± 4.77 ISQ which was statistically not significant. The mean value of marginal bone loss was 0.22 ± 0.07mm after 6 months.
CONCLUSION: Immediate placement of dental implant in fresh extraction socket should be considered as a valuable option to replace missing tooth in anterior maxilla. The RBM surface treated dental implant can support osseointegration.
KEY WORDS: Immediate implant, RBM surface, Osstell.
CONFLICT OF INTEREST: The authors declare that they have no conflicts of interest.

1. B.D.S. Faculty of Dentistry, Alfateh University
2. Professor of Oral & Maxillofacial Surgery, Faculty of Dentistry, Alexandria University, Egypt.
3. Professor of Periodontology, Oral medicine, Diagnosis and Radiology, Faculty of Dentistry, Alexandria University, Egypt.
4. Assistant professor of Oral and Maxillofacial Surgery, Faculty of Dentistry, Alexandria University, Egypt.

INTRODUCTION

Dental implants have become an increasingly used treatment option for partially edentulous and completely edentulous patients. The locations which were all previously considered unsuitable for implant placement have been made possible by means of guided bone regeneration and soft tissue augmentation procedures (1). The success of implant therapy depends primarily on appropriate treatment planning and properly performed implant placement surgery (2).

According to the original Branemark's protocol for implant placement, a 3 months soft and hard tissue healing period following tooth removal and an additional 3 to 6 months of load free period were recommended (3).

Immediate implant placement in fresh extraction sockets allows placement of implants during the same visit at which the tooth is extracted, which reduces morbidity and decreases treatment time and allows placement of implant in ideal position from the prosthetic point of view. Also, it also helps to preserve the height of the alveolar bone and to avoid marginal bone loss that typically occurs during socket healing after extraction (4).

In recent years, surface treatments have been performed on machined titanium implants to improve osseointegration (5,6). The roughened RBM titanium surfaces exhibited better early cell attachment of osteoblast than the smooth surfaces (7,8). Also it showed an excellent survival rate, and less marginal bone loss (9,10).

Therefore, the present study aimed to evaluate resorbable blast media in immediate dental implant.

MATERIALS AND METHODS

The ethical clearance was obtained by the ethical committee before the study began, and the selected patients were informed about the nature of the study and the informed consent was obtained.

Patients

This study was conducted on ten adult patients of both genders. The patients were selected from the outpatient clinic of the Oral and Maxillofacial Surgery Department, Faculty of Dentistry, Alexandria University.

Inclusion criteria

Patient with maxillary anterior tooth indicated for extraction, age range from 20-40 years, free from any systemic disease that might interfere with the bone healing, sufficient quality and quantity of bone, and adequate zone of keratinized mucosa.

Exclusion criteria

Inadequate interocclusal space, bruxism, diabetes and osteoporosis, patient under chemotherapy, heavy smokers, immunosuppressed patients, pregnancy, and tooth with periapical or periodontal infection.

MATERIALS

Ten dental implants from DENTIS (Ki Chul Sim 6 Centerpointe Dr Suite 600, La Palma CA 90623) with diameters (3.7, 4.1, 4.3, 4.8) mm, and lengths (8, 10, 12, 14) mm. The implants surfaces treated by resorbable blast media.

METHODS

A. Pre-surgical phase

I- History of the patient

- Both medical and dental history were taken.

II-Clinical examination

Extra oral and intra oral clinical examination were carried out.

