

Success rates in subjects rehabilitated with immediate loading technique on according to AISI guidelines

Enrico Moglioni¹
Paolo Diotallevi¹
Eugenio Pezzuti²
Marco Pasqualini¹
Giuseppe Ferrante¹
Pierluigi Floris¹

¹ AISI Accademia Italiana di Stomatologia Implantoprotesica (Italian Academy of Implant Prosthetic Stomatology)

² "Tor Vergata" University of Rome, Faculty of Engineering

Correspondence to:
Dott. Enrico Moglioni
Via Cristoforo Colombo, 348 - 00147 Roma
Ph./Fax 06 5123341
E-mail: enrico.moglioni@fastwbnet.it

Submitted for publication: 15/05/2008

Accepted for publication: 07/07/2008

Summary

Success rates in subjects rehabilitated with immediate loading technique on according to AISI guidelines.

Introduction. The aim of the work is to verify the success rates of the immediate load technique after 48 months, on subjects operated on according to AISI guidelines, and to identify key factors in successful surgery and main causes of failure.

Materials and method. 62 patients rehabilitated with immediate load one-piece self-threading screws, in the period between January and November 2002. The subjects were checked clinically, by X-rays and through biomechanical analysis.

Results. In seriated checkups and in the final check up four years after the operation, we found no subjective or objective symptoms, good stability and, after X-rays, a normal peri-implant bone. The implants satisfied the tests adopted with 98.4% success rate of subjects operated on and an implant survival rate of 99%.

Discussion. Successful surgery presupposes the correct application of a validated protocol. Key success factors are patient selection, careful surgical planning, primary and secondary stability. The main cause of failure is identified as an incorrect prosthetic design.

Key words: Oral implantology, immediate loading, AISI.

Sommario

Percentuali di successo nei soggetti riabilitati con tecnica a carico immediato secondo le linee guida AISI.

Introduzione. Scopo del lavoro è verificare le percentuali di successo della tecnica a carico immediato a distanza di 48 mesi, su soggetti operati nel rispetto delle linee guida AISI, individuare i fattori chiave del successo chirurgico e identificare le principali cause di insuccesso.

Materiali e metodi. Fanno parte del presente studio 62 pazienti riabilitati con viti autofilettanti monostrutturali a carico immediato, nel periodo compreso tra Gennaio e Novembre 2002. I soggetti sono stati controllati clinicamente, radiologicamente e mediante analisi biomeccaniche.

Risultati. Nei controlli seriat e nel controllo finale a quattro anni dall'intervento abbiamo riscontrato assenza di sintomi e soggettivi e oggettivi, buona stabilità e normalità radiologica dell'osso peri-implantare. Gli impianti hanno soddisfatto i test adottati, con percentuale di successo corrispondente al 98,4% dei soggetti operati e con una percentuale di sopravvivenza degli impianti del 99%.

Discussione. La corretta applicazione di un protocollo convalidato è presupposto del successo chirurgico. I fattori chiave del successo sono la selezione dei pazienti, la pianificazione accurata dell'atto chirurgico, la ricerca della stabilità primaria e secondaria. La principale causa di insuccesso si individua nella errata progettazione protesica.

Parole chiave: Implantologia orale, carico immediato, AISI.

Introduction

The long-term success of implant prosthetic rehabilitation is principally based on the knowledge of and adherence to shared guidelines, based on anatomic, biological, surgical and biomechanical presuppositions. On the other hand, the constant growth of oral implantology has favoured the development of different surgical schools, sometimes in conflict with each other, and this situation has not allowed the setting up of universally accepted guidelines.

Implantology really began in the first half of last century, thanks to the intuitions of several pioneers, (the majority of whom were Italian), and became widespread after the 1960s with the introduction of titanium. During all this time its basic premise never changed: the immediate functional loading of one piece implants, emerging from the alveolar edge aimed at supporting the prosthesis from the day of the operation (Fig. 1). No-one else had in fact questioned the basic principle according to which bone tissue repair is made possible thanks to standard functional activity (Guyton, 2000). It is for this reason that many implantologists today adopt the immediate load technique.

However, in 1977 the Swedish biologist Branemark, openly disagreeing with accepted practice, announced a new theory according to which osseointegration would be possible only on the condition that the implant was not subjected to masticatory load immediately, but only after 4-6 months (Branemark, 2001). On the basis of these new assumptions, new implants, made up of more components and to be inserted during two separate operations, were designed and made.

In spite of the obvious conceptual incompatibilities between the two schools, the case histories published showed high success rates over time, for both techniques (Baek, 2008; Esposito, 2007; Grant, 2007; Cooper, 2007; Blus, 2006; Blanes, 2007).

The aims of the present work are to:

- Verify the success rate of the immediate load technique four years after the operation, by means of a prospective study on subjects operated on according to AISI guidelines (FISM, 2001);
- Identify the key factors of surgical success through clinical, radiological and biomechanical evaluations;
- Identify the main causes of failure in medium-term checkups.

Materials and methods

62 patients rehabilitated with immediate load one-piece self-threading screws, in the period between January and November 2002 take part in the present study. They are 28 women and 34 men aged between 30 and 75 years. In the same period 7 subjects were excluded from the programme because they were unsuited to implant rehabilitation on the basis of laboratory test results and of the orthopantograph.

28 operations were carried out on the maxilla, 8 of which were of a fixed-type with mixed implant-dental rest and 20 of a fixed-type with only an implant rest for a total of 134 implants, 27 of which positioned in post-extraction alveoli (Fig. 1).

34 operations were carried out on the mandible, 10 of which were of a fixed-type with mixed rest, 20 of a fixed-type with only an implant rest and 4 immediate load over-dentures for a total of 92 implants, of which 44 positioned in post-extraction alveoli.

All the rehabilitations were carried out by loading the temporary prostheses on the same day as surgery. In 18 cases (93 implants) the screws were strengthened

