LUIZ FELIPE SILVA NOVY

AVALIAÇÃO CLÍNICA E TOMOGRÁFICA DE INDIVÍDUOS SUBMETIDOS À CIRURGIA DE ENXERTO ÓSSEO AUTÓGENO TRIDIMENSIONAL EM MANDÍBULA POSTERIORMENTE ATRÓFICA

Faculdade de Odontologia
Universidade Federal de Minas Gerais
Belo Horizonte
2018

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Dissertação apresentada ao Colegiado de Pós-Graduação em Odontologia da Faculdade de Odontologia da Universidade Federal de Minas Gerais, como requisito parcial à obtenção do título de Mestre em Odontologia- área de Concentração em clínica Odontológica

Orientadora: Profa. Dra. Amália Moreno

Co-orientadora: Profa. Dra. Cláudia Silami de Magalhães

Belo Horizonte

2018

FOLHA DE APROVAÇÃO

Ficha Catalográfica

N945a 2018 T

Novy, Luiz Felipe Silva.
Avaliação clínica e tomográfica de indivíduos submetidos à cirurigia de enxerto ósseo autógeno tridimensional em mandíbula posteriormente atrófica / Luiz Felipe Silva Novy. -- 2018.

98 f. : il.

Orientadora: Amália Moreno.
Coorientadora: Cláudia Silami de Magalhães.

Dissertação (Mestrado) -- Universidade Federal de Minas Gerais, Faculdade de Odontologia.

1. Transplante ósseo. 2. Regeneração óssea. 3. Tomografia computadorizada por raios X. 4. Mandíbula. 5. Inquéritos e questionários . I. Moreno, Amália. II. Magalhães, Cláudia Silami de . III. Universidade Federal de Minas Gerais. Faculdade de Odontologia. IV. Título.

BLACK - D047

Elaborada pela Biblioteca da Faculdade de Odontologia - UFMG

UNIVERSIDADE FEDERAL DE MINAS GERAIS

PROGRAMA DE PÓS-GRADUAÇÃO EM ODONTOLOGIA

FOLHA DE APROVAÇÃO

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LUIZ FELIPE SILVA NOVY

Dissertação submetida à Banca Examinadora designada pelo Colegiado do Programa de Pós-Graduação em Odontologia, como requisito para obtenção do grau de Mestre, área de concentração Clínica Odontológica.

Aprovada em 31 de julho de 2018, pela banca constituída pelos membros:

Profa. Amalia Moreno - Orientadora
FO-UFMG

Profa. Claudia Silami de Magalhaes - Coorientadora
FO-UFMG

Prof(a). Marcelo Drummond Naves
FO-UFMG

Prof(a). Marcelo César Sette Dias
Centro UNiversitario Newton Paiva

Belo Horizonte, 31 de julho de 2018.

AGRADECIMENTOS

Agradeço a minha orientadora, Profa. Dr. Amália Moreno, pela brilhante orientação durante a execução da presente pesquisa. A sua presença, disponibilidade, paciência ajuda e cobrança quando necessário sempre me motivaram a seguir buscando o melhor para meu mestrado. Apesar de tê-la conhecido a pouco tempo já a considero uma grande amiga.

Agradeço a Prof. Dra. Cláudia Silami de Magalhães, minha coorientadora pela imensa ajuda durante a execução e conclusão desta pesquisa. Ao longo destes anos de convivência, desde a graduação tive o prazer de crescer e aprender com ela, tanto profissionalmente como pessoalmente.

Agradeço ao Prof. Dr. Evandro Guimarães de Aguiar, grande colaborador desta pesquisa sem o qual não seria capaz de realizá-la. Só tenho a agradecer pelos ensinamentos a mim concedidos desde o início na vida profissional, as várias oportunidades a mim dadas, que foram fundamentais para meu crescimento pessoal, bem como cirurgião-dentista bucomaxilofacial. Além é claro da grande amizade criada que levarei ao longo dos anos.

Agradeço aos professores doutores Allyson Nogueira Moreira e Mônica Yamauti, que ajudaram na minha formação e crescimento durante o mestrado, com incentivos e “puxões de orelha” quando necessário.

Agradeço ao Prof. Dr. Vinícius, e todos os seus funcionários da Scan, pela paciência apoio e parceria na obtenção dos exames de imagem e pelo auxílio no desenvolvimento da metodologia desta pesquisa.

Agradeço ao Prof. Dr. Maurício A. A. de Castro, pela paciência, dedicação, irrestrito apoio, e disponibilidade na interpretação dos dados tomográficos desta pesquisa.

Agradeço a todos os professores, funcionários e alunos do Curso de Especialização em Cirurgia e Traumatologia Buco-Maxilo-Facial, e Aperfeiçoamento em implantodontia da FO-UFMG. O aprendizado e a convivência ao longo destes anos foram fundamentais para minha formação profissional, e conclusão desta pesquisa. Em especial as Sras. Cristina e Chayene.

Agradeço aos professores e funcionários integrantes do Colegiado de Pós-graduação em Odontologia da FO-UFMG, pela excelência do Programa, o qual tive a oportunidade de frequentar.

Agradeço aos participantes da pesquisa, pelo apoio e confiança, levando ao meu aperfeiçoamento profissional.

Agradeço aos meus familiares, principalmente aos meus pais que sempre me apoiaram, e me deram e continuam dando suporte para minhas conquistas, e realização de meus sonhos, e de minhas aspirações profissionais.

Agradeço, por fim, a Deus, por me dar saúde para buscar cada vez mais o crescimento intelectual e moral.

RESUMO

O objetivo desse estudo foi avaliar a condição óssea, a dor e a ansiedade em indivíduos submetidos à cirurgia de enxerto ósseo autógeno tridimensional em mandíbula posterior, provenientes da linha oblíqua externa. Foram mensuradas altura e largura do enxerto ósseo, volume e qualidade óssea da região receptora, antes e após a instalação do enxerto em dois momentos, por meio de softwares e imagens tomográficas. Adicionalmente obteve-se o auto relato dos pacientes por meio de questionários de ansiedade (IDATE T-E) e a percepção de dor (EVA) durante o tratamento e pós-operatório de 14 dias. Algumas variáveis clínicas de interesse do tratamento cirúrgico, limitação das atividades diárias, bem como sintomas pós-operatórios foram coletadas respectivamente: durante, e no pós-operatório de 14 dias. Tratou-se de estudo de coorte *quasi-experimental* prospectivo, de amostra não-probabilística contando com 15 indivíduos selecionados. O estudo foi dividido em quatro etapas. A primeira etapa consistiu na seleção e recrutamento da amostra e requisição de exames complementares. Na segunda etapa, foi realizado o enxerto de tecido conjuntivo proveniente do palato, 3 meses antes da cirurgia de enxerto ósseo e obtida a tomografia inicial. Na terceira etapa, foram aplicados questionários pré e pós-operatórios, e realizadas as cirurgias de enxerto ósseo autógeno tridimensional. Na quarta e última etapa, realizou-se a aplicação de questionários e tomografias pós-operatórios, e análise estatística dos dados. Os resultados da análise linear da área receptora nos diferentes momentos da avaliação apresentaram diferença significante, resultando em ganho médio ósseo final de 0,3mm (±1,3). para largura, e 1,7 mm (±0,94) para altura, a análise fractal não foi observada diferença significativa para a trabeculagem óssea entre os diferentes momentos de avaliação. No entanto, pode-se verificar diferença significativa entre os resultados do volume ósseo da área receptora inicial em relação ao final, com ganho em volume ósseo de 3,412 mm^3 (± 1,55), taxa de 71,6%. A reabsorção média do volume do enxerto obteve-se taxa de 14,4%, correspondendo a média de 0,688 mm^3 (±1,48). Não houve associação significativa entre a maioria das atividades diárias/sintomas pós-operatórios e percepção da dor, bem como entre características clínicas e os níveis de ansiedade (IDATE), na terceira etapa do estudo (P>0.05). Como exceção pode-se verificar associação significativa entre halitose e IDATE-Estado, na terceira etapa (P=0.014). Não foi observada diferença significante entre os níveis de ansiedade (IDATE) obtidos entre os 3 momentos de avaliação (P>0.05). A análise de correlações cruzadas não apresentou relação de causalidade entre as respostas de ansiedade-estado e percepção de dor (P>0.05). Houve apenas uma correlação positiva (P=0.044) entre a percepção de dor no dia da cirurgia e IDATE-T no pós-operatório de 14 dias. Concluiu-se que a reconstrução de defeitos verticais de mandíbulas posteriormente atróficas pela técnica tridimensional, proporcionou adequada cicatrização com baixas complicações e mínima reabsorção óssea, favorecendo ganho ósseo vertical. A autoavaliação do paciente parece indicar que o nível de dor e ansiedade se manifestou durante o tratamento, no entanto pode não estar diretamente associado ao procedimento cirúrgico. Não foi possível provar a causalidade que a dor prediz a ansiedade dos pacientes neste tratamento.

Palavras-chave: Transplante ósseo. Regeneração óssea. Tomografia Computadorizada por Raios X. Mandíbula. Questionários.

ABSTRACT

Clinical and tomographic evaluation of individuals submitted to three-dimensional autogenous bone surgery in posteriorly atrophic mandible.

The aim of this study was to evaluate the bone condition, pain and anxiety in individuals submitted to three-dimensional autologous bone graft surgery in the posterior mandible from the external oblique line. Bone graft height and width, bone volume and quality of the recipient region were measured before and after the graft installation in two moments, through software's and tomographic images. Additionally, self-report of the patients was obtained through an anxiety questionnaire (IDATE T-S) and pain perception (VAS) during the treatment and 14 days postoperative. Some clinical variables of interest in the surgical treatment, limitation of daily activities, as well as postoperative symptoms were collected, respectively, during, and in the postoperative period of 14 days. This is a prospective, almost experimental, cohort study of a non-probabilistic sample with 15 selected individuals. The study was divided into four stages. The results of the linear analysis of the receptor area at the different moments of the evaluation showed a significant difference, resulting in a mean bone gain of 0.3 mm (± 1.3). for width, and 1.7 mm (± 0.94) for height, the fractal analysis did not observe a significant difference for bone trabeculation between the different moments of evaluation. However, a significant difference could be observed between the results of the bone volume of the initial recipient area in relation to the final one, with gain in bone volume of 3,412 mm3 (± 1,55), a rate of 71.6%. The average resorption of the graft volume obtained a rate of 14.4%, corresponding to the mean of 0.688 mm3 (± 1.48). There was no significant association between the majority of daily activities / postoperative symptoms and pain perception, as well as between clinical characteristics and levels of anxiety (STD), in the third stage of the study (P> 0.05). As an exception, a significant association between halitosis and IDATE-Estado can be observed in the third stage (P = 0.014). No significant difference was observed between the levels of anxiety (IDATE) obtained between the 3 moments of evaluation (P> 0.05). Cross-correlation analysis did not present a causal relationship between anxiety-state responses and pain perception (P> 0.05). There was only a positive correlation (P = 0.044) between the perception of pain on the day of surgery and the IDATE-T in the postoperative period of 14 days. It is concluded that the reconstruction of vertical defects of posterior atrophic mandibles by the three-dimensional technique, provided adequate healing with low complications and minimal bone resorption, favoring vertical bone gain. The self-assessment of the patient seems to indicate that the level of pain and anxiety manifested during the treatment, however it may not be directly associated with the surgical procedure. It was not possible to prove the causality that the pain predicts the anxiety of the patients in this treatment.

Keywords: Bone transplantation. Bone regeneration. X-ray Computed Tomography. Jaw. Questionnaires.

LISTA DE ILUSTRAÇÕES

LISTA DE ABREVIATURAS E SIGLAS

DICOM	Digital Image Communication in Medicine
FA	Análise Fractal
PVPI	Polivinil Pirrolidona Iodo
TCCB	Tomografia computadorizada tipo cone bean
UFMG	Universidade Federal de Minas Gerais
ROI	Região de Interesse
IDATE	Inventário de Ansiedade Traço-Estado
EVA	Escala Analógica Visual

SUMÁRIO

1 CONSIDERAÇÕES INICIAIS

A instalação de implantes osseointegráveis requer um volume ósseo suficiente como pré-requisito de prognóstico favorável, em longo prazo. Para alcançar a estabilidade adequada do implante, especialmente quando ocorrem defeitos horizontais do rebordo alveolar, tem-se utilizado enxertos ósseos para o aumento da crista alveolar, como opção viável e largamente empregada (Esposito *et.al,* 2009; Esposito *et.al,* 2010; Von Arx *et al*., 2006; Voss *et.al*, 2016).