III-Radiological examination

- Periapical radiograph was performed for preliminary assessment of the patients.
- Cone Beam Computed Tomography (CBCT) was performed for all patients to measure the vertical height and width of the bone to select the suitable implant length and width. (Fig. 1)

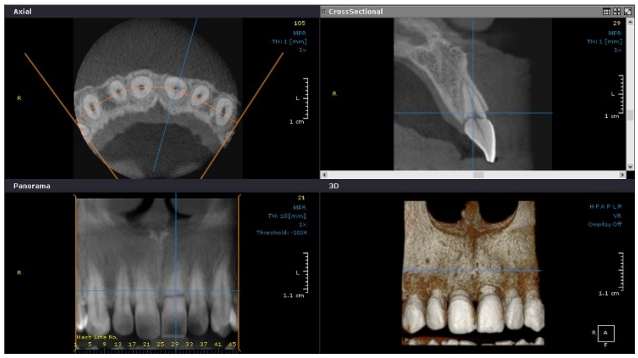
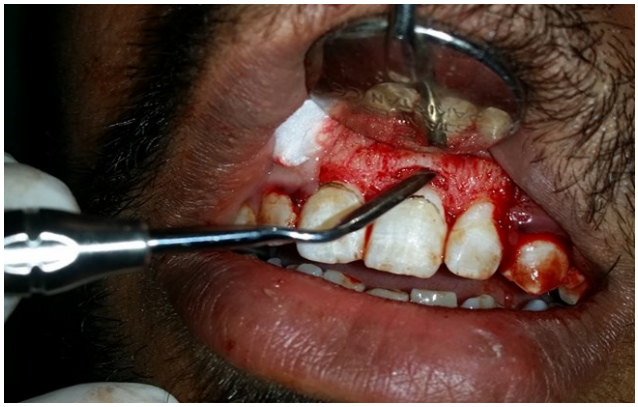


Figure (1) Preoperative Cone Beam Computed Tomography (CBCT).

B. Surgical phase

2g Augmentin (Amoxicillin and clavulenic acid) (Glaxo Smith Klin. 980 Great West Road, Brentford, Middlesex, TW8 9GS, UK). One hour Preoperative orally were given.

- Chlorohexidin (Hexital MW, Arab drug company, Cairo, Egypt) Mouth Wash for thirty seconds before operation.
- Infiltration anesthesia (Articaine HCL with epinephrine 1:100,000 were done).
- Atraumatic extraction using Periotome. (Fig. 2)
- Drilling was extended 3-4 mm beyond to the root apex. (Fig. 3)
- Dental implant was installed (Dentis with RBM surface). (Fig. 4)
- Smart peg was applied to measure implant stability by Osstell. (Fig. 5)
- Cover screw was applied after Smart peg removal.
- Suturing to approximate the socket margin with 3/0 silk sutures. (Fig. 6)



Figure(2) Aphotograph showing atraumatic extraction using periotome.

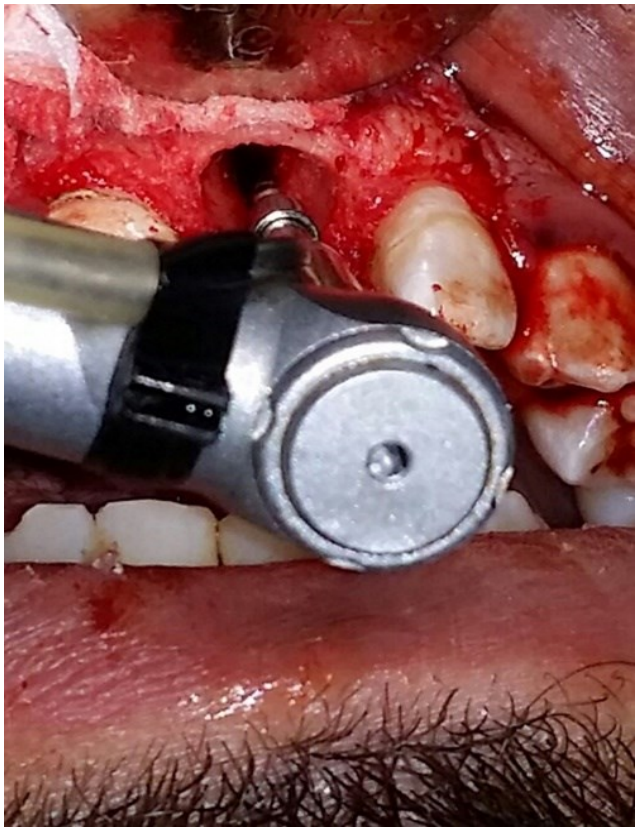


Figure (3) A photograph showing drilling of the socket.

