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OUTCOME OF DENTAL IMPLANTS PLACED WITH HIGH INSERTION TORQUE

Ramy Ragab Elbeialy* *and* Waleed R. El-Beialy**

ABSTRACT

To determine the success rate of immediately loaded implants placed with high insertion torque.

Materials and methods: In this study, a total of 84 implants placed at high insertion torque in the mandible and immediately functional loaded with provisional prosthesis. Insertion toque, primary stability and secondary stability were recorded.

Results: All implants were osseointegrated under function.

Conclusion: Insertion torque and primary stability are considered the keys of success to immediate functional loading of dental implants.

INTRODUCTION

Implant stability plays a critical role for successful osseointegration, which has been viewed as a direct structural and functional connection existing between bone and the surface of a load carrying implant [(1)]. Achievement and maintenance of implant stability are prerequisites for successful clinical outcome [(2)]. Therefore, measuring the implant stability is an important method for evaluating the success of an implant. Implant stability is achieved at two different stages: primary and secondary. Primary stability of an implant comes from mechanical engagement with cortical bone and is affected by quality and quantity of bone, surgical procedure and technique, implant length, diameter and form.[(3)] Secondary stability is developed from regeneration and remodelling of the bone and it is affected by the primary stability, bone formation and remodelling [(4)]. Therefore, it is crucially important to be able to quantify implant stability at various time points.

* Lecturer, Oral & Maxillofacial Surgery Department, Faculty of Dentistry, Cairo University
** Associate Professor, Oral & Maxillofacial Surgery Department, Faculty of Dentistry, Cairo University, Associate Professor, Oral & Maxillofacial Surgery Department, Faculty of Dentistry, Future University in Egypt (FUE)

Implant insertion timing

TABLE (1) Classification of the timing of implant placement following tooth extraction (5)

Classification	Descriptive Terminology	Period after Tooth Extraction	Desired Clinical Situation at Implant Placement
Type 1	Immediate placement	Immediately following extraction	Post extraction site with no healing of bone or soft tissues
Type 2	Early Placement with soft-tissue healing	Typically 4 to 8 weeks	Post –extraction site with healed soft tissue but without significant bone healing
Type 3	Early placement with partial bone healing	Typically 12 to 16 weeks	Post extraction site with healed soft tissues and with significant bone healing
Type 4	Late placement	Typically 6 months or longer	Fully healed post-extraction site

Loading Protocols

TABLE (2) Definitions of loading protocols (6)

Loading Protocol	Definition
Immediate Restoration	A restoration is inserted within 48 hours of implant placement, but not in occlusion with the opposing dentition.
Immediate loading	A restoration is placed in occlusion with the opposing dentition within 48 hours of implant placement.
Conventional Loading	The prosthesis is attached after a healing period of 3 to 6 months
Early Loading	A restoration in contact with the opposing dentition is placed at least 48 hours after implant placement but not later than 3 months afterwards
Delayed Loading	The prosthesis is attached in a procedure that takes place some time later than the conventional healing period of 3 to 6 months.

Ostell device:

This is a device invented to measure the resonance frequency value of the implant fixture through the transducer which is mounted directly to the fixture with a screw. The instrument measures the resonance frequency and display the result as the implant stability quotient (ISQ) value on a scale from1-100.[7] Higher ISQ value means means higher resonance frequency value, which means more primary stability.

Fig. (1) Ostell device.

MATERIALS AND METHODS

84 implants were included in this study.

Inclusion criteria:

Age between 30 and 55 years.

Good oral hygiene

Need to rehabilitate a partial edentulism of mandible with two adjacent implants

Exclusion criteria

Lack of opposing dentition in the area intended for implant placement.

Patients with history of head and neck radiotherapy.

Patients with Medically free history

Poor oral hygiene

Need for bone or soft tissue augmentation

Patients with signs and symptoms of severe bruxism or clenching.

All implants were inserted in partially edentulous mandibles to restore missing teeth. All cases were delayed implantation (More than six months post extraction).