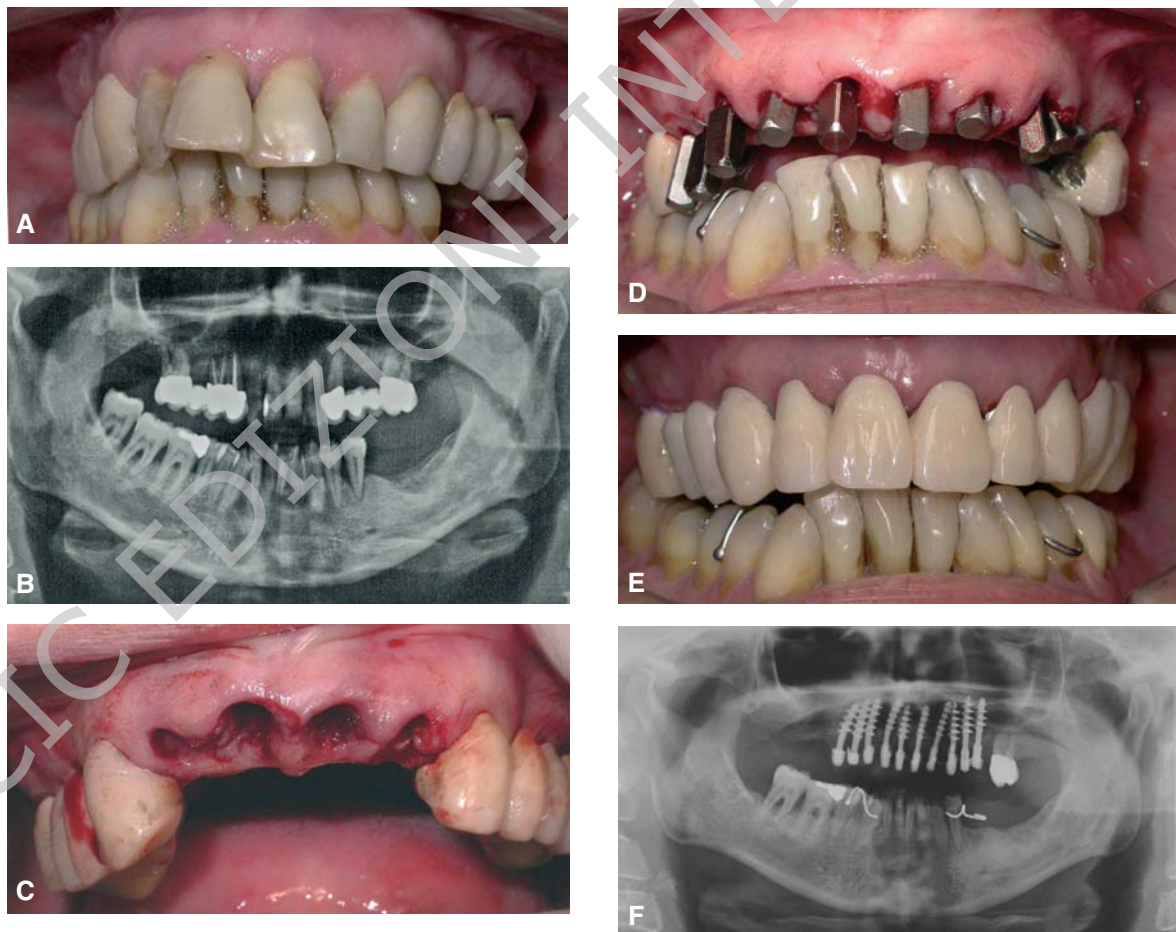


Figure 1 - Upper prosthetic-implant rehabilitation in a 50 y.o. female patient: A) Third grade mobility of residual teeth B) Pre-surgical Orthopantograph C, D) Extraction of natural teeth and flapless insertion of one piece implants at the same time: each tooth natural element is replaced with a one piece implant E) Insertion of cement retained acrylic resin temporary prosthesis during the same post extraction surgery F) The Orthopantograph, three days after the operation, highlights the bicorticalism achieved.

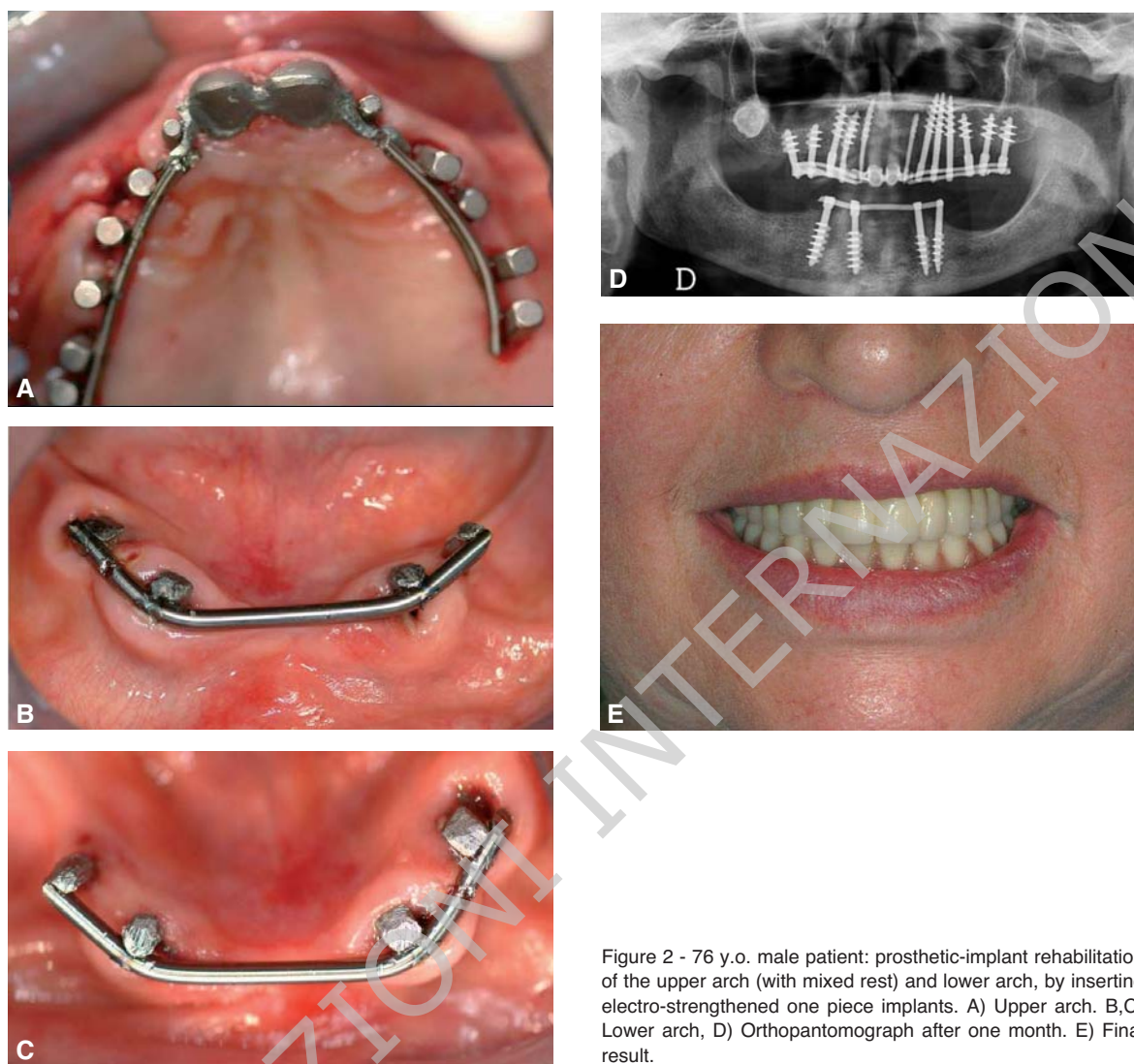


Figure 2 - 76 y.o. male patient: prosthetic-implant rehabilitation of the upper arch (with mixed rest) and lower arch, by inserting electro-strengthened one piece implants. A) Upper arch. B,C) Lower arch. D) Orthopantomograph after one month. E) Final result.

by means of a bar which was positioned and fixed with endoral syncrystallization technique (Fig. 2).

Before the operation each patient underwent a multi-slice CT scan with cross and panoramic reconstructions.

After the operation all the patients underwent digital panoramic radiography after 1, 24 and 48 months from surgery. In the 4 year check up a CT scan was carried out on 21 doubtful cases with the aim of better evaluating the bone situation around the implant and at the collar level.

A biomechanical analysis of the work performed was carried out on all the patients, by means of reproductions of FEM models, extrapolated from our x-ray images, with the aim of evaluating implant response to load (Fig. 3).

The following parameters of success were adopted:

- No paresthesias and painful symptoms
- No implant mobility
- No changes in the peri-implant soft tissues
- No X-ray evidence of pathological peri-implant cone resorption and other significant radiotransparencies.

Results

In seriated checkups and in the final check up four years after the operation, we always found that there were no subjective or objective symptoms, but there was good stability and, after X-rays, a normal peri-implant bone (Fig. 2).

Ten days after the operation, and only in one case, did we find hyper mobility of two fixtures in the distal region of the mandible, which therefore cannot be considered a full success according to the parameters adopted. The mobile implants were immediately replaced by screws of a bigger diameter, inserted after having removed the bar, without any intra operative problems and duly integrated after 4 years.

The other implants satisfied the tests adopted, with a screw survival rate equal to 99% and a 98.4% success rate in the operations carried out.

As far as the biomechanical analyses are concerned, the results have constantly identified the implant collar as the area of greatest stress. With bicorticalism and multicorticalism one part of the load is transferred, via

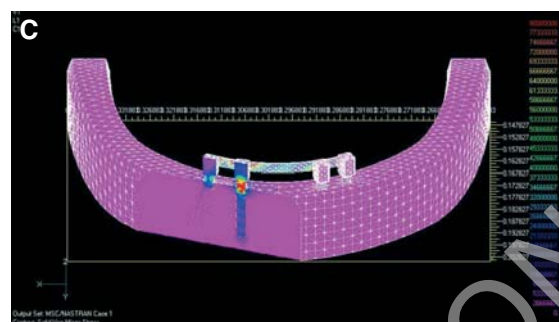
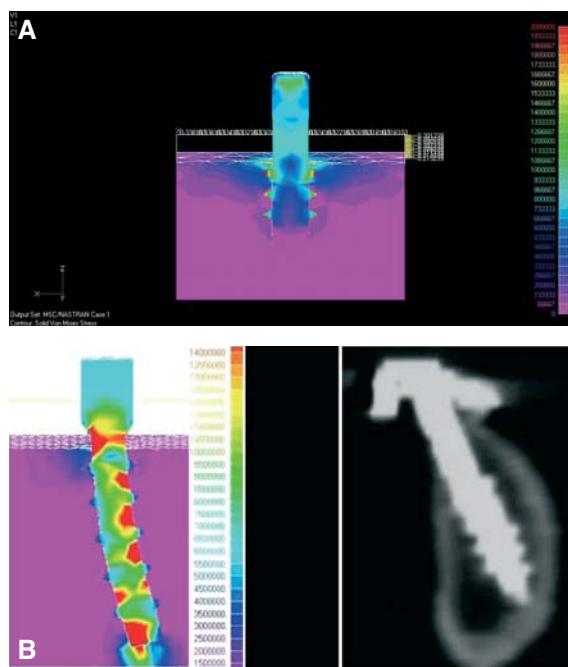


Figure 3 - Completed FEM models. A) Biphasic implant: typical transferral of stresses in the area surrounding the collar, a typical site of bone resorption. B) Through bicorticalism and coils, some of the stress is transferred to the bone and in particular to the basal cortical, with load reduction around the critical area of the implant collar. C) Case shown in figure 1: the bar allows the transfer of some of the stress to adjacent implants. No significant differences emerged, however, in success rates with or without bars.

the coils and the tip of the implant, to the oral, vestibular and distal corticals.

If utilized, the electro-welded bar allows the transfer of part of the stress to the adjacent implants (Fig. 3); however no significant differences emerged in the success rate with or without bars.

Discussion

Our results confirm that the correct application of a validated protocol is one of the premises for surgical success.

This is even more true in the immediate load technique which must follow several operative phases, first among all being a careful selection of patients obtained through complete clinical and hematochemical screening and a preliminary Orthopantograph, so as to highlight general or local problems which could prove to be relative or absolute contraindications to the operation.

In the next phase it is necessary to evaluate the quality and quantity of the bone substrate by means of a volumetric CT scan with cross and panoramic reconstructions and this allows a possible further selection of the patients (Scribano, 2003). The cone-beam CT can replace the multislice CT scan in basic implantological planning (Fanucci, 2006). The advantage of the cone beam CT scan in these cases is in the smaller dose of radiation utilised.

By respecting all these conditions, the mini-invasive surgery and the immediate use of the implant, typical of immediate load with one-piece screws, explain the drastic reduction in cases of oedema, pain and all the post-surgical consequences, including bacterial infections.

Coils of a suitable width, bicorticalism and probable strengthening with a titanium bar allow the distribution of loads and the optimization of the technique, thus reducing implant micro movements and allow it to func-

tion also as an anti unscrewing system, in opposition to functional stress (Diotallevi, 2007).

Where possible we inserted the implants by looking for marginal crested, basal, vestibular and oral multicorticalism. This allowed us to achieve primary stability – the turning point in the immediate load technique – even without strengthening the screws (Fig. 4).

Even the insertion of immediately loaded temporary resin prostheses in centric occlusion has effectively compensated, especially in the distal mandible sections, the lingual tendency to shift the implants, mainly during deglutition, when the suprahyoid and oral floor muscles exert a prominent dislodging action in a vestibular direction (Cerro, 1990) (Fig. 5).

Careful oral hygiene is important in order to avoid the build-up of food particles with consequent fermentation and phlogosis of the peri-implant tissues.

In the only case of early screw hyper mobility, given the good CT characteristics of the bone and the absence of any unusual intra operative manoeuvres, the cause of

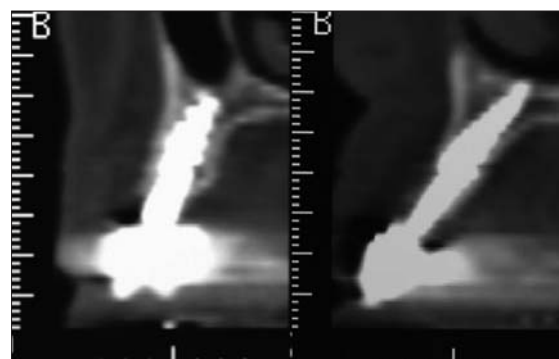


Figure 4 - CT scan after 20 months, cross reconstructions; multicorticalism guarantees stability, a basic requirement of the immediate load technique, and is one of its key success factors.

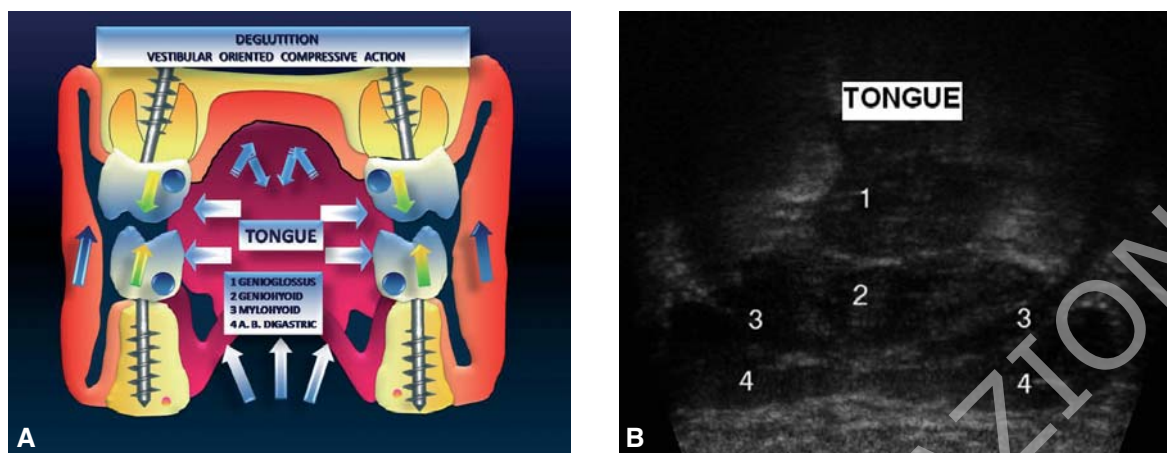


Figure 5 - A) Schematic portrayal of lingual action on implants during deglutition. B) Image taken by a dynamic US scan of the oral floor, showing the main muscles involved in deglutition.

the problem was the wrong load of the temporary prosthesis. In any case, it was not a question of failure but of a simple complication easily and safely resolved with the insertion of another two screws after having removed the bar - this all being made possible thanks to the great ease in the use and handling of these implants which can be easily extracted and repositioned without significant osseo-gingival traumas.

Conclusions

In patients operated on with an immediate load procedure according AISI protocols, the expected success rate in the short and medium terms are 98.4%, with an implant survival rate of 99%.

The main key factors in success are careful selection of patients and correct surgical planning by means of adequate diagnostic and radiological steps, the achievement of stability by using the most suitable implant, coils of the right type, bicorticalism and multicorticalism. If immediate load rehabilitation is correctly performed, implant instability is firstly to be found in the faulty design of the prosthesis.

References

1. Baek SH, Kim BM, Kyung SH, Lim JK, Kim YH. Success rate and risk factors associated with mini-implants reinstalled in the maxilla. *Angle Orthod* 2008 Sep; 78(5):895-901.
2. Blanes RJ, Bernard JP, Blanes ZM, Belser UC. A 10-year prospective study of ITI dental implants placed in the posterior region. Clinical and radiographic results. *Clin Oral Implants Res* 2007; 18(6):699-706.
3. Blus C, Szmukler-Moncler S. Split-crest and immediate

implant placement with ultra-sonic bone surgery. A 3-year life-table analysis with 230 treated sites *Clin Oral Implants Res* 2006; 17(6):700-7.

4. Brånemark R, Brånemark PI, Rydevik B, Myers RR. Osseointegration in skeletal reconstruction and rehabilitation: a review *J Rehabil Res Dev* 2001 Mar-Apr; 38(2): 175-81.
5. Cerro P, Diotallevi P, Fanucci E, Metastasio F, Fanucci A. Echography of the oral phase of deglutition *Radiol Med* 1990; 79:59-64.
6. Cooper LF, Ellner S, Moriarty J et al. Three-year evaluation of single-tooth implants restored 3 weeks after 1-stage surgery *Int J Oral Maxillofac Implants* 2007; 22(5): 791-800.
7. Diotallevi P, Moglioni E, Pezzuti E, Pierazzini A, Pasqualini M, Floris PL. Biomechanical and radiological correlation on the resorption of the alveolar bone. A comparative study on 47 subjects. *Doctor Os* 2007; 18:117-123.
8. Esposito M, Grusovin MG, Willings M, Coulthard P, Worthington HV. The effectiveness of immediate, early, and conventional loading of dental implants: a Cochrane systematic review of randomized controlled clinical trials. *Int J Oral Maxillofac Implants* 2007; 22(6):893-904.
9. Fanucci E, Leporace M, Di Costanzo G, Fiaschetti V, Simonetti G. Multidetector CT and Dentascan software: dosimetric evaluation and technique improvement - *Radiol Med* 2006; 111:130-138.
10. FISM - Federazione Italiana Società Medico Scientifiche: Linee guida in Implantologia AISI FISM - Linee Guida delle Società Medico-Scientifiche 2001.
11. Grant BT, Kraut RA. Dental implants in geriatric patients: a retrospective study of 47 cases. *Implant Dent* 2007; 16(4):362-8.
12. Guyton AG. *Textbook of medical physiology*. WB Saunders Company, 2000.
13. Scribano E, Ascenti G, Mazziotti S, Blandino A, Racchiusa S, Gualniera P. Computed tomography in dental implantology: medico-legal implications. *Radiol Med* 2003; 105:92-99.