Figure (4) A photograph showing implant installed.

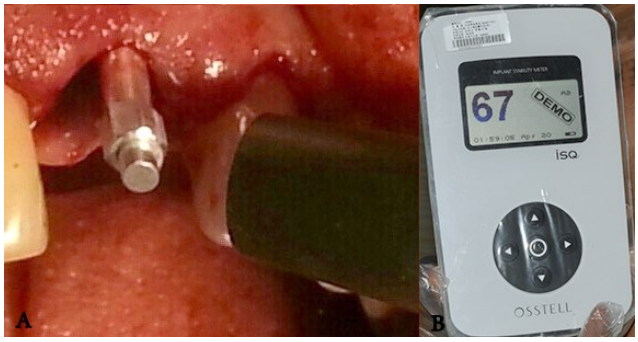
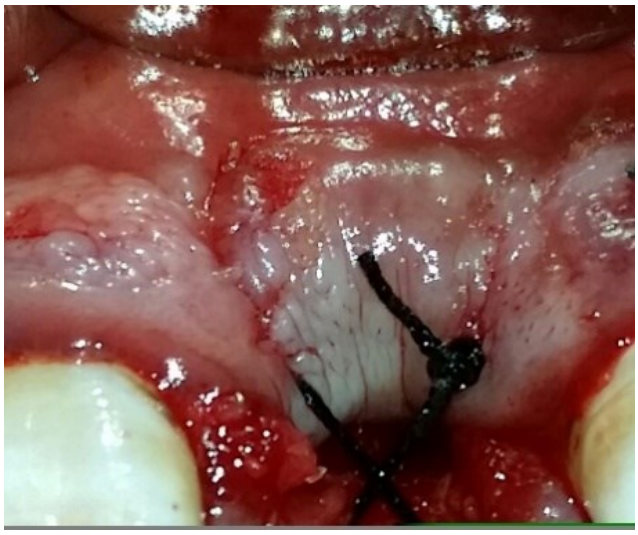


Figure (5) A photograph showing primary (initial) stability by osstell.



Figure(6) A photograph showing wound closure.

C. Post surgical phase

Postoperative instructions were given to the patients including cold packs on the first day, then warm mouth wash for the following days and oral hygiene instructions. Postoperative medication including: Antibiotic: Augmentin tablet 625mg three times daily for 7 days. Non-steroidal anti-inflammatory drugs (NSAID): Ibuprofen 400mg (Brufen 400 tab, kahira pharma and Chem.Ind.com, Cairo, Egypt) 1 tablet 3 times daily for 3 days.

The sutures were removed after one week post operatively.

D. Follow-Up

Each patient was evaluated clinically and radiographically on intervals of one month, three months and six months.

Clinical evaluation

- Pain measured by VAS (11).
- Swelling and infection (12).
- Implant mobility "Osstell" (Gotebogsvagen, Sweden).

Osstell based on resonance frequency analysis "RFA" was used to measure of the primary stability immediately after installation of the dental implant, and measuring of the secondary stability after 6 months (13).

Radiographic evaluation

Periapical radiographs were taken for each patient immediately postoperative, and after one month, three months, and six months.

To evaluate:

- Marginal bone loss.
- Bone density.

Standardized periapical radiograph film was taken using paralleling cone technique by XCP film holder for standardization. The radiograph was measured by a computer-aided software program by Image J software (14).

Prosthetic phase

Porcelain fused to metal crown restoration was delivered after 6 months postoperative.