Variados métodos cirúrgicos e materiais para aumento ósseo foram desenvolvidos e empregados ao longo dos últimos anos, como os enxertos em bloco, particulados, alógenos, xénogenos e materiais aloplásticos (Aghaloo *et al.,* 2007; Khoury *et al*., 2007; Khoury & Hanser, 2015; Raghoebar et al. 2001). A utilização de enxerto ósseo autógeno é considerada padrão ouro para reabilitação de diferentes áreas (Esposito *et.al,* 2009; Esposito *et.al.,* 2010; Khoury *et al*., 2007; Khoury & Hanser 2015), e, apesar da morbidade gerada, apresentam boa confiabilidade e previsibilidade, para posterior colocação de implantes, independentemente da área doadora (Esposito *et.al* 2009, Esposito *et.al,* 2010; Misch,1997; Triplett & Sterling, 1996). Khoury *et al*. (2007), Khoury & Hanser (2015) relataram à possibilidade da utilização de enxerto em bloco dividido, em região posterior mandibular, como alternativa as possíveis desvantagens dos enxertos autógenos em bloco, com ganho ósseo vertical e horizontal, em longo prazo. Esta técnica incorpora a vantagem do arcabouço que o enxerto de osso autogéno cortical fornece, e a do esponjoso que como a rápida vascularização e reparação por “creeping substutition” Pallesen *et al*. (2002), Pikos *et al*. (2005); em comparação com o enxerto autogéno cortical convencional que é normalmente lenta e ocorre por meio de canais de Havers existentes, acarretando em mistura de osso necrosado ao novo osso viável, (Pikos, 2000; Raghoebar *et al.*, 2007; Sbordonee *et al*., 2009).

As áreas doadoras intraorais, além da proximidade do local doador e receptor, tem como vantagens: fácil acesso cirúrgico, pequena morbidade e ausência de internação hospitalar. Para reconstruções bi ou tridimensionais de atrofias do rebordo alveolar, blocos corticoesponjosos são preferíveis e estes podem ser removidos da região de sínfise mandibular, retro e paramolares ou áreas desdentadas (Khoury *et al.,* 2007; Khoury& Harse, 2015).

Além da disponibilidade óssea, sua qualidade representada por: aspectos fisiológicos, grau de mineralização, morfologia e padrão trabecular são fatores importantes a serem analisados para o sucesso do implante, bem como o diagnóstico de doenças caracterizadas pela perda óssea (Licata, 2009; Magat & Sener, 2018). Várias estratégias para avaliação da arquitetura trabecular tem sido desenvolvidas, podendo-se estimar a microestrutura do tecido ósseo à análise fractal (AF), usa análise estatística de textura para examinar a microarquitetura óssea trabecular com uma expressão numérica da dimensão fractal como uma medida da complexidade da imagem. (Huh K-H 2011 *et al).*

Particularmente, a AF se mostrou como um método econômico, preciso e eficaz (Huh KH 2011 *et al.*; Magat & Sener, 2018). A AF da estrutura óssea trabecular, usando radiografias digitais, pode ser usada para avaliar a alteração óssea patológica e a qualidade óssea prévia ao implante (Huh K-H, *et al.* 2011, Magat & Sener, 2018).

O uso das radiografias panorâmica e periapical é recomendada pela Academia Americana de Radiologia Oral e Bucomaxilofacial como exames de imagem iniciais, na avaliação do paciente para implantodontia. Entretanto, para diagnóstico e planejamento apropriados, a tomografia computadorizada tipo cone bean (TCCB) é, atualmente, o exame que fornece o melhor custo benefício, com dose de radiação aceitável (Pena de Andrade *et al.,* 2016; Tyndall, 2000; Tyndall *et al.,2012*). Estudos recentes demonstraram que, em casos de procedimentos cirúrgicos de enxertia óssea, a TCCB é um método viável e preciso para verificar o volume ósseo disponível e os resultados de reabsorção e neoformação óssea (Pena de Andrade *et al.,* 2016; Hohlweg-Majert *et al*., 2010; Braut *et al*., 2014; Bornstein *et al*., 2015).

Adicionalmente, a condição emocional e da vida cotidiana do indivíduo que é submetido a procedimentos de enxertia óssea, podem influenciar a efetividade do tratamento (Cordaro et al., 2011; Hashem *et al*., 2005; Weisensee *et al.*, 2012). Tais procedimentos podem ser moderadamente estressantes, levando a limitações das atividades cotidianas e gerando dor, nos primeiros três dias de pós-operatório (Hashem *et al.,* 2005; Goiato et al., 2016). A avaliação do impacto nas atividades diárias e dos níveis de ansiedade destes indivíduos torna-se importante, podendo influenciar o controle subjetivo da dor, e consequentemente, a morbidade da região operada (Enkling *et al*., 2013).

O presente estudo se justifica pela necessidade de verificar se rebordos com menor volume de tecido ósseo apresentam menor potencial para revascularização do enxerto livre e maior índice de reabsorção. Existem técnicas bem documentadas de enxertia óssea em bloco utilizando a linha oblíqua como área doadora para reconstrução de mandíbulas posteriormente atróficas. Contudo, poucos estudos avaliaram a condição óssea horizontal e vertical de regiões de enxertos autógenos tridimensionais em mandíbula posterior, bem como a condição emocional dos indivíduos submetidos a tais procedimentos. As informações resultantes deste estudo poderão ampliar as possibilidades terapêuticas de reabilitação efetiva de casos de atrofia posterior de mandíbula.

2 OBJETIVOS

2.1 Objetivo Geral

Avaliar a condição óssea, a dor e a ansiedade em indivíduos submetidos a cirurgia de enxerto autógeno tridimensional em mandíbula posterior, provenientes da linha oblíqua externa.

2.2 Objetivos específicos

1. Mensurar altura e largura do enxerto ósseo, bem como volume e qualidade óssea da região receptora, antes e após a instalação do enxerto.

2. Comparar altura e largura do enxerto, bem como volume e qualidade ósseos da região receptora, antes e após a instalação do enxerto (14 dias) e no acompanhamento de quatro meses, por meio de avaliação tomográfica.

3. Analisar a associação de ansiedade e percepção de dor em relação a variáveis clínicas do tratamento cirúrgico, atividades de vida diária/sintomas pós-operatórios, em indivíduos submetidos a cirurgia de enxerto ósseo em bloco.

4. Avaliar o efeito de causalidade entre ansiedade e percepção de dor em indivíduos submetidos a cirurgia de enxerto ósseo em bloco, em três momentos de avaliação.

3 METODOLOGIA EXPANDIDA

3.1 Desenho do estudo:

Trata-se de um estudo de coorte *quasi-experimental* prospectivo. O presente estudo foi aprovado pelo Comitê de Ética em Pesquisa em Seres Humanos da Universidade Federal de Minas Gerais (UFMG) sob o número 67497617.7.0000.5149 (Anexo 1). Todos os participantes assinaram um Termo de Consentimento Livre e Esclarecido. Empregou-se amostragem não-probalística, de conveniência, de acordo com o fluxo de pacientes que atenderam aos critérios de inclusão do estudo, o qual foi divido em quatro etapas.

A primeira etapa consistiu na seleção e recrutamento da amostra, bem como requisição de exames complementares. Na segunda etapa, foi realizado o enxerto de tecido conjuntivo proveniente do palato, três meses antes da cirurgia de enxerto ósseo. Posteriormente, na terceira etapa, foram aplicados questionários pré e pós-operatórios, e realizadas as cirurgias de enxerto ósseo autógeno tridimensional. Na quarta e última etapa, realizou-se a aplicação de questionários e tomografias pós-operatórios, e análise estatística e dos dados (Figura 1).

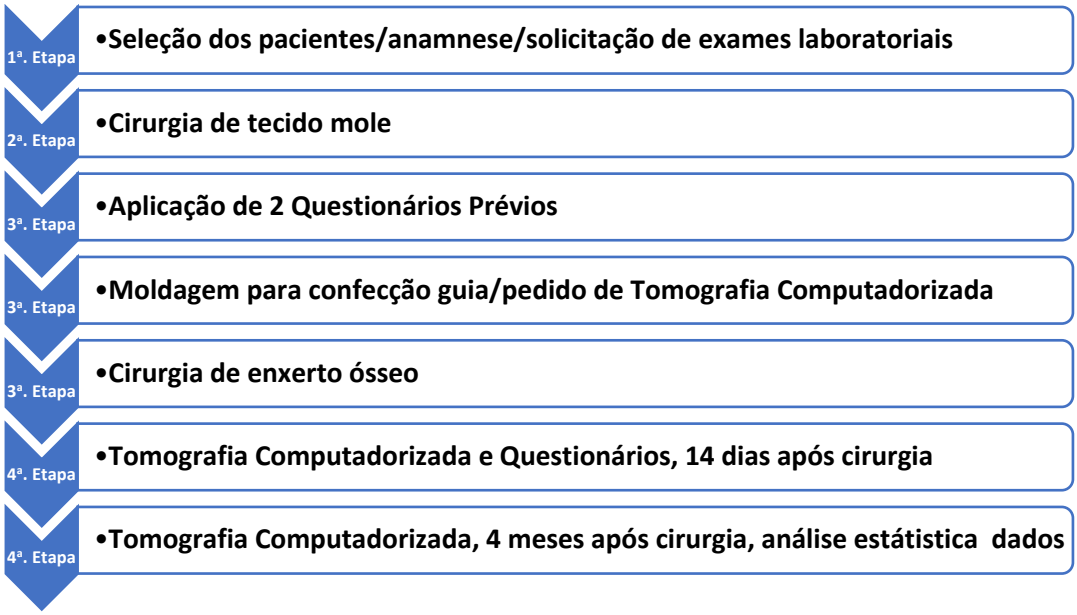

Figura 1 – Fluxograma ilustrativo das etapas do estudo

3.2 Sujeitos

Dentre os indivíduos atendidos no Projeto de Extensão em Implantodontia da Faculdade de Odontologia da UFMG, no período de julho a dezembro de 2017, foram selecionados 15 participantes, de ambos os sexos, com idade entre 25 e 68 anos, que apresentassem indicação para reabilitação oral por meio de implantes osseointegráveis. Todos os indivíduos foram avaliados por meio de anamnese, exames clínicos e de imagens, devendo apresentar região desdentada posterior, em mandíbula, com indicação de aumento de espessura e altura de rebordo para a instalação de implantes dentários.

Para todos os pacientes, foram solicitados os seguintes exames laboratoriais e de imagem: hemograma, coagulograma, uréia, creatinina, glicemia jejum, paratormônio, Cálcio (Ca), Fósforo (P), calcitonina, fosfatase alcalina, vitamina D, densitometria óssea e tomografia computadorizada.

Os seguintes critérios de inclusão foram utilizados: (1) idade entre 25 e 70 anos; (2) apresentar necessidade de enxertia óssea em espessura, em mandíbula posterior, independentemente do número de dentes, determinada por exame visual e palpação, e confirmada por exame tomográfico posterior e/ou; (3) apresentar defeito ósseo em altura em forma de vale, com profundidade mínima de 2 mm em relação à crista óssea adjacente (Figuras 2 e 3); (5) ter capacidade cognitiva para entendimento e resposta aos questionários aplicados.