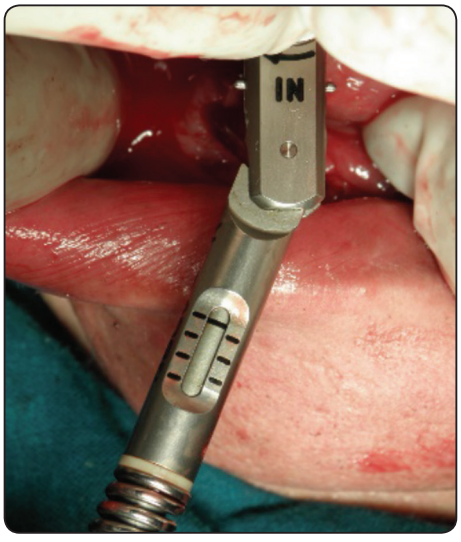

Fig. (2) Adjustable Torque Ratchet Ranch.

Surgical technique

Two implants were placed in each patient in order to rehabilitate a partially edentulous mandible. Full thickness mucoperiosteal flaps were elevated with minimal extension to minimize the patient discomfort, to gain access to the surgical site. Osteotomy site preparation was performed with conventional drilling while leaving a gap of 0.8-1.2 mm between the diameter of the final drill and the diameter of the implant to allow to achieve high insertion torque and consequently high primary stability. Insertion torque was monitored using an adjustable torque ratchet ranch graduated from 10nm to 50nm and then infinity. Following implant placement, ostell device was used to record the initial stability of the implants. If insertion torque of at least 35nm was not reached, patients were excluded from the study.

Following implant insertion, the abutment was secured over the implant with a 25nm torque, then

All patients received postoperative instructions as follows;

Apply ice packs on the region for eight to twelve hours.

Consume soft food for the first two to three days while avoiding chewing on this side for six weeks.

Brush the involved region with a soft tooth brush and rinse their mouths with 0.2% chlorohexidine mouth wash twice daily for ten days.

Antibiotic and anti inflammatory was prescribed for all patients, in accordance with established guide lines. Amoxicillin (1gm) was administred one hour before surgery and every twelve hours thereafter for five days. In case of allergy to penicillin , clarithromycin was used (500 mg) one hour before surgery followed by 250mg every twelve hours for five days.

To reduce post surgery pain, Ibuprofen (400mg) was administered every 12 hours for 3-4 days.

Immediately following implant placement, a prefabricated acrylic resin crown was cemented to the implant abutment in contact with opposing dentition centric occlusion within the first 48 hours post operatively.

Patients were treated following an immediate loading protocol. Prefabricated Acrylic resin crown was cemented

After four months, Ostell was used to record the stability again and final ceramo metallic restorations were cemented in place.

Fig. (3) Preoperative photograph showing fixed prosthesis on the lower premolar-molar teeth.

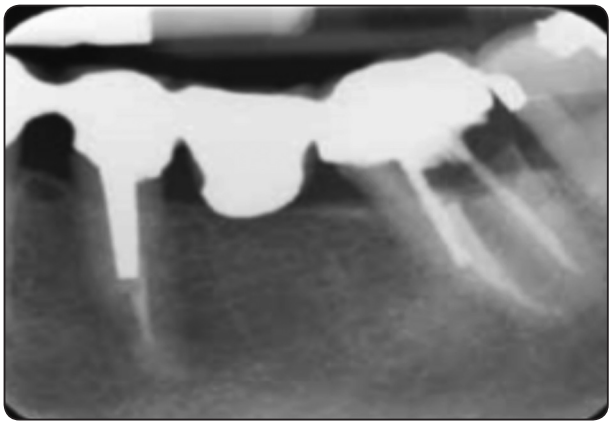

Fig. (4) Preoperative radiograph showing missing lower first molar.