Statistical analysis of the data

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. Quantitative data were described using range (minimum and maximum), mean, standard deviation and median. The distributions of quantitative variables were tested for normality using Kolmogorov-Smirnov test, Shapiro-Wilk test and D'Agstino test, if it reveals normal data distribution, parametric tests was applied. If the data were abnormally distributed, non-parametric tests were used. For abnormally distributed data, comparison between two independent population were done using Mann Whitney, Significance of the obtained results was judged at the 5% level

RESULTS

Clinical evaluation

1) Pain

All patients experienced no pain to mild pain for few days postoperative at the surgical site.

2) Infection or swelling

All patients continued the follow up period without any signs of infection, or swelling.

3) Implant Mobility (Table 1)

The mean value of primary stability was 64.10 ± 4.79 ISQ. And the mean of the secondary stability was 66.10 ± 4.77 ISQ which was statistically not significant difference as p value = 0.334. $p \leq 0.05$.

Table (1) Comparison between the different studied periods according to evaluation of implant stability (n = 10).

	Primary stability	Secondary stability	t	p
Evaluation of Implant stability				
Min. – Max.	58.0 – 74.0	59.0 – 74.0		
Mean ± SD.	64.10 ± 4.79	66.10 ± 4.77	1.020	0.334
Median	64.0	66.50		

t: Paired t-test

II. Radiographic evaluation

1) Marginal bone loss (Table 2)

Immediately post-operative

The mean value of marginal bone loss was 0.0 ± 0.0.

At 1st month

The mean value of was 0.15 ± 0.04. The decrease in marginal bone loss from immediately post-operative to first month was found to be statistically significant as p = 0.001 ($p \leq 0.05$)

At 3rd month

The mean value of marginal bone loss was 0.20 ± 0.06. The decrease in marginal bone loss from first month to third month was found to be statistically significant as p= 0.028 ($p \leq 0.05$)

At 6th month

The mean value of marginal bone loss was 0.22 ± 0.07. The decrease in marginal bone loss from third month to six month was found to be statistically insignificant as p= 0.109 ($p \leq 0.05$)

Table (2) Comparison between the different studied periods according to evaluation of marginal bone loss (n = 10).

Evaluation of marginal bone loss	Immediately Post-operative	After			F	p
		One month	3 months	6 months		
Min. – Max.	0.0 – 0.0	0.10 – 0.20	0.12 – 0.33	0.15 – 0.40		
Mean ± SD.	0.0 ± 0.0	0.15 ± 0.04	0.20 ± 0.06	0.22 ± 0.07	54.983*	<0.001*
Median	0.0	0.15	0.20	0.20		
$p_{Immd.}$		<0.001*	<0.001*	<0.001*		
Sig. bet. periods		p_1= 0.028*, p_2=0.025*, p_3=0.109				

F: F test (ANOVA) with repeated measures,
Sig. bet. periods was done using Post Hoc Test (LSD) for ANOVA with repeated measures
$P_{Immed.}$: p value for comparing between Immediately Post-operative and each other periods
p_1 : p value for comparing between 1 month and 3 months
p_2 : p value for comparing between 1 month and 6 months
p_3 : p value for comparing between 3 months and 6 months
*: Statistically significant at $p \leq 0.05$

The decrease in marginal bone loss along follow-up period was found to be statistically significant as p = 0.001 ($p \leq 0.05$)

2) Evaluation of bone density

Immediately post-operative

The mean value of bone density was 69.60 ± 4.42.

At 1st month

The mean value of bone density was 72.56 ± 4.51. The increase in bone density from immediately post-operative to first month was found to be statistically significant as p = 0.001 ($p \leq 0.05$)

At 3rd month

The mean value of bone density was 75.60 ± 4.35. The increase in bone density from first month to third month was found to be statistically significant as p = 0.001 ($p \leq 0.05$)

At 6th month

The mean value of bone density was 78.47 ± 4.62. The increase in bone density from third month to sixth month was found to be statistically significant as p = 0.001 ($p \leq 0.05$)

The increase in bone density along follow-up period was found to be statistically significant as p = 0.001 ($p \leq 0.05$)

DISCUSSION

The present study was conducted on ten patients from both genders, with age ranged between 20-40 years. The patients were selected from the outpatient clinic of the Oral Maxillofacial Surgery Department, Faculty of Dentistry, Alexandria University.

The immediate implant placement is strongly recommended in the anterior maxillary region, where esthetic and speech are of prime importance as reported by Nemcovsky 2002 (15), and also it reduces alveolar bone resorption as mentioned by Degidi in 2007 (16).

In the present study, the cases with periapical lesion was excluded. Cavacchia and Bravi in 1999 (17) stated that the extraction socket should be free from residual infection.

Heavy smokers were excluded from this study. Kasat and Ladda in 2012 (18) mentioned that the local absorption of nicotine into bloodstream causes vasoconstriction which is a significant factor for implant failure.

In the present study, all cases were free from parafunctional habits such as bruxism and clenching. Manfredini et al in 2012 (19,20) mentioned that the increase in the magnitude of the occlusion forces leads to mechanical complications and failure of implants.

In this study, the atraumatic extraction with use of periotomes for luxation of tooth was to preserve the walls of the extraction socket. That was in agreement with Bhat and Bangawala in 2014 (21), who mentioned that atraumatic extraction improves primary stability.

In the current study, the marginal gap of the extraction socket was filled with blood and healed by itself, without use of any bone graft material or barrier membrane. That was in agreement with some studies (15, 22-26). The hard tissue formation was the result of proper blood clot maturation, and the application of bone grafts and or barrier membranes increases the complexity of surgery and cost of the treatment.

In the present study, all the patients were followed at the regular intervals of 1, 3, 6 months to evaluate the survival of immediate implant placement, clinically and radiolgraphically.

Regarding the clinical evaluation in this study during the follow up period which was extended to six months, all the patients exhibited no postoperative pain or swelling. This was in agreement with the studies of Schwartz Arad and Chaushu in1998 (27) and Misch et al in 2004 (28).

In this study, the primary stability of each implant was assessed by Osstell device. The mean of Implant stability quotient (ISQ) was 64.10± 4.79 ISQ. That was in agreement with Shiigai in 2007 (29) and Anitha et al in 2014 (30) who mentioned that the primary stability of immediate implants with ISQ >62 was considered to be suitable.

In this study, no significant difference between the primary and secondary stability by use of Osstell device. This is in agreement with Valderrama et al in 2007 (31) and Han in 2010 (32) who mentioned that the range of ISQ values during all observation periods did not differ significantly.

Marginal bone loss around implants is an important clinical marker for the success of implants because gradual marginal bone loss may lead to the failure of implants by ultimately destroying the osseointegration of implants to the bone. Evaluation of marginal bone loss around implants showed insignificant difference between 3rd and 6th month postoperative and the success rate was 100%. That was in agreement with Kim in 2014 (10) who reported success rate of the RBM implants in the anterior area was 100%.

RBM surfaces treated dental implant had advantages because surface area increases as particles are blasted on the surface, the degree of osseointegration increases. In this study, the bone density increased across the follow up period and subsequently caused increase in the implant stability. That was in agreement with Coelho et al in 2011

(33) who mentioned that the RBM surface resulted high degrees of osseointegration and biomechanical fixation.

Finally, proper patient selection is very important factor to achieve success of this technique. Patient has to be in ideal conditions, regarding systemic health that can affect the bone, oral hygiene, presence of sufficient bone beyond the apex, absence of parafunction habits to ensure good condition of the bone.

CONCLUSIONS

From the results of this study we can conclude that placement of the RBM surface treated dental implant in fresh extraction socket considered a valuable option to replace missing tooth in anterior maxilla. The RBM surface treated dental implant can support osseointegration assessed by clinical and radiographic findings.

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