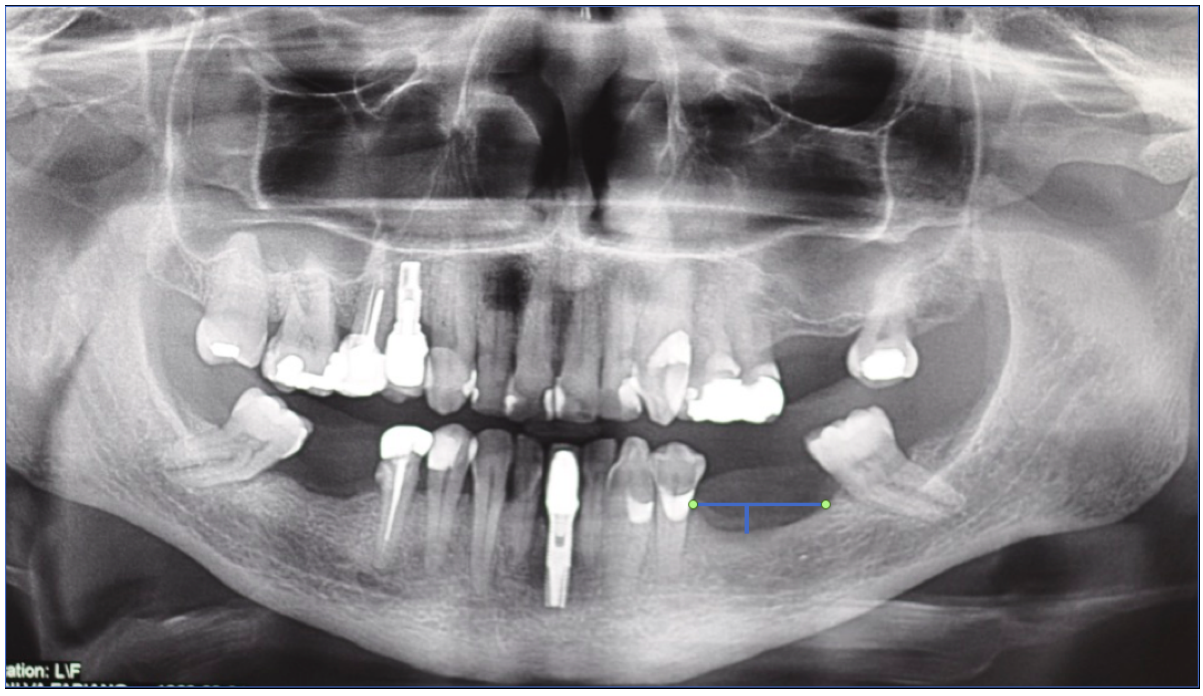

Figura 2 - Radiografia panorâmica evidenciando o defeito ósseo em forma de vale.

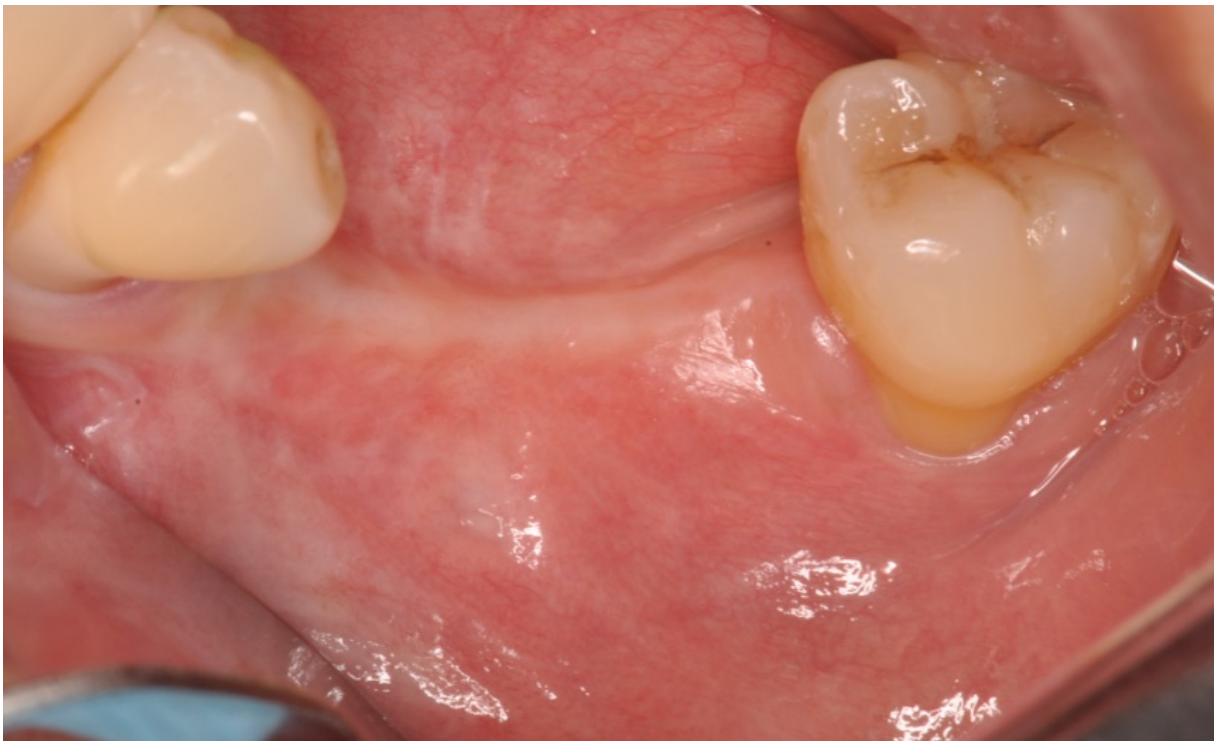

Figura 3- Vista vestibular da área receptora do enxerto ósseo, após cirurgia de tecido conjuntivo.

Foram adotados os seguintes critérios de exclusão: (1) apresentar contraindicações gerais para o tratamento cirúrgico; (2) estar em tratamento ou fazer uso de medicação e/ou apresentar doenças que interfiram no reparo tecidual; (3) fumantes ou etilistas; (4) presença de processo infeccioso ativo na região a ser operada; (5) grávidas ou lactantes; (6) presença de neoplasias malignas e/ou submetidos à radioterapia ou à quimioterapia; (7) história de cirurgias para instalação de implantes ou enxerto na região do estudo.

3.3 Procedimentos cirúrgicos

Os procedimentos cirúrgicos foram realizados em bloco cirúrgico sob anestesia local, no Projeto de Extensão em Implantodontia da Faculdade de Odontologia da UFMG. Todos os procedimentos foram executados pelo mesmo cirurgião, seguindo as técnicas cirúrgicas convencionais, tanto para a cirurgia de tecido conjuntivo, quanto para a cirurgia de enxerto ósseo tridimensional. Os

exames pré-operatórios, terapêutica medicamentosa, controles pós-operatórios e acompanhamentos foram realizados por outro profissional.

3.3.1 Cirurgia de tecido conjuntivo

Com o objetivo de melhorar as características dos tecidos moles da região onde foram realizados os enxertos ósseos, evitando a possível exposição do mesmo, realizou-se a cirurgia de enxerto de tecido conjuntivo. A antissepsia intraoral foi realizada com bochecho de digluconato de clorexidina 0,12% por um minuto, seguida da assepsia da pele com Polivinil Pirrolidona Iodo (PVPI) com 1% de iodo ativo e montagem de campos operatórios estéreis. Todos os participantes foram medicados com: Tenoxicam, 20 mg administrado uma hora antes do procedimento e duas vezes ao dia, durante cinco dias, no pós-operatório e Paracetamol, 750 mg administrada uma hora antes do procedimento e três vezes ao dia, durante cinco dias, no pós-operatório, e enquanto apresentassem sintomatologia dolorosa.

O protocolo cirúrgico na região correspondente à área receptora, consistiu no bloqueio anestésico local com Articaína 4% + epinefrina 1:100.000 (DFL, Rio de Janeiro, Brasil) na vestibular e lingual. Na sequência, realizou-se incisão sobre o rebordo ósseo deslocada 1 mm para lingual em relação ao centro do rebordo com lâmina 15 C (SOLIDOR, Osasco, Brasil), seguindo-se com descolamento do retalho de espessura total. Posteriormente, com lâmina nova de bisturi 15 C (Solidor, Osasco, Brasil), foi feita incisão no periósteo na base do retalho para aumentar sua elasticidade e permitir um fechamento passivo após o enxerto conjuntivo.

A anestesia da área doadora, consistiu no bloqueio anestésico local com Articaína 4% + epinefrina 1:100.000 (DFL) no palato ipsilateral ao leito receptor. A remoção do conjuntivo foi realizada através de uma incisão com lâmina 15 C (SOLIDOR, Osasco, Brasil) que se inicia a 2 mm da margem cervical do primeiro molar até distal de canino, sendo realizadas incisões de alívio de cerca de 4 mm em mesial e distal, conservando-se um pedículo cranial para irrigação do retalho (Edel, 1974; Langer e Langer, 1985). Iniciou-se a remoção do tecido conjuntivo com nova lâmina 15 C (Solidor) posicionada paralelamente ao longo eixo dos dentes, dividindo o conjuntivo subjacente à incisão supradescrita, tomando-se cuidado para não fenestrar a mucosa do palato. Ao

alcançar a largura almejada realizou-se uma incisão no tecido conjuntivo perpendicularmente ao osso, seguida da remoção do tecido.

A espessura média do tecido conjuntivo foi de 1,5 mm. O tamanho do enxerto foi relativo ao tamanho do defeito ósseo a ser reconstruído posteriormente. Uma compressão com gaze foi realizada na região doadora a fim de se obter hemostasia. O tecido conjuntivo foi colocado sobre o rebordo receptor, adaptado ao tecido lingual da região receptora e suturado com pontos simples, usando fios não reabsorvíveis (Nylon 6-0, Ethicon, São José dos Campos, Brasil). Em seguida, realizou-se o fechamento total da ferida cirúrgica com pontos simples (Nylon 6-0, Ethicon). A região doadora recebeu sutura contínua por toda área incisada. As suturas foram removidas com sete dias de pós-operatório.

3.3.2 Cirurgia de enxerto ósseo tridimensional

A realização dos enxertos ósseos autógenos tridimensionais provenientes da linha oblíqua externa baseou-se na técnica descrita por Khoury et al. (2007) com modificações descritas a seguir. A antissepsia intraoral foi realizada com bochecho de digluconato de clorexidina 0,12% por um minuto, seguida da antissepsia da pele com PVPI, 1% de iodo ativo e montagem de campos operatórios estéreis. Todos os participantes foram medicados com um protocolo utilizado pelo projeto que consiste em: Amoxicilina, 875 mg administrada uma hora antes do procedimento, e duas vezes ao dia, durante sete dias, no pós-operatório; Tenoxicam, 20 mg administrado uma hora antes do procedimento e duas vezes ao dia, durante cinco dias, no pós-operatório; Dexametasona, duas cápsulas de 4 mg administradas 12 horas antes do procedimento, 8 mg duas horas antes do procedimento, 8 mg duas vezes ao dia, durante cinco dias, no pós-operatório; Paracetamol, 750 mg administrada uma hora antes do procedimento, e três vezes ao dia, durante cinco dias, no pós-operatório, e enquanto houvesse sintomatologia dolorosa.

O protocolo cirúrgico na região correspondente à área receptora, consistiu no bloqueio anestésico local com Articaína 4% + epinefrina 1:100.000 (DFL) dos nervos alveolar inferior, lingual e bucal. Na sequência, com lâmina 15 (Solidor, Osasco, Brasil), realizou-se incisão sobre a linha oblíqua, seguindo-se sobre a crista do rebordo em sua porção central; uma incisão de alívio na mesial

da incisão com cerca de 5 mm de extensão foi realizada com o intuito de liberação do retalho para posterior cobertura do enxerto ósseo.

Nos casos em que havia dentes entre a área receptora e o início da incisão na linha oblíqua, uma incisão intrasulcular foi realizada para contornar os dentes em questão até a área receptora. Posteriormente, foi obtido retalho de espessura total através de cuidadoso descolamento mucoperiostal envolvendo as áreas doadora e receptora, as quais eram contíguas. Subsequentemente, foi feita incisão do periósteo na base do retalho relativo à área receptora para aumentar sua elasticidade nessa região e permitir um fechamento passivo da ferida cirúrgica. Ainda com o intuito de diminuir a tensão dos tecidos moles para a cobertura do enxerto ósseo, realizou- se o descolamento dos mesmos por lingual na área incisada e, através de pressão com o dedo indicador, realizou-se a liberação do músculo milohióideo da linha milohióidea. Nenhum tipo de preparo foi realizado no leito receptor, como perfurações ou aplainamentos ósseos (Figura 4 e 5).

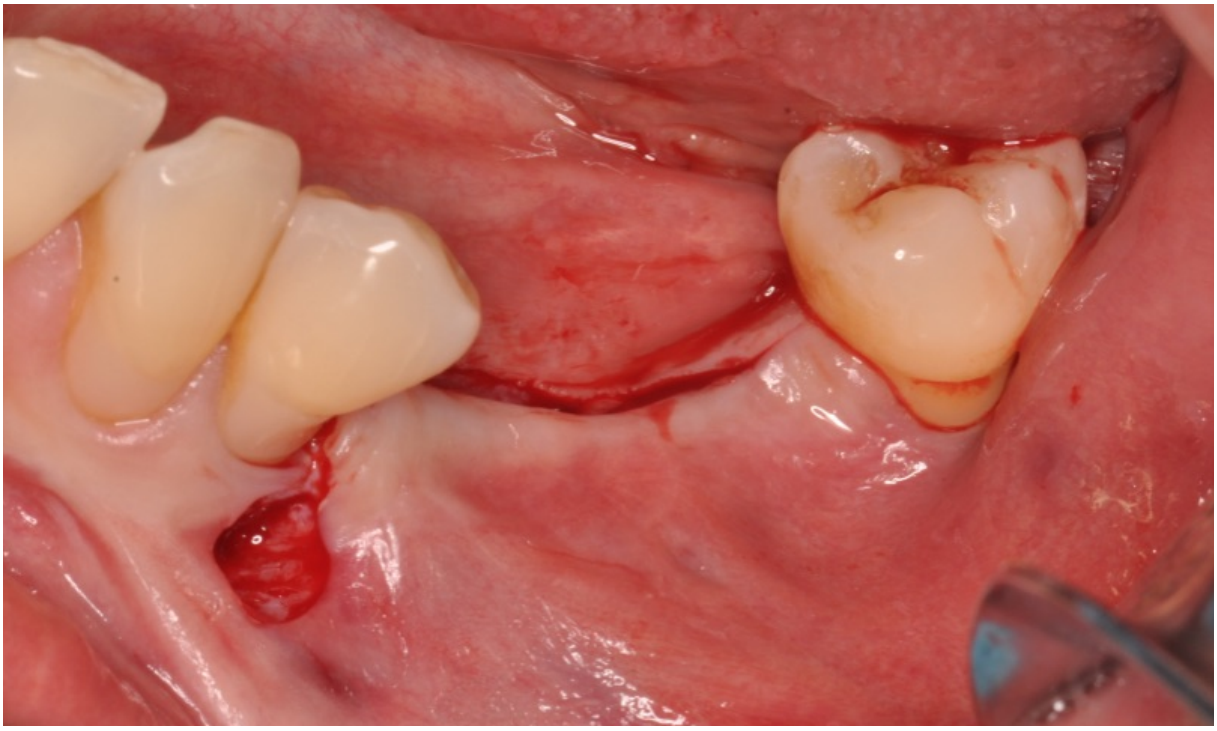

Figura 4 - Incisão da área receptora.

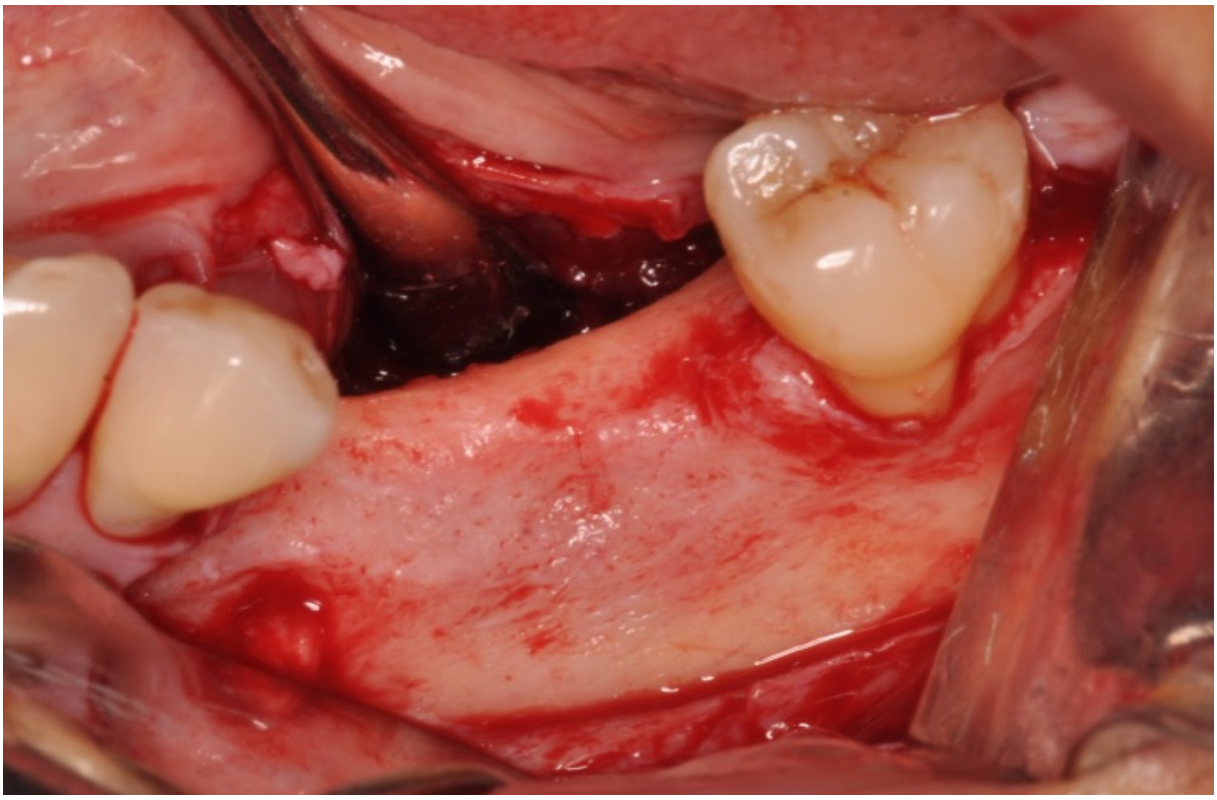

Figura 5 - Descolamento de espessura total do retalho da área receptora.

Na região correspondente à área doadora, já previamente anestesiada, com a broca n.699 (JET, Canadá) em baixa rotação, foram realizadas perfurações pontilhadas paralelamente à linha obliqua externa e abrangendo toda a espessura do osso cortical nesta região; em seguida duas linhas verticais de osteotomia foram realizadas também com brocas 699 (JET), sendo uma mesial e outra distal à osteotomia inicial, determinando o comprimento do enxerto (Figura 6).

Finalmente, uma osteotomia horizontal ao nível caudal das osteotomias verticais foi realizada, usando-se disco diamantado de 5 mm de diâmetro em baixa rotação (Odontomega, Ribeirão Preto, São Paulo). Todas as osteotomias acima descritas ocorreram sob irrigação constante com soro fisiológico resfriado à temperatura de 5 ºC. Em seguida, o bloco ósseo foi removido utilizando-se cinzel e martelo, de modo a manter a maior quantidade possível de osso autógeno para realização da técnica tridimensional.

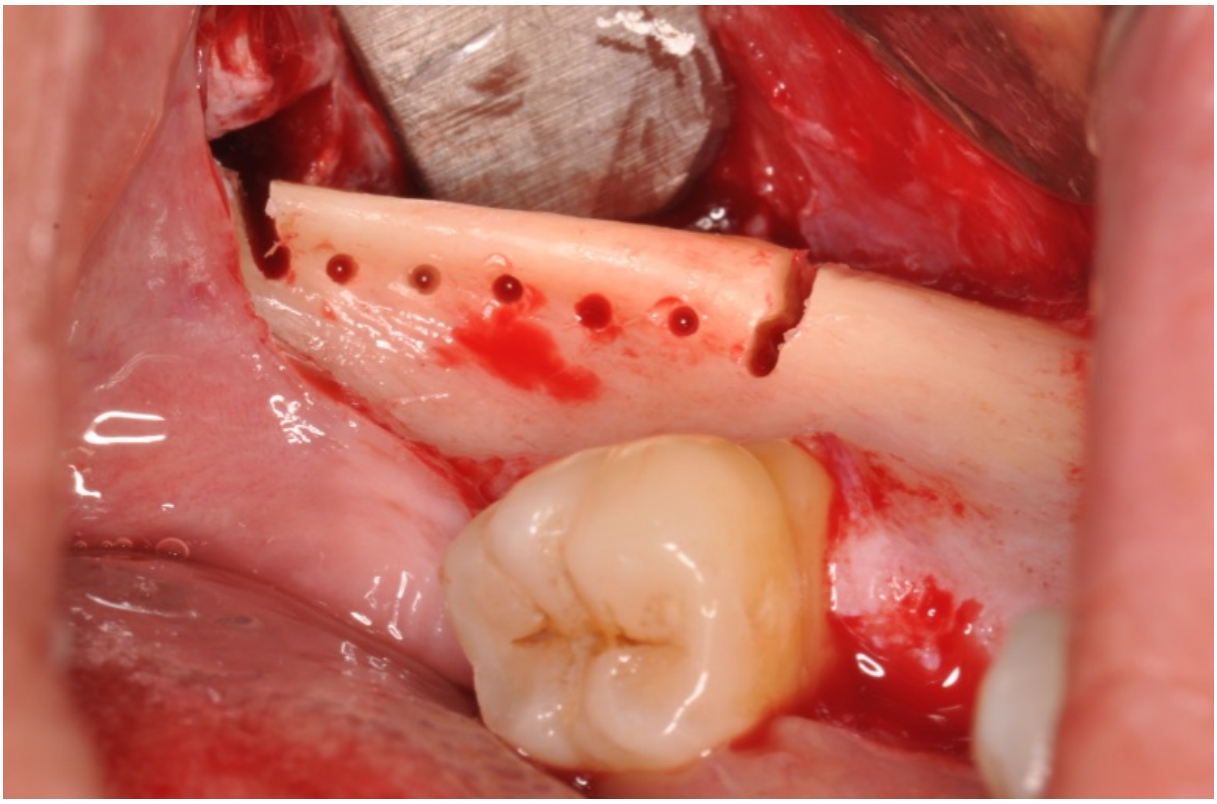

Figura 6 - Área doadora incisada e descolada com as osteotomias presentes.

Após esta etapa, obteve-se osso autógeno particulado com auxílio de broca particuladora (ACM Neobiotech, Seoul, Korea), proveniente da região adjacente ao leito doador do bloco ósseo. O bloco ósseo foi dividido longitudinalmente em dois blocos delgados e de igual diâmetro usando disco adiamantado em baixa rotação, sob irrigação constante com soro fisiológico resfriado a 5 ºC (Odontomega, Ribeirão Preto, São Paulo). As arestas que poderiam danificar o retalho e, consequentemente expor o enxerto, foram removidas com pontas esféricas diamantadas, sob irrigação constante com soro fisiológico (Figura 7).

Em seguida, realizou-se a fixação do primeiro bloco ósseo na oclusal do defeito ósseo a ser reconstruído. Os blocos foram perfurados em sua mesial e distal e estabilizados nas cristas ósseas do defeito com parafusos de titânio de diâmetro de 1,5 mm e de comprimento determinado de acordo com a necessidade de cada caso. Os parafusos foram inseridos manualmente utilizando-se chave porta parafuso de ponta ativa quadrada (PECLAB, Belo Horizonte, Brasil) (Figura 8). Em seguida, o espaço existente entre a cortical

oclusal e o osso original remanescente foi preenchido com osso autógeno particulado, sem mistura de outro biomaterial a ele.

Então, foi instalada a outra porção cortical obtida da divisão do bloco de osso autógeno original. Esta foi cuidadosamente adaptada à vestibular do defeito remanescente cobrindo toda sua extensão e foi fixada com os mesmo parafusos descritos previamente (Figura 9 e 10).

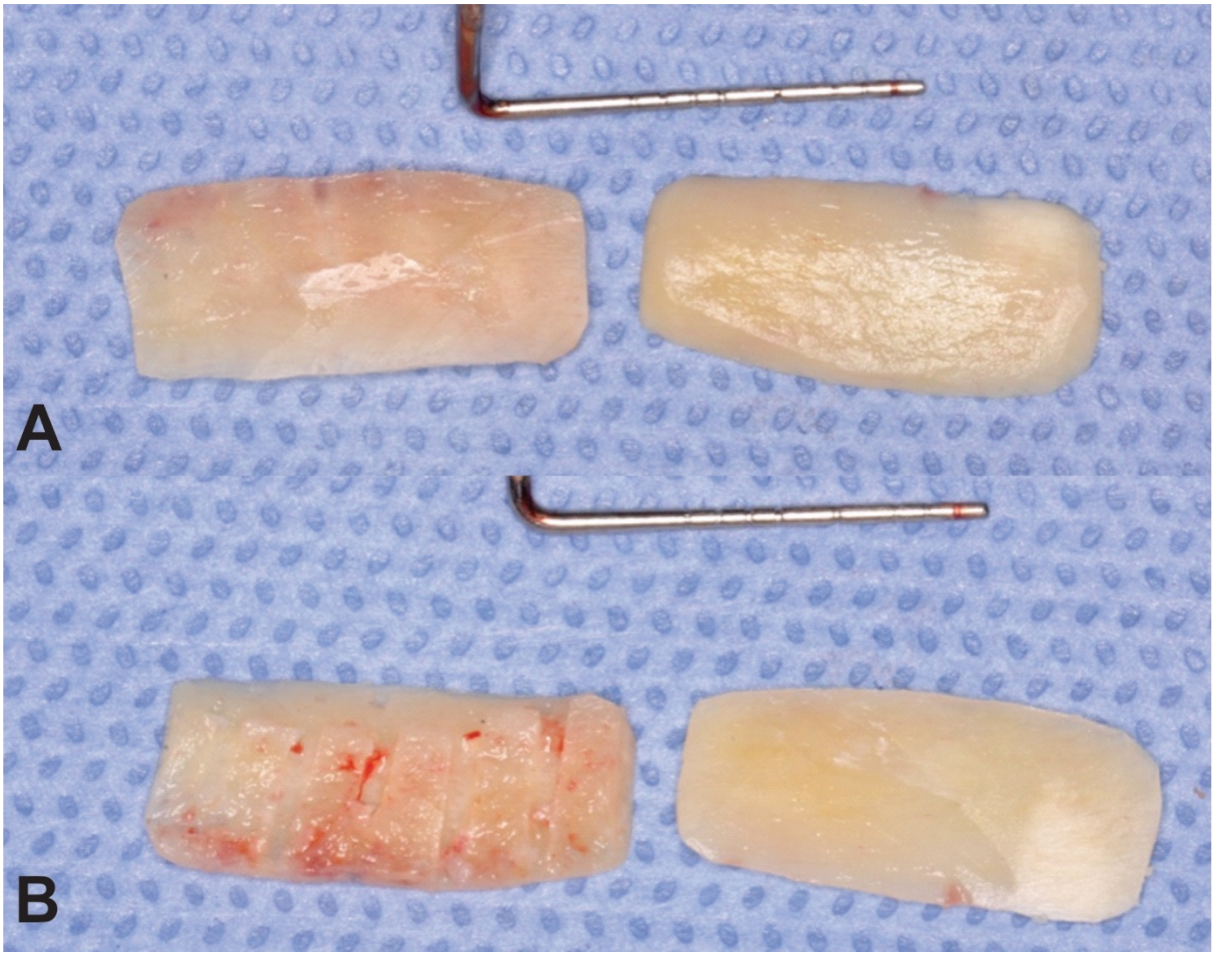

Figura 7 - Bloco do enxerto dividido longitudinalmente, vista externa (A), vista interna (B).

Após a fixação dos enxertos, foi verificada a estabilidade da estrutura no leito receptor. O fechamento da ferida cirúrgica na área receptora foi realizado com pontos tipo Donnati e pontos simples com fios não reabsorvíveis (Nylon 6-

0, Ethicon). Na área doadora foi utilizado o mesmo fio, e somente pontos simples (Figura 11).

Ao final do procedimento foram registrados: o número de tubetes anestésicos utilizados, tempo cirúrgico e intercorrências transoperatórias.

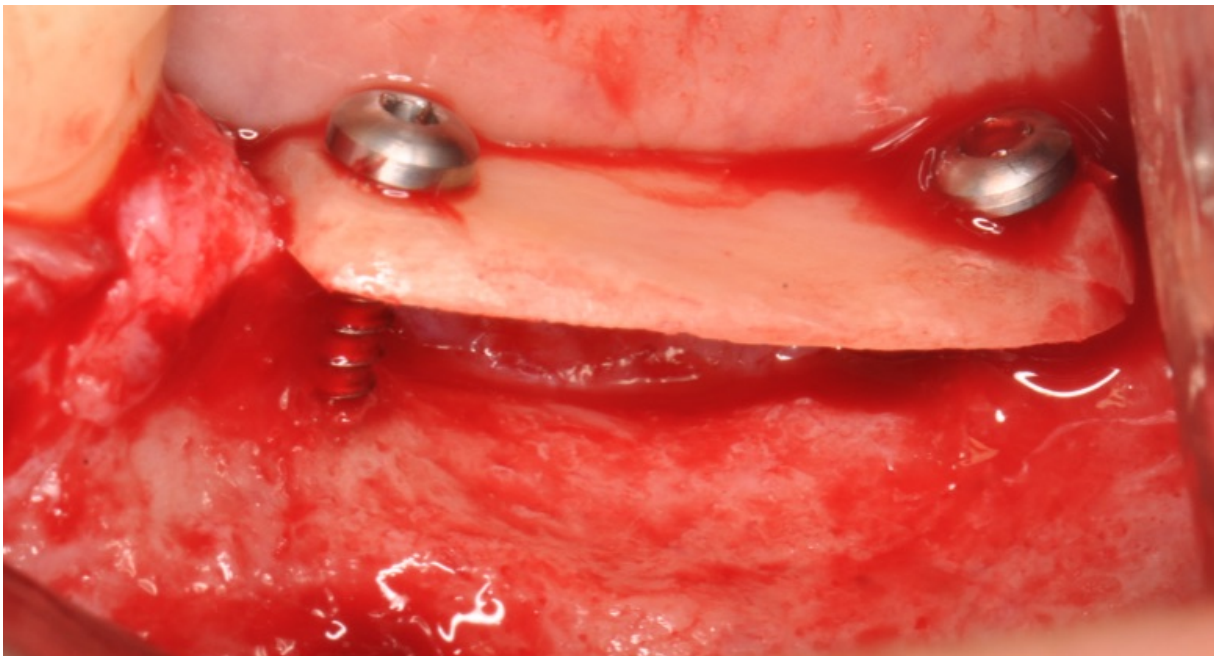

Figura 8 - Lâmina oclusal do enxerto estabilizada com dois parafusos.

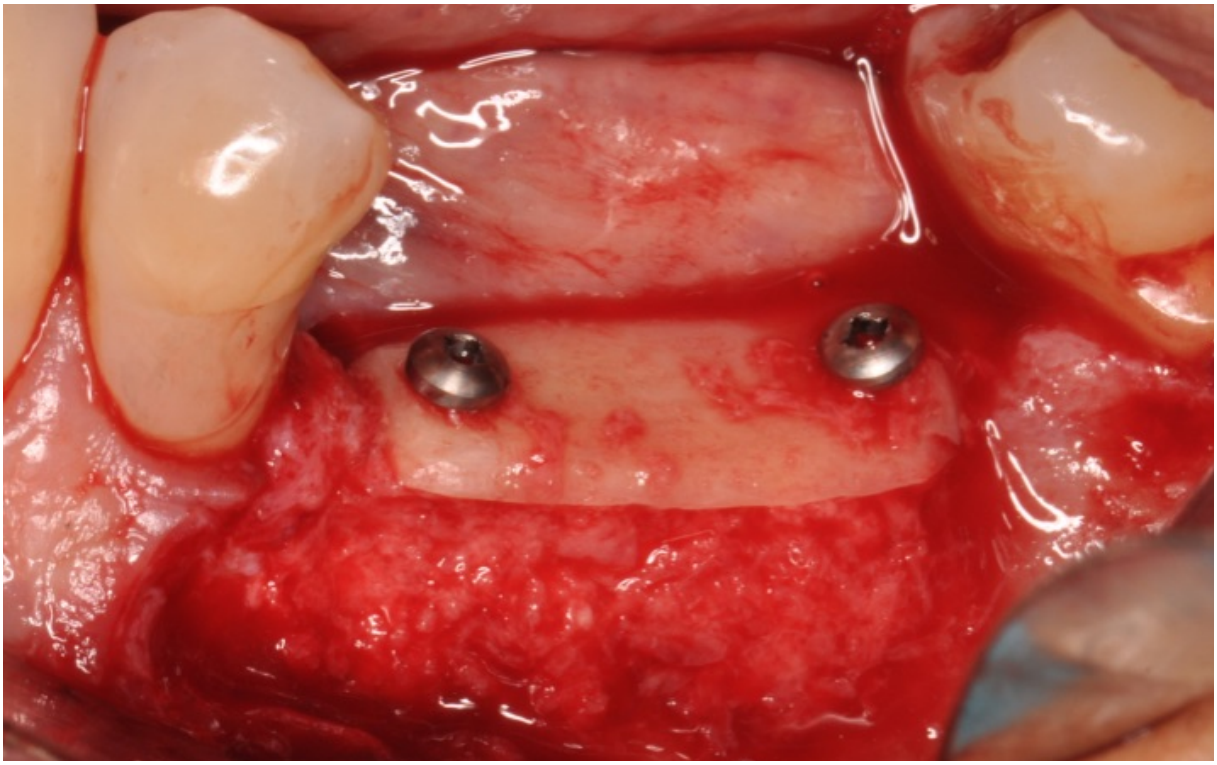

Figura 9 - Preenchimento do espaço com osso particulado.

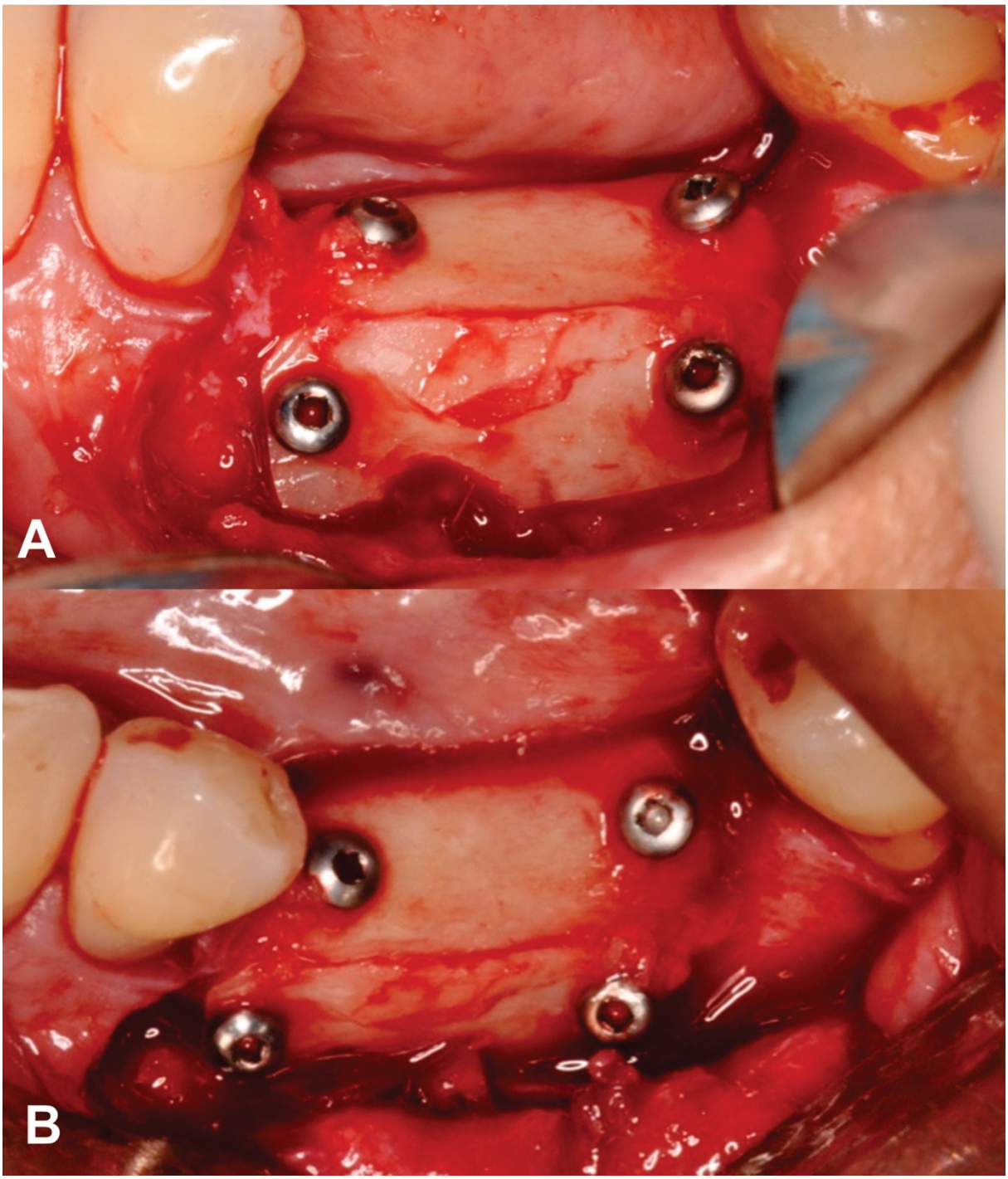

Figura 10 - Enxerto ósseo com as tabuas ósseas estabilizadas em posição, Vista vestibular (A), vista oclusal (B).

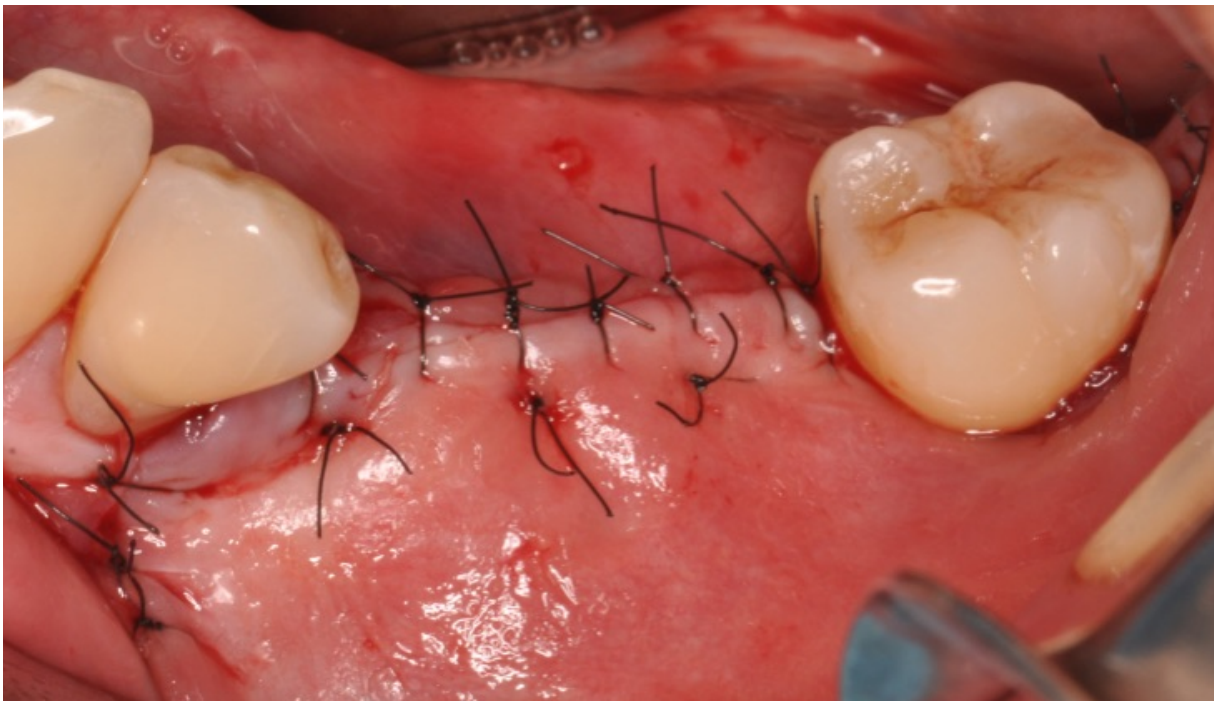

Figura 11 - Sutura da área receptora.

Foi feita a prescrição de bochecho com 5 ml de solução de digluconato de clorexidina a 0,12%, sem álcool, durante um minuto, trinta minutos após a higienização bucal, três vezes ao dia, iniciando três dias após a cirurgia, por um período de sete dias.

Os pacientes foram reavaliados sete dias após a cirurgia e a sutura foi removida após dez dias. A região operada permaneceu sem influência de carga direta proveniente de uso de próteses dentárias durante toda a fase de regeneração óssea (Khoury *et al.,* 2007). Todos os pacientes, conforme planejamento protético inicial, receberão implantes em mandíbula para posterior reabilitação protética.

3.4 Avaliação tomográfica

Todas as tomografias foram realizadas utilizando o tomógrafo computadorizado de feixe cônico *I-CAT® (Next Generation Model – Imaging Sciences International* – Hatfield, PA, EUA), com campo de visão (FOV) de 8 cm de altura por 16 cm de diâmetro, voxel isotrópico de 0,20 mm, tempo de aquisição de 26,9 seg, incluindo as regiões onde foram realizados os enxertos ósseos.

Para padronizar as mensurações feitas na mesma região de interesse (*ROI*) no pré e pós-operatórios, foram obtidos modelos de gesso das mandíbulas para o enceramento diagnóstico da área a ser enxertada. Foram confeccionadas guias tomográficas em placas de acetato de 1mm de espessura, com lâminas de chumbo de 2mm de largura, contornando a coroa dos dentes encerados. Também foram posicionados fios de aço de 1mm de diâmetro, delimitando as superfícies proximais dos dentes encerados (Bornstein *et al*., 2015; Pena de Andrade, *et al.* 2016) (Figura 12).

Os exames tomográficos foram realizados em três diferentes momentos: T1- um a quatro meses antes da realização do enxerto ósseo, para confirmar a necessidade do mesmo; T2- 14 dias após a realização do enxerto ósseo, permitindo a avaliação pós-cirúrgica do mesmo; e T3- quatro meses após a cirurgia de enxerto, para avaliação do tecido ósseo neoformado e planejamento da instalação dos implantes.

As imagens obtidas foram exportadas em formato *Digital Image Comunication in Medicine* (*DICOM*) e reconstruídas nos programas: Xoran® (*Xoran Technologies* - Ann Arbor, MI, EUA), para realização de medidas lineares de altura e largura da região receptora dos enxertos; *IMAGE J* (https://imagej.nih.gov/ij/index.html) para análise fractal da mesma região; ITK SNAP (https://www.itksnap.org.) para mensuração dos volumes inicial e final dos enxertos ósseos, e da área receptora. As mensurações foram realizadas por um especialista em Radiologia Odontológica.

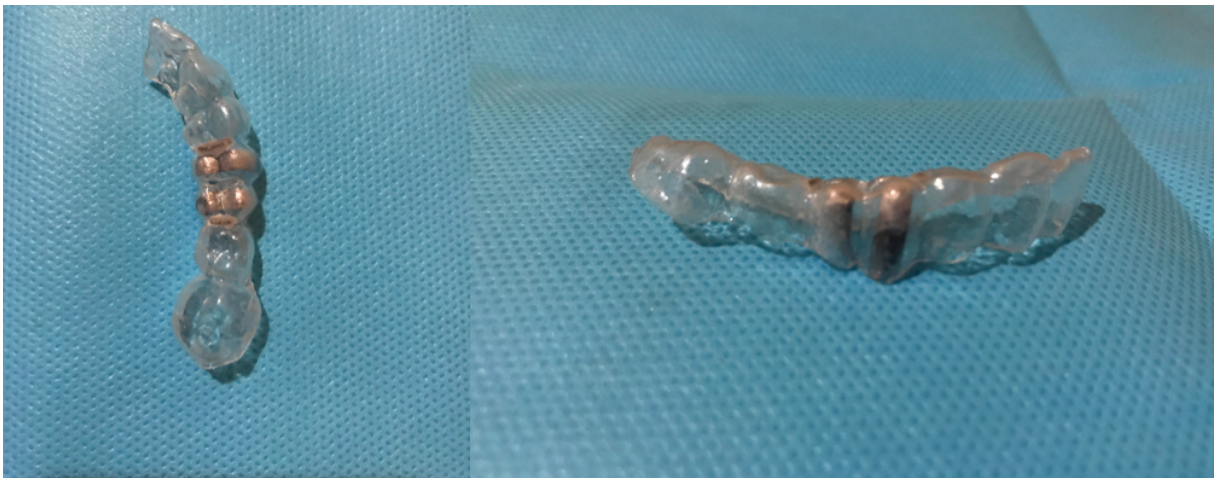

Figura 12 - Guia tomográfica.

3.4.1 Análise Linear

As imagens dos cortes ortogonais (axiais, coronais e sagitais) foram inicialmente escaneadas no programa Xoran® (*Xoran Technologies - Ann* Arbor, MI, EUA), para avaliação da presença de patologias ou alterações que contraindicassem o procedimento ou excluíssem o paciente da amostra. Nos cortes sagitais e coronais, realizou-se a reorientação do posicionamento da mandíbula, para alinhamento vertical do longo eixo do dente adjacente à área edêntula (sítio receptor de enxerto), para padronização dos exames na mesma posição nos diferentes tempos de exame (Figura 13).

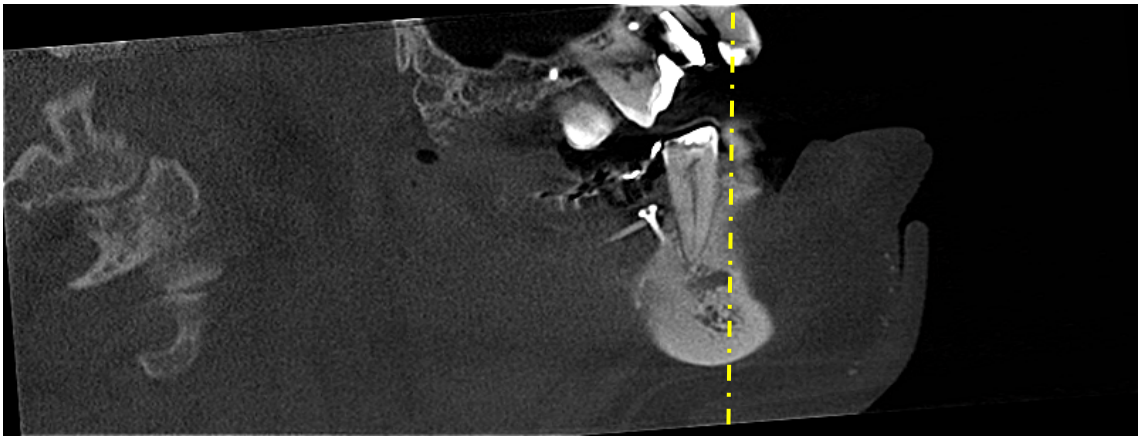

Figura 13 - Imagem reorientada pelo alinhamento vertical do dente adjacente à área receptora.

Em seguida, foi realizada a reconstrução oblíqua curva (panorâmica) com espessura de 10 mm, de modo a incluir a região de interesse (ROI), e cortes ortorradiais com 23 x 40 x 1 mm (largura x altura x espessura), com 1 mm de espaçamento entre os cortes. A sequência de cortes sagitais oblíquos foi posicionada paralelamente ao trajeto do canal mandibular ipsilateral e realizada com 50 x 40 x 1 mm (largura x altura x espessura), com 1 mm de espaçamento entre os cortes. Nos cortes ortorradiais foram medidas a largura (horizontal), em azul, e a altura (vertical), em amarelo, a partir do teto do canal mandibular (Figura 14). Nos cortes sagitais oblíquos, a dimensão anteroposterior do enxerto foi mensurada e nos cortes coronais, foram medidas as espessuras mínima e máxima do enxerto (Figura 15). As medidas foram registradas em milímetros.

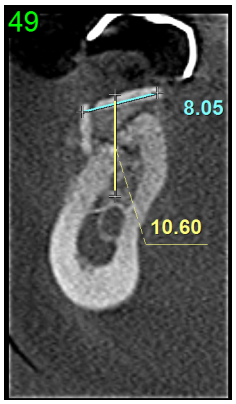

Figura 14 - Marcações em um dos cortes ortorradiais de largura (horizontal) em altura (vertical) em amarelo.

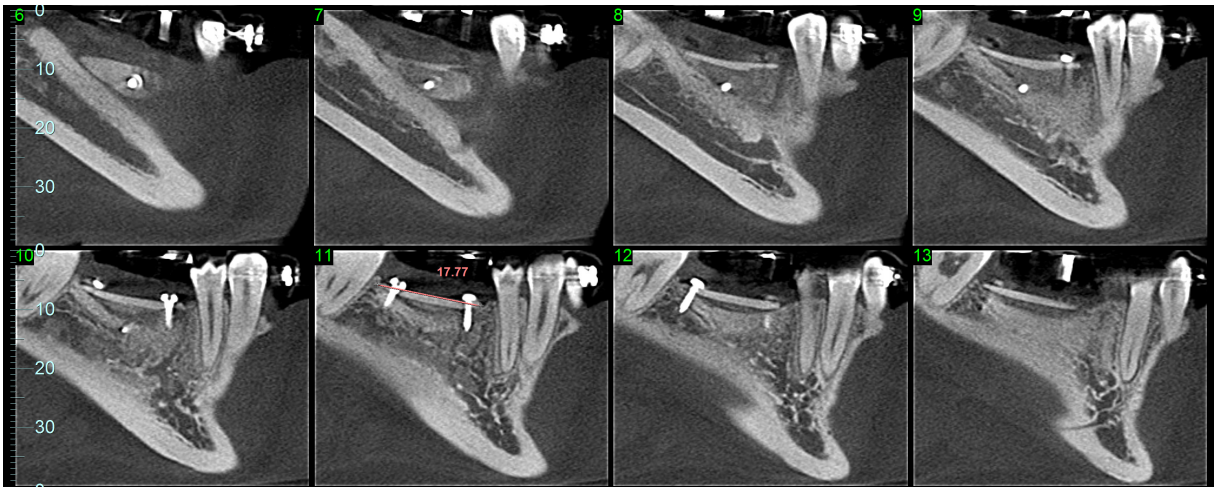

Figura 15 - Cortes axial, coronal e sagital para mensuração da espessura e do comprimento da tábua óssea do enxerto.

3.4.2 Análise Fractal

Inicialmente, foram importados os arquivos *DICOM* para leitura no Image J, gerando uma imagem com vista axial. Nessa vista, foi determinada a *ROI* no sentido ocluso-basilar do início da mandíbula até o final da cortical basilar. A *ROI* foi refinada no sentido mesio-distal na metade dos dentes adjacentes ou quando não havia dente adjacente, junto à marcação do fio de aço do guia cirúrgico. Realizou-se o recorte da área pré-selecionada e a reconstrução 3D (Figura 16). Após gerada a reconstrução 3D, foi realizado novo refinamento da *ROI* em uma visão axial e sagital, utilizando a guia tomográfica como referência (Figura 17).

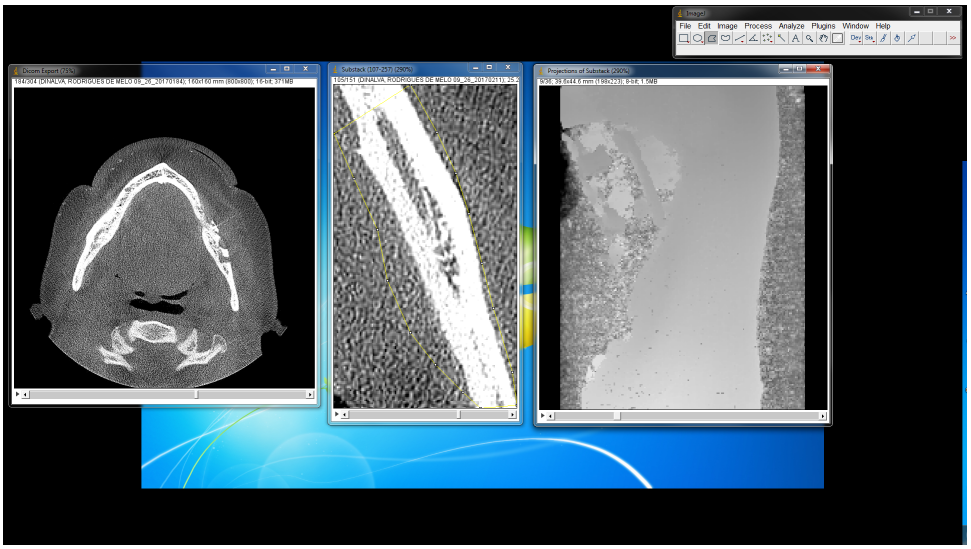

Figura 16 - Seleção da *ROI* e reconstrução 3D.

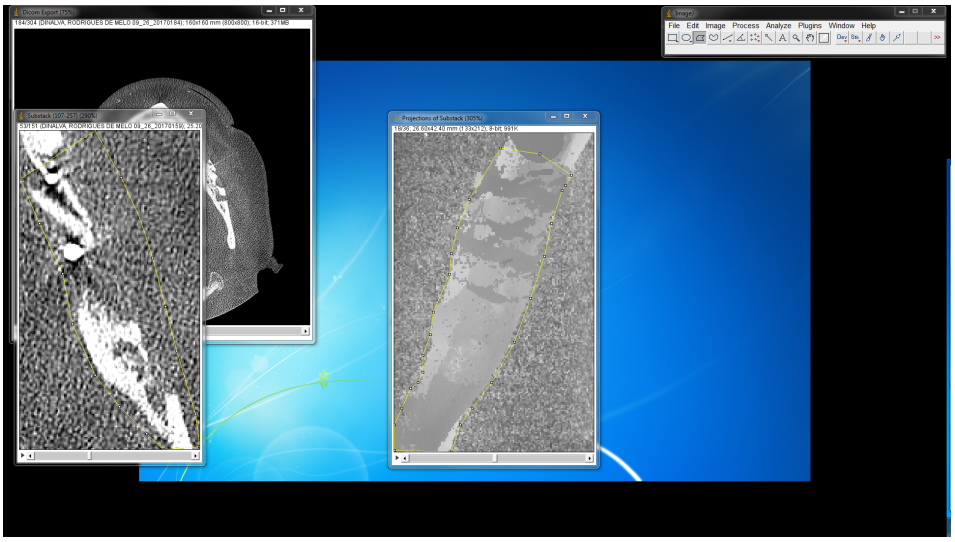

Figura 17 - Refinamento da *ROI.*

Com a *ROI* determinada, iniciou-se um protocolo baseado por Huh K-H, *et al.* (2011), para finalizar o tratamento da imagem e realizar a análise fractal. Aplicou-se um filtro 3D (Gaussian Blur 3D) (Figura 18), seguido da subtração da imagem filtrada da *ROI* original, adição de 128 pixels, transformação para imagem binária, aplicação das ferramentas erodir, dilatar, esqueletonizar e, por fim, realização da análise fractal pelo método box counting (Figura 19).

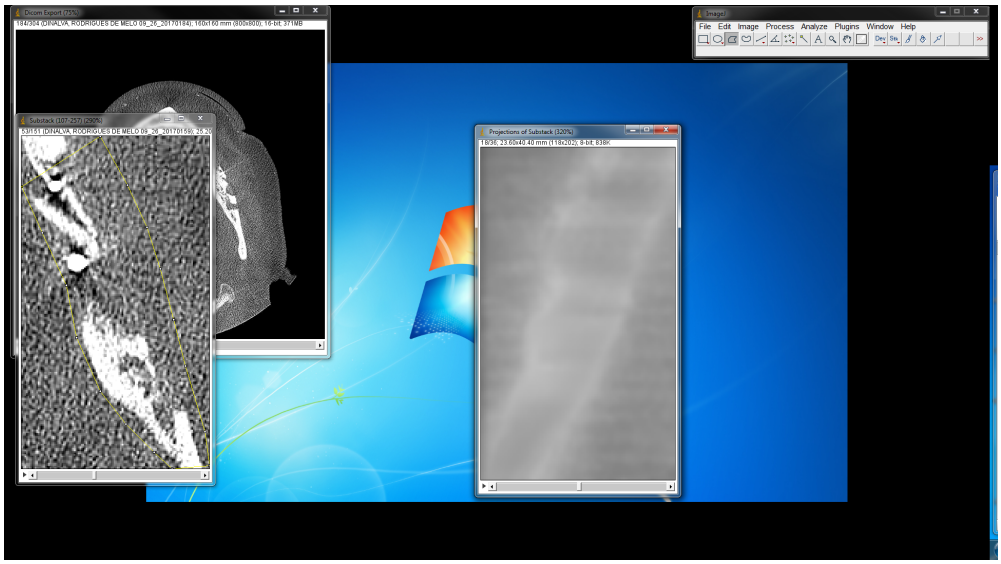

Figura 18 - Aplicação do filtro Gaussian Blur 3D.

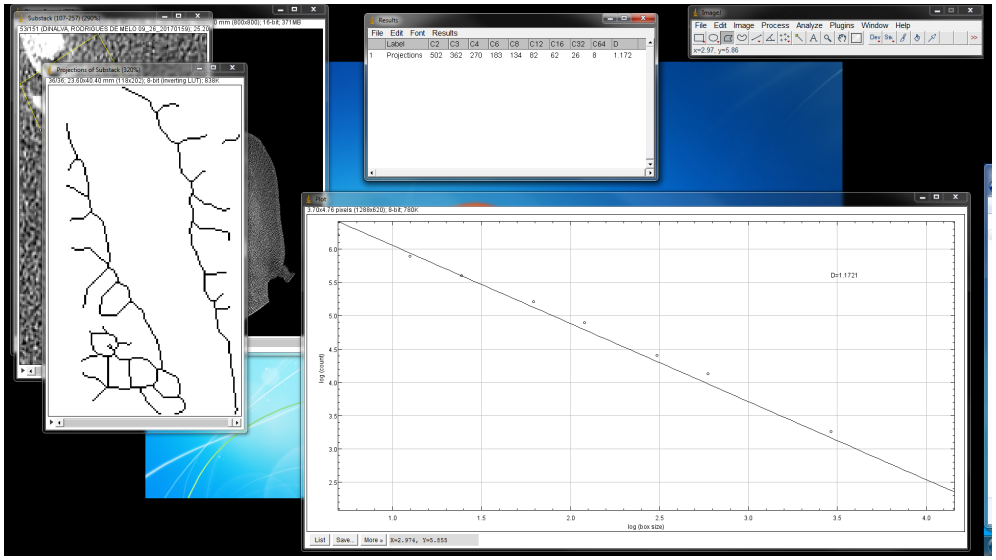

Figura 19 - Tratamento final da imagem e análise fractal.

3.4.3 Análise Volumétrica

Foi realizada a importação das imagens em formato *DICOM* para o programa ITK-SNAP, nas vistas axial, sagital e coronal (Paul *et al.,* 2006). Determinou-se a *ROI a partir* da metade dos dentes adjacentes à área receptora ou, na ausência do dente adjacente, incluiu a marcação do fio de aço da guia (Figura 20).

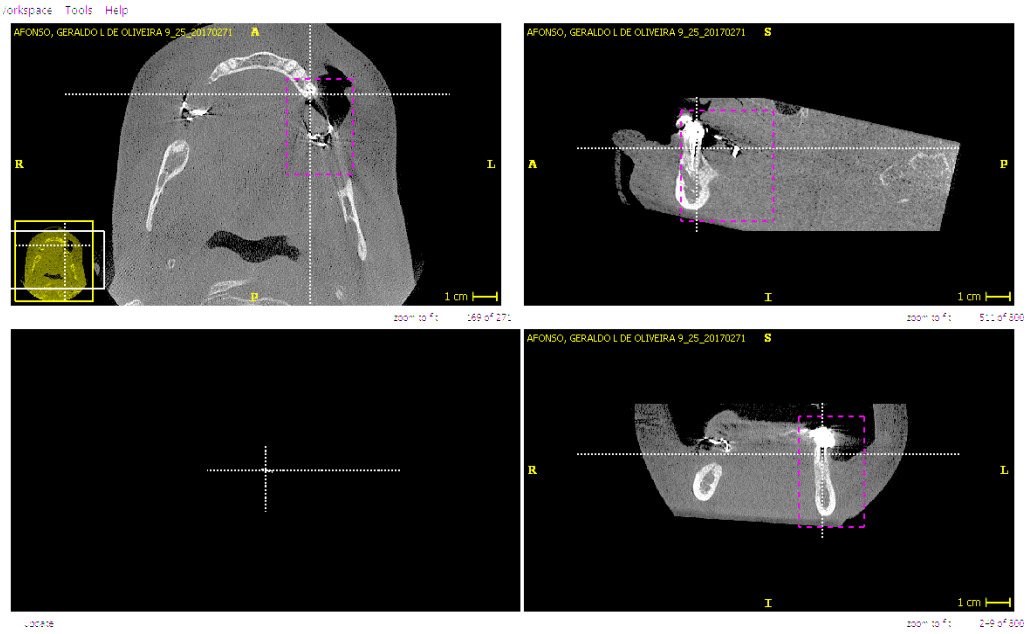

Figura 20 - Determinação da *ROI.*

Foi realizada, então, a segmentação 3D da região de interesse. Iniciou-se a marcação do volume do enxerto através de um cursor com formato de circunferência, com raio de 0,8 mm, corte a corte, de 1 em 1 mm, nas três vistas (axial, coronal e parasagital) (Figura 21). Finalizou-se a marcação da *ROI* com aplicação de uma ferramenta de expansão para preenchimento de eventuais espaços não demarcados entre as marcações circunferenciais, gerando, assim, o volume (mm^3) da área marcada (Figura 22).

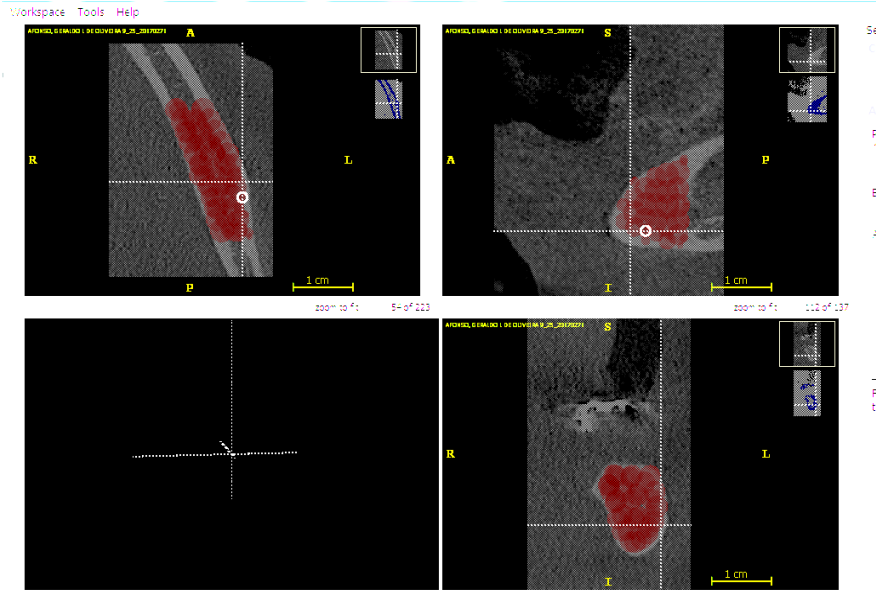

Figura 21 - Marcação da *ROI.*

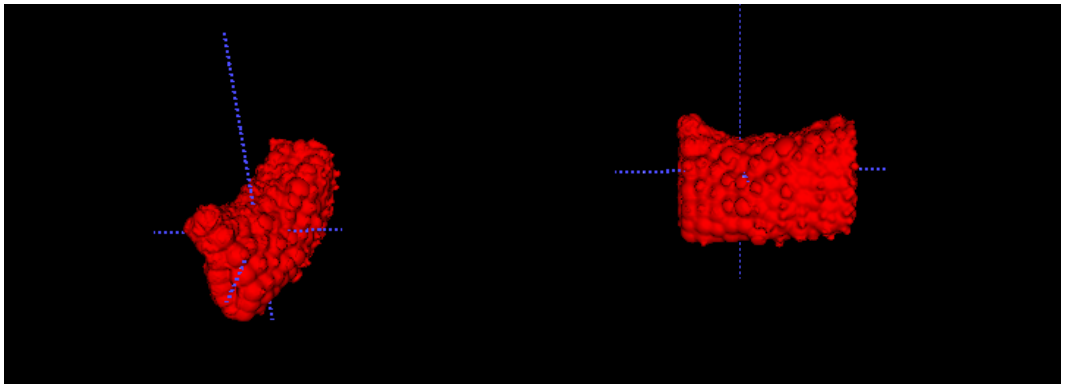

Figura 22 - Volume gerado após marcação do ROI em visão anterossuperior e vestibular.

3.5 Avaliação de dor, ansiedade e atividades diárias e sintomas pós-operatórios

Todos os participantes do estudo foram avaliados em relação a: percepção de dor por meio da escala visual analógica (EVA), ansiedade (IDATE T-E), atividades diárias e sintomas pós-operatórios. A escala de dor e os questionários de ansiedade foram aplicados em diferentes momentos: (1) 7 dias antes da cirurgia de enxerto ósseo (IDATE T-E), (2) 30 minutos antes da cirurgia de enxerto ósseo (IDATE T-E), ao final do dia da cirurgia de enxerto ósseo (EVA), (3) 14 dias após a realização do enxerto ósseo (EVA e IDATE).

3.5.1 Escala Visual Analógica

O teste EVA consistiu em registrar a percepção da dor, a partir de uma escala de 0 a 10, sendo uma extremidade da escala identificada como "sem dor" (zero), e a outra como “pior dor já sentida” (dez) (Anexo B).

3.5.2 IDATE (T-E)

Para avaliar a ansiedade, os pacientes foram solicitados a preencher dois questionários de auto-avaliação de Spielberger (1970), Ansiedade Traço e Estado, em três momentos distintos. A versão em português utilizada neste estudo foi validada por Biaggio *et al*. (1979). O questionário de ansiedade do Estado consiste em 20 afirmações que avaliam como os entrevistados se sentem “neste momento”.

A escala de ansiedade do Traço consiste em 20 declarações que avaliam como as pessoas “geralmente se sentem”. Sentimentos de apreensão, tensão, nervosismo e a preocupação são avaliados em ambas as escalas. Para cada afirmativa, os participantes foram orientados a responder de acordo com escala tipo-Likert de 0 a 4 (Anexo C).

3.5.3 Atividades diárias e sintomas pós-operatórios

Os pacientes relataram se houve ou não interferência em suas atividades diárias como a mastigação, abertura de boca em extensão, comunicação, sono, trabalho/escola, vida social, atividades favoritas. Relataram, também, os sintomas pós-operatórios, como: presença de edema facial, náusea e percepção de mau hálito/gosto.

3.6 Análise estatística

Análise descritiva, incluindo distribuições de frequências absoluta e relativa, foram realizadas a partir dos dados demográficos, clínicos, tomográficos dos pacientes, e respostas aos questionários aplicados. As análises foram realizadas utilizando o programa SPSS (v22.0; IBM Corp), e programa R (Core Time). As taxas de reabsorção e ganho ósseo para os dados lineares e volumétricos foram calculadas por das diferenças das medidas obtidas nos momentos respectivamente, T2-T3 e T3-T1. Para as medidas lineares de altura e largura foi calculada a média a partir das medidas realizadas na mesial, medial e distal.

Os resultados da análise linear, fractal e volume ósseo foram comparados nos três momentos do estudo, por meio do teste de Friedman (α=0.05). Post-hoc testes foram realizados usando o pacote (PMCMR) no programa R (Nemenyi, 1963). O teste exato de Fisher foi utilizado para verificar associação entre os grupos definidos pela análise de Cluster e outras variáveis (enxerto entre dentes, intercorrências pós-operatórias, osteopenia, vitaminia D e tempo de cirurgia) em relação da taxa de reabsorção óssea. Foi realizada a dicotomização das variáveis: intercorrência pós-operatórias (presente ou ausente), osteopenia (ausente ou presente), vitamina D (normal ou alterada), tempo de cirurgia ($\leq$ ou > 120 min). A avaliação de Cluster foi realizada utilizando o método Ward’s na escala hierárquica com distância Euclidiana Ward

(1963), a partir de quatro variáveis quantitativas (volume e análise fractal inicial da área receptora, comprimento e espessura inicial do enxerto). Os resultados quantitativos da taxa de reabsorção óssea foram dicotomizados utilizando a mediana

Para a percepção da dor (EVA), as respostas foram dicotomizadas como “sem dor” para o *score* zero e “com dor” para os *scores* de 1 a 10. Para análise da ansiedade (IDATE), calculou-se a soma das pontuações para todas as perguntas de cada paciente. Baixa ansiedade foi identificada por meio do intervalo IDATE de 0-40 e alto nível de ansiedade representado pela faixa IDATE de 40-80 (Barker et al., 1970). Foram testadas as hipóteses de que não existe associação entre as variáveis clínicas e o IDATE no dia da cirurgia; e entre atividades diárias/sintomas pós-operatórios e EVA/IDATE, após 14 dias de pós-operatório, ambos na etapa 3 do estudo. O teste exato de Fisher foi utilizado para verificar as hipóteses de associação, devido ao tamanho da amostra (Fisher, 1970). As respostas do IDATE e EVA foi comparada entre os momentos de avaliação, usando respectivamente teste de Friedman e Wilcoxon. O teste *post-hoc* para Friedman ($\alpha = 0,05$) quando necessário foi empregado de acordo com Nemenyi (1963) usando o pacote (PMCMR) (Pohlert, 2016) no programa R (R Core Team, 2018).

A hipótese de causalidade entre o IDATE e EVA foi verificada por análise *cross-lagged*. Foram realizados três tipos de correlações: autocorrelações (entre duas medidas de uma variável em momentos diferentes), correlações síncronas (entre diferentes variáveis no mesmo momento) e correlações cruzadas (entre diferentes variáveis em diferentes momentos). As diferenças entre estas correlações foram analisadas pelo teste de Pearson-Filon modificado no programa R usando o pacote (COCOR) (Diedenhofen & Musch, 2015).

4 ARTIGOS

4.1 ARTIGO 1 - Clinical and tomographic evaluation of individuals submitted to three-dimensional autogenous bone surgery in the posterior atrophic mandible

Objectives: To evaluate the effects of posterior atrophic mandibular reconstructions employing a three-dimensional technique as final bone quality and the final bone gain of the graft, linearly and volumetrically.

Methods: A total of 15 mandibular autogenous block bone surgeon were carried out. Demographic data and clinical variables about surgery were collected. Before of surgery, and after 14-day and 4 months of post-operative was performed tomography images. Parametric tests (α=0.05) was used on data and cluster analyses was performed.

Results: The findings of the linear analysis for the width and height of the recipient area at the different moments of evaluation presented a statistically significant difference. Resulting in final average growth in height of 1.7 mm (±0.94). The fractal analysis in the different moments of evaluation, there was no significant statistical difference. The results of the bone volume of the recipient area at the different moments of evaluation presented a statistically significant difference. 71.6% of individuals showed volume gain with mean final of 3.412 mm^3 (±1.55), and 14.4% showed mean graft reabsorption between T3 and T2 of 0.688 mm^3 (±1.48).

Conclusions: Reconstruction of three-dimensional posterior mandibular vertical defects, provided good healing with low complications and minimal grafted bone resorption, favoring a vertical bone gain.

Keywords: bone transplantation; bone regeneration; cone bean computed tomography; mandible.

Introduction

The installation of osseointegrable implants requires sufficient bone volume as a prerequisite for favorable prognosis in the long term. To achieve adequate implant stability, especially when horizontal defects of the alveolar ridge occur, bone grafts have been used to increase the alveolar crest as a viable and widely utilized option.[1-4]

Several surgical materials and methods for bone augmentation have been developed and employed over the last few years, such as autogenous block and particulate grafts as well as alloys, xenogeneic grafts and alloplastic materials.[5-8] The use of autogenous bone grafts is considered gold standard for the rehabilitation of atrophic areas,[1,2,6,7] and present good reliability and predictability for posterior placement of implants, independently of the donor area.[1,2,9,10] Moreover, has been reported the possibility of using a split block graft with vertical and horizontal bone gain in the posterior mandