



CATÓLICA
FACULDADE DE MEDICINA DENTÁRIA

VISEU

IMMEDIATE IMPLANT WITH PROVISIONALIZATION AND SOFT TISSUE GRAFTING: A CASE REPORT WITH 4-YEARS FOLLOW-UP

Dissertação apresentada à Universidade Católica Portuguesa
para obtenção do grau de Mestre em Medicina Dentária

Por:

Glaudemir Reinaldo Cavalcanti de Siqueira

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Orientador: Prof. Doutor Gustavo Vicentis de Oliveira Fernandes

Coorientador: Doutor Rafael Amorim Cavalcanti de Siqueira

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“Sou definitivamente contra o definido, porque o definido é o bastante e o bastante não basta”

Fernando Pessoa

ABSTRACT

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Purpose: This paper presents a case report of immediate implant placement (IIP) with provisionalization and soft-tissue grafting to restore function and esthetics, with follow-up of 14-months and 4-years.

Materials and Methods: Minimally traumatic extraction was performed with IIP, soft-tissue grafting, and immediate provisional crown. Six months after optimal healing, the patient was submitted to an esthetic restorative work through veneers in lithium disilicate.

Results: Fourteen months and 4-year follow-up visits revealed stability of the peri-implant soft-tissues with peri-implant health status. At both follow-up visits, pink and white esthetic score (PES/WES) were evaluated to objectively assess esthetic outcomes. Intraoral digital radiographs showed minimal crestal bone level changes throughout the follow-up period. It was demonstrated that IIP is a sensitive technique procedure and a 3D implant position is crucial for success.

Conclusion: Immediate implant with grafting to fill the gap and soft tissue augmentation led to minimal changes of peri-implant tissues and PES/WES scores were high. Immediate provisionalization helped to maintain soft tissue architecture although proper case selection is key for long-term success.

Keywords: Dental implants, Esthetic, Extraction socket, Single-tooth implants, immediate loading, implant placement.

RESUMO

Objetivo: Este artigo apresenta um relato de caso de colocação imediata de implante (CII) com uma técnica de provisionalização para restaurar a função e a estética com seguimento, com acompanhamento de 14 meses e 4 anos.

Materiais e métodos: Extração minimamente traumática foi realizada com CII, com enxerto de tecido mole e enxerto ósseo, além da coroa provisória imediata. Seis meses após a cicatrização ideal, o paciente foi submetido a um trabalho restaurador estético através de facetas em dissilicato de lítio.

Resultados: Com catorze meses e com 48 meses, foram feitas visitas de acompanhamento que revelaram estabilidade dos tecidos moles peri-implantares com *status* de saúde. Nas duas visitas de acompanhamento, o escore estético rosa e branco (PES/WES) foi avaliado para avaliar objetivamente os resultados estéticos. As radiografias digitais intraorais mostraram alterações mínimas do nível ósseo da crista ao longo do período de acompanhamento. Foi demonstrado que o IIP é um procedimento técnico sensível e a posição do implante 3D é crucial para o sucesso.

Conclusão: Assim, o CII é um procedimento sensível e a posição do implante 3D é crucial para o sucesso. Implante imediato com enxerto ósseo para preencher o “gap” e o aumento de tecidos moles levaram a menores alterações e à estabilidade da margem mucosa. A provisionalização imediata ajudou a manter a arquitetura dos tecidos moles e a seleção adequada de casos é a chave para o sucesso a longo prazo.

Palavras-chave: Implantes dentários, Estética, Alvéolo de extração, Implantes unitários, carga imediata, colocação de implantes.

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I. INTRODUCTION

I. INTRODUCTION

Despite the great advancements in oral health care that took place in the last decades, tooth extraction due to disease and/or trauma is still a repeated event leading to the indication of tooth replacement. The challenge of replacing a missing tooth is especially greater in the anterior maxillary area because excellent soft and hard tissue contours are required to obtain an exceptional esthetic outcome¹.

Immediate implant placement (IIP) following tooth extraction and as part of the same surgical procedure has been advocated as an advantageous option for the replacement of an anterior maxillary tooth as it can reduce the number of surgical procedures, reduce overall treatment time, and provide immediate esthetics². This surgical approach has gained tremendously in popularity and patient acceptance is often combined with bone grafts³⁻⁵ and soft tissue augmentation⁶⁻⁹ to accomplish implant esthetics. However, several disadvantages and unsuccessful treatments have been linked to IIP as well, and the technique-sensitive feature of it has been described¹.

Two recent systematic reviews compared IIP to delayed single implant placement (DIP, ≥ 3 months post-extraction) in terms of implant survival and reported lower survival rates for IIP^{10,11}. However, when analyzing survival rates for IIP, an important aspect is that tooth extraction is the result of either an important trauma or a disease process. In many cases therefore tooth extraction is accompanied by severe loss of alveolar bone and the presence of significant microbial contamination of the area. Both situations can lead to reduced primary stability, early implant surface exposure, and infections that will result in a decreased or a lack of osseointegration.

Among the key factors for achieving adequate esthetic outcomes, ideal implant positioning, and good prosthetic contour, among many other conditions, should be carefully considered. Prosthetically-driven implant placement must be always the goal and when this condition cannot be satisfied due to the sagittal anatomical position of the root in the socket, IIP should be avoided¹².

IIP approach has been suggested to reduce facial mucosa recession, especially when the implants were also immediately provisionalized¹³. An evident advantage is to restore esthetics immediately with a fixed solution. Additionally, the gingival phenotype is one of the most important parameters to evaluate when planning for an IIP. While a thick gingival biotype is related to a lower risk of midfacial recession, it was shown that thin biotype was associated with greater bone remodeling and midfacial recession than thick biotype following IIP¹. Autologous connective tissue graft (CTG) harvested from the palate includes

increased soft tissue thickness, increased keratinized mucosa width, improved esthetics, and stability of the soft tissue margin when associated with IIP⁶⁻⁹.

Hence, the present case report aimed to describe the technique of IIP in the maxillary esthetic zone in combination with immediate provisionalization and grafting of soft and hard tissues, exploring the key aspects related to achieving the maximum performance in the esthetic rehabilitation and showing the predictability after a 4-year follow-up, using the CARE statement for standardizing this case report.

II. CASE DESCRIPTION AND RESULTS

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Diagnosis

A 22-year-old man with a dental history of perforation of the buccal aspect of the root of the maxillary right lateral incisor during endodontic treatment presented seeking for the restoration of a hopeless tooth by a dental implant (Fig. 1). Medical history evaluation did not reveal any significant findings. Dental and periodontal examination showed a fistula at the buccal mucosal area of the tooth and probing pocket depths (PPD) did not exceed 4 mm in any of the 6 examined sites around the tooth. A cone-beam computed tomography (CBCT) scan confirmed an adequate amount of apical bone for implant installation. Also, CBCT was taken with lips retracted according to Januario et al.¹⁴, and mucosa thickness of 1.03 mm was measured (Fig. 2).

Surgical and Immediate Prosthetic Procedures

Minimally invasive extraction of the right upper lateral incisor was performed using an atraumatic tooth extractor (Neodent©, Curitiba, Brazil), and the socket was gently curetted and irrigated with saline solution (Fig. 3A, B). The osteotomy was performed following the manufacturer's recommendation and a tapered internal connection implant was placed (Alvim Cone Morse 3.5x13 mm; Neodent©) (Fig. 4). The abutment (CM Universal abutment, Neodent©) for a cemented provisional crown was chosen with the help of an abutment selection kit (Neodent©) and placed with a torque of 32 N.cm (Fig. 5). The provisional crown was fabricated using an acrylic denture tooth stock and adjusted intra- and extra-orally to establish an ideal critical and subcritical contour that will support soft tissue and create emergence profile (Fig. 6). The socket was grafted with demineralized bovine bone mineral (DBBM) with 10% of collagen (Bio-Oss Collagen; Geistlich©, Switzerland). A free connective tissue graft (CTG) was harvested from the right palate in the area between premolars and de-epithelized extra-orally with the use of a 15c blade (Fig. 7), following the de-epithelialized connective tissue graft¹⁵. The CTG was then sutured at the buccal mucosa of the alveolar socket to augment the peri-implant soft tissues. The palatal donor site was covered with a collagen membrane to protect the wound and post-op instructions were given. After cementation of the provisional crown, the occlusal adjustment was performed to avoid any contact during excursive movements during the osseointegration period (Fig. 8).

Final Restorative Procedures

Six months after implant placement healing revealed optimal situation and the patient presented for final esthetic restorative procedures. The patient undergoes an esthetic treatment planning for veneers anterior teeth and a mock-up was done to determine esthetic try-in and guide teeth preparation for veneers (Fig. 9). Teeth were prepared approximately 0.3 to 0.5 mm for veneers and peri-implant soft-tissues presented healthy with adequate emergence profile before impression (Fig. 10). After impression procedures with PVS, the lab technician customized an implant crown for the right lateral incisor to match with veneers fabricated in lithium disilicate (Emax, Ivoclar Vivadent Co.) (Fig. 11). The idea of an implant crown prepared to receive the cementation of a veneer was to have an adequate shade balance with adjacent teeth that will receive veneers cementation (Fig. 12). Implant crown and veneers were then cemented with a resin-based cement (Fig. 13).

Follow-up visits

The patient presented 14 and 48 months after implant placement when maintenance of the soft tissue architecture was noted, and an intraoral digital radiograph was taken (Figs. 14 and 15A). Radiographic analysis at 48 months showed no significant changes in crestal bone levels (Fig. 15B). At both follow-up visits, the pink esthetic score (PES)¹⁶ and white esthetic score (WES)¹⁷ were used to present an objective esthetic outcome evaluation of the treatment performed (Tables 1 and 2).

Table 1. The pink esthetic score (PES) by Furhauser *et al.* (2005) and white esthetic score (WES) by Belser *et al.* (2009) performed by each author in two periods of follow-up.

1 st analysis	2 nd analysis	3 rd analysis
1. mesial papilla 2. distal papilla 3. level of the gingival margin 4. curvature of the facial mucosa 5. alveolar process 6. color of the soft tissue 7. soft tissue texture	1. mesial papilla 2. distal papilla 3. curvature of the facial mucosa 4. level of the facial mucosa 5. root convexity/color and texture of the soft tissue	1. tooth shape 2. tooth volume and curvature 3. color (hue / value) 4. tooth texture 5. translucency

For each item was attributed the score 0 (zero) = absent/obviously different; 1 = incomplete/slightly/moderate difference; 2 = complete/without discrepancies/no difference.

Table 2. PES and WES reported as mean \pm SD, and agreement among investigators.

Score/assessment		14-months	4-years
PES	1st assessment	11,75 \pm 2,06	11,75 \pm 1,70
	2nd assessment	11,50 \pm 2,08	10,25 \pm 0,95
	Inter-examiner agreement	84%	79%
WES	1st assessment	18,5 \pm 1,29	18,25 \pm 0,50
	2nd assessment	18 \pm 1,63	17 \pm 0,81
	Inter-examiner agreement	85%	76%

III. DISCUSSION

III. DISCUSSION

An esthetically pleasing smile in implant-supported restorations is largely dependent upon proper management of the transition zone between peri-implant soft tissues and white esthetics (ceramic crowns). This case report describes key factors for obtaining long-term esthetic outcomes when restoring anterior maxillary teeth with a mix of implant crown and veneers. Following this period, several studies have confirmed the feasibility of this treatment modality with high success rates¹⁸⁻²⁰.

A reduced number of surgical procedures, reduced overall treatment time, and immediate esthetics are frequently reported as the main advantages of IIP with provisionalization, however, its ability in helping to preserve the existing osseous and gingival architecture should be the main aspect of discussion since this will ultimately lead to esthetic success. Esthetic outcomes in the present case report, in addition to patient satisfaction, was objectively evaluated through PES and WES, yielding to high satisfactory scores in 14-months and after 4-years, compared with previously literature (Furhauser et al., 2005 and Belser et al., 2009)^{16,17} (see Table 2). The esthetic success, in this case, could have suffered the influence of multiple factors such as but not limited to the advantageous nature of the flapless procedure, tridimensional implant position, gap filling between the implant and the buccal bone, simultaneous augmentation of soft tissues, and prosthetic procedures (e.g., abutment and restoration contours).

The main advantage of a flapless procedure is explained biologically by the opportunity to preserve periosteum and supraperiosteal plexus and consequently maintain the blood supply to the alveolar bone¹. To further improve this concept and maintain intact papilla, a minimally invasive extraction approach was performed in the present surgical case. Clinical trials have investigated the use of a similar device of the one used here for atraumatic tooth extraction (Benex extraction System, Helmut Zepf Medizintechnik, and Hager & Meisinger)^{21,22}. Both studies have concluded that the device presents a high success rate for the extraction of single-rooted teeth, and its use may lead to a marked reduction in the need for flap surgery.

In the early days of IIP protocol development, it was believed that bone resorption following tooth extraction was reduced by IIP, however, there is a body of evidence today proving that IIP per se does not exert an influence on post-extraction bone remodeling^{23,24}. The bone remodeling that takes place invariably after a tooth extraction is influenced by the apicocoronal and buccopalatal position of the implant¹². Treatment planning performed with the aid of CBCT cross-sectional images revealed a Class I sagittal root position according

to Kan *et al.*¹², which is a favorable condition for IIP. Also, the gap between the implant and buccal bone plate was filled with xenogeneic grafting material to help to preserve buccal bone plate and horizontal volume to avoid implant threads exposure at the buccal aspect. Roe and coworkers reported that socket grafting can minimize the horizontal bone remodeling and the horizontal bone changes are significantly greater at the implant platform having a positive correlation with the vertical changes⁴. More recently, a randomized clinical trial evaluated the effect of placing bone graft at the gap in 86 subjects receiving 86 implants, correlating the clinical outcomes with the baseline bone thickness. The gap between the implant surface and the inner bone walls was filled with demineralized bovine bone mineral with 10% collagen. The horizontal crest dimension underwent marked changes during healing mainly at the buccal aspect of the alveolar crest where this reduction amounted to 1.1 (29%) in the test group (graft) and 1.6 mm (38%) in the control group (gap unfilled), being these statistically significant ($p=0.02$). This outcome was even more pronounced at sites in the anterior maxilla and with thinner buccal bone plates where interestingly thin buccal sites (≤ 1 mm) showed 0.4 mm of horizontal crest changes for the test group and 2.7 mm of horizontal contraction for the control group. The latest evidence from experimental and clinical trial supports that placing a bone replacement graft significantly reduces the horizontal bone resorptive changes occurring in the buccal bone after the immediate implantation in fresh extraction sockets⁵.

Among the key factors for peri-implant tissues stability in the long-term is the periodontal phenotype. Although immediate implant placement procedures have demonstrated high success rates, the facial gingival recession has been reported as a common finding following the first year of function, especially in thin periodontal phenotype^{1,25}. Gingival thickness at the level of crestal bone was measured as 1.03 mm in the present case, and therefore the decision of grafting with a CTG harvested from the palate to convert the phenotype into thick was taken at the time of surgery. The mid-buccal mucosal margin remained stable throughout the follow-up period with minimal changes in the horizontal dimension. A similar finding was observed in one case of series⁶ study and two recent randomized clinical trials^{9,25}. Both RCTs demonstrated the efficacy of the CTG in maintaining a significantly more coronally located mid-facial mucosa level. Zuiderveld and collaborators⁹ observed a mean gain of 0.1 mm in the mid-buccal mucosal tissue versus a loss of 0.5 mm in the no graft site. Nimwegen and coworkers⁷ had similar findings, however, highlighted that the use of a CTG in immediately placed and provisionalized implants in the aesthetic zone did not result in less mucosal volume loss after 12 months, leading to the assumption that a CTG cannot fully compensate for the underlying facial bone loss.

Prosthetic procedures at the time of provisionalization of IIP and final implant-supported crown fabrication are detrimental for the esthetic success. The literature remains limited regarding the effect of immediate provisionalization on peri-implant soft tissues and more randomized clinical trials are needed to evaluate the effect of immediate provisionalization on the marginal bone level as esthetic outcomes.

A recent published RCT compared the facial mucosal level of single immediately placed implants with and without immediate provisionalization. Twenty patients in the control group (IIP + healing abutment) and 18 patients in the test group (IIP + provisionalization) completed the 12-month follow-up. Mid-facial mucosal marginal level and papilla height changes were minimal within groups, and no significant differences were found between the two groups. The authors concluded that Immediate implant placement with or without provisionalization can achieve stable vertical soft tissue level for 12-months as compared to the pre-extraction level. However, immediate provisionalization was not able to improve the aesthetic outcome further¹⁹. The outcomes of this study should be interpreted with caution since a flared healing abutment was used. Large diameter healing abutments as the ones used in this previously mentioned study can confer similar peri-implant soft tissue support as provisional restorations, in specific clinical conditions.

IV. CONCLUSION

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Thus, it can conclude that immediate implant placement is a sensitive technique procedure and a 3D implant position is crucial for success. When a thin phenotype is encountered, an immediate implant with grafting to fill the gap and soft tissue augmentation leads to less horizontal changes and stable mucosal margin. Immediate provisionalization helps to maintain soft tissue architecture and proper case selection is key for long-term success.

V. REFERENCES

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VI. FIGURES

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Fig 1. Initial preoperative clinical labial view of the maxillary right lateral incisor.

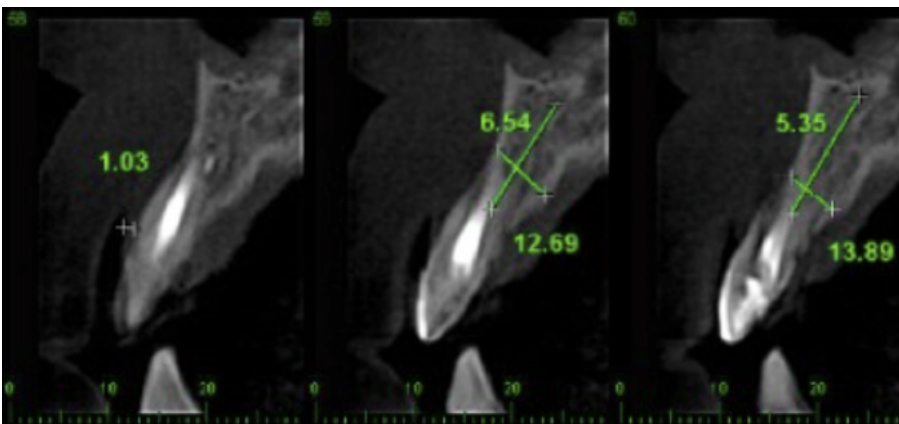


Fig 2. Sagittal view of Cone Beam computed tomography (CBCT) image showing remaining apical bone and measurement of gingival thickness. Image, in the right, is confirming the perforation existent in the root.

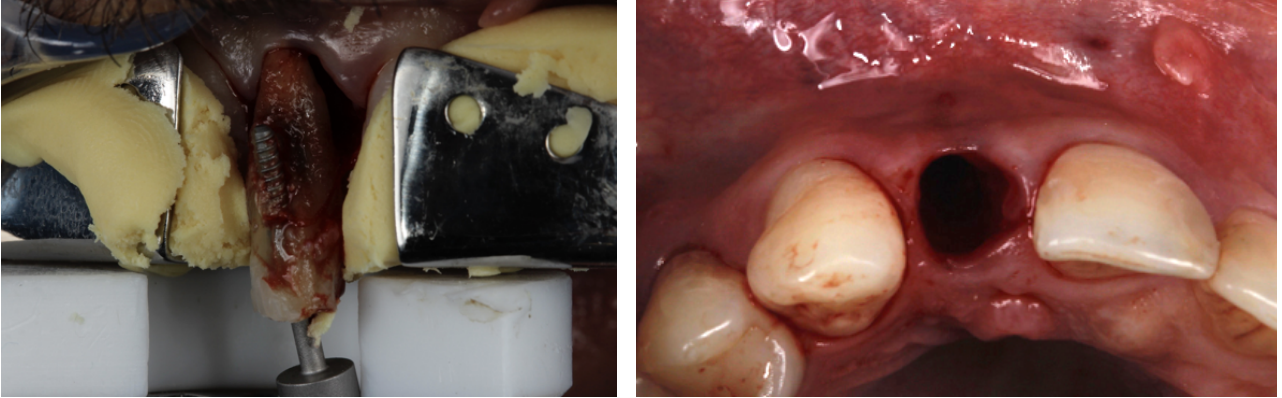


Fig 3. Minimally traumatic extraction: (A) extractor device engaged to the root during extraction exactly in the region perforated; (B) preservation of gingival architecture after tooth extraction.



Fig 4. Occlusal view of implant placement in relation to surgical guide utilized during surgery.



Fig 5. Labial view of implant placement and prosthetic abutment installed.



Fig 6. Provisional crown with critical and subcritical contour established to support peri-implant soft tissues.

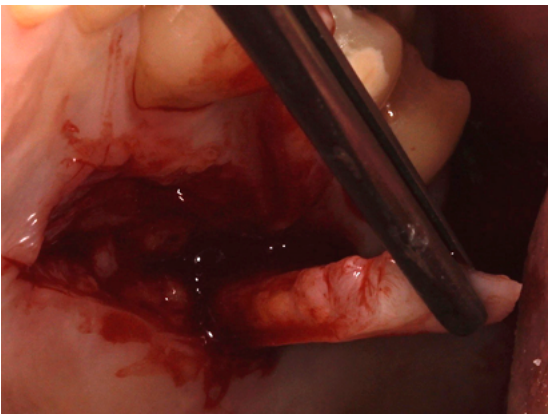


Fig 7. A free CTG was harvested from the right palate in area between premolars and de epithelized extra-orally with the use of a 15c blade.



Fig 8. View from the surgical site after suturing CTG, cementation of the provisional crown and occlusal adjustment.



Fig 9. Mock-up with bis-acryl (Protemp, 3M, USA) was used for esthetic and functional try-in, and to guide teeth preparation for veneers. (A) lateral view; (B) frontal view.



Fig. 10 – Occlusal aspect of the peri-implant soft-tissues 6-months after IIP

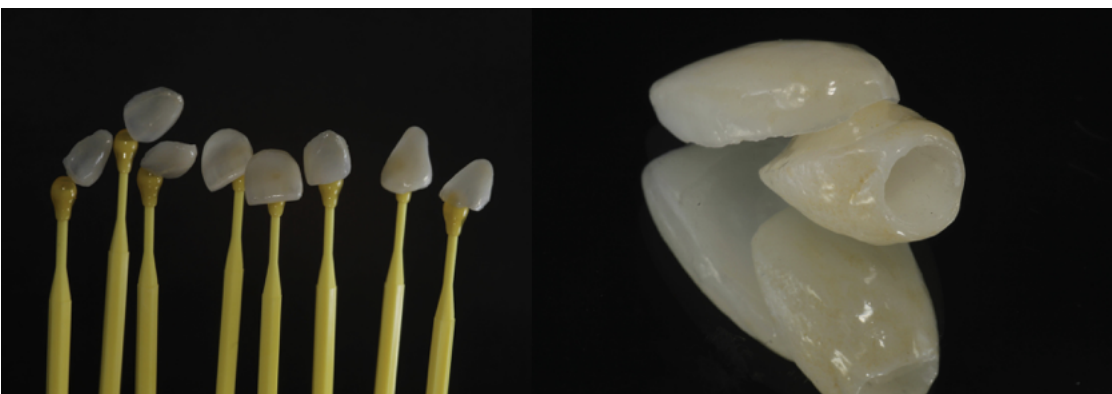


Fig. 11 – Veneers and implant crown prepared to receive the cementation of a veneer on top.



Fig. 12 – Implant crown prepared to receive the cementation of a veneer in place showing adequate shade balance with adjacent teeth that will receive veneers cementation.



Fig. 13 – Immediate final aspect after cementation of implant crown and veneers.



Fig. 14 – (A) Intraoral view 14 months after implant placement. Note the maintenance of the soft tissue architecture. (B) Intraoral digital radiograph taken 14 months after the procedure and showing no significant changes in crestal bone level.



Fig. 15 (A) The intraoral view 48 months after implant placement; (B) An intraoral digital radiograph showing preserved crestal bone levels