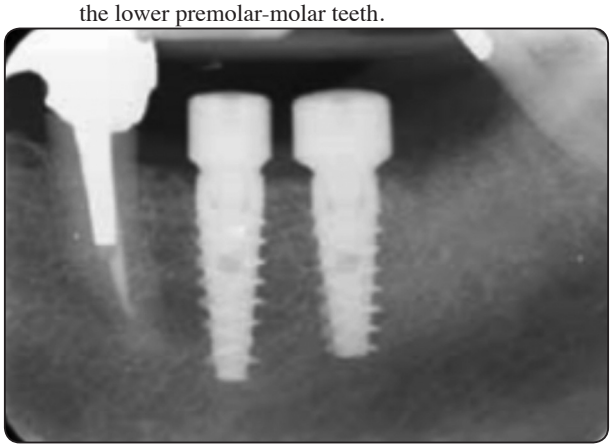

Fig. (5) Postoperative periapical radiograph showing implants inserted to restore missing first and second molars

Fig. (6) Clinical photograph showing abutments screwd in place.

Fig. (7) Clinical photograph showing prosthesis in place.

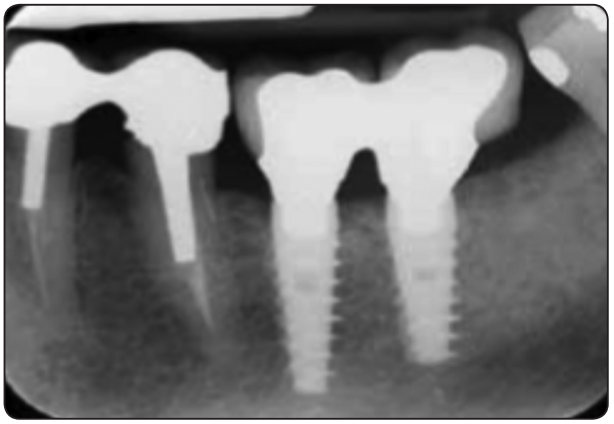

Fig. (8) Periapical radiograph showing implants with final prosthesis four months postoperative.

RESULTS

All 42 patients were treated according to the study protocol and all implants reached the minimal torque value needed to be included in the study. There were no drop outs and all patients regularly attended the check up and maintained a good level of oral hygiene. None of the implants have failed after 4 months and no patient reported pain from palpation, percussion or function. All implants were clinically stable and meet the success criteria. Survival and success rate after 4 months were 100%.

Overall 84 implants were placed. Length and diameter of implants are reported in table (3). The values of the insertion torque for each implant are reported in table (4).

TABLE (3) Table showing the lengths and diameters of implants used.

Length(mm)	Implants number
10	28
11.5	34
13	22
Diameter(mm)	Implants number
4.1	24
4.7	48
5.7	12

TABLE (4) Table showing the insertion torque, Primary stability and Secondary stability of the implants.

Patient I.D.	**Implant 1 insertion torque(NM)**	**Implant 1 Ostell reading(ISQ) intraoperative**	**Implant 1 Ostell reading(ISQ) 4 months**	**Implant 2 Insertion torque(NM)**	**Implant 2 Ostell reading(ISQ) Intraoperative**	**Implant 2 Ostell reading(ISQ) $ months**
1	45	72	78	>50	79	81
2	>50	86	86	>50	88	82
3	40	60	66	50	75	81
4	40	69	71	45	71	75
5	40	65	71	45	73	75
6	45	73	77	>50	76	76
7	45	69	72	>50	88	81
8	45	71	69	>50	81	83
9	45	75	75	>50	74	79
10	45	74	71	>50	81	81
11	50	79	81	>50	80	80
12	>50	83	79	>50	80	76
13	40	59	68	45	74	78
14	45	74	76	>50	78	76
15	50	76	81	>50	70	76

Patient I.D.	Implant 1 insertion torque(NM)	Implant 1 Ostell reading(ISQ) intraoperative	Implant 1 Ostell reading(ISQ) 4 months	Implant 2 Insertion torque(NM)	Implant 2 Ostell reading(ISQ) Intraoperative	Implant 2 Ostell reading(ISQ) $ months
16	45	73	71	>50	85	80
17	40	70	70	45	71	77
18	>50	82	80	45	69	75
19	50	81	76	>50	77	74
20	>50	84	81	>50	86	83
21	45	76	78	45	76	74
22	45	78	81	50	81	81
23	40	61	66	45	69	69
24	40	66	66	45	66	68
25	40	64	71	>50	74	76
26	45	71	77	>50	82	79
27	45	70	71	>50	84	76
28	50	79	81	>50	79	81
29	>50	83	82	>50	77	82
30	>50	81	83	>50	79	83
31	50	78	79	>50	81	81
32	>50	88	79	>50	80	81
33	45	79	81	>50	79	82
34	>50	81	78	>50	79	78
35	>50	84	86	50	74	77
36	50	78	82	50	77	79
37	>50	81	84	>50	88	81
38	>50	80	78	>50	79	80
39	45	76	71	>50	79	82
40	45	74	76	>50	85	78
41	>50	82	82	50	78	79
42	>50	88	84	50	77	78

The values of insertion torque recorded in this study ranged between 40->50 Ncm. The range of the ostell ISQ values ranged from 59-88 ISQ.

DISCUSSION

Osseointegration is a complex biological phenomenon guided by a series of biochemical events that stimulate angiogenesis, osteoblastic differentiation of mesenchymal cells, extracellular matrix deposition and in the end, mineralization.[8]

The early and immediate loadind of implants causes an increase of stresses acting on healing tissues. If loading is high enough to induce excessive micromovements, the fibrocellular blastemal developed on the immediate healing phase undergoes a fibrous differentiation. If loading does not induce excessive micromovements, the newly develoed bone tissue is stimulated to acquire a microstructure adequate to the intensity and direction of the forces acting on the implant.[9,10]

The primary stability of the implant at the time of placement is fundamental to obtaining immobility of the fixturewith respect to bone tissue when chewing stresses are applied . It represents a key factor for high implant survival rates when applying early and immediate loading protocols.[11]

The primary stability of the implant depends on bone density and quality, optimal implant dimensions, implant macrostructure and under preparation of the osteotomy site. In this study, implants with standard length and diameter were used[12]. They are characterised by an adequate design mainly due to the deepness and the cutting performance of the threads. The screwing of self tapping implants in the underprepared osteotomy causes the engagement of the threads in the peri implant bone together with bone compaction. Therefore, for mechanical reasons, an increase in the implant insertion torque and primary stability is observed followed by bone compaction.

Bone tissue is very sensitive to temperature and pressure, which are both able to induce bone necrosis. Necrotic bone is gradually removed with vital bone during the bone healing period. If the implant is loaded early, bone must be vital to be able to react adequately and rapidly to mechanical stresses. Guidelines recommend the use of implant surgery motor with high torque and sufficient irrigation to avoid overheating.

It is surgically accepted that implants inserted at high torque of insertion have higher survival rates than implants inserted at low insertion torque. The value of the torque which represents the cut-off value to avoid bone necrosis has not yet been determined. However, it is recommended not to exceed an insertion torque of 80-90 Ncm.

Several reports in the literature demonstrate that a relationship exists between the insertion torque and the primary stability of implants. Ottoni et al have demonstrated that a high insertion torque can improve the overall survival rates of immediately loaded single implants. Trisi et al stated that if an implant is placed with an insertion torque of more than 80 Ncm, it is unlikely to have micromovements that leads to implant failure.

Torque is an indicator of the primary stability. The forces needed to insert an implant into the undersized osteotomy reflects the intimate three dimensional contact between the implant surface and the periimplant bone.

Our results are in agreement with the study by Meltzer etal, who have placed implants with high values of insertion torque of 80 Ncm. These implants were immediately loaded and were followed for 24 months. 66 out of 67 implants had complete osseointegration.

In conclusion, based on the results of our study, the insertion torque is considered a key for successful implantation. Immediate loading of implants placed at high insertion torque is a safe procedure that does not compromise the final outcome of the implant surgery. Further histological studies are warranted to better evaluate the role of insertion torque in the healing process that regulate osseointegration of dental implants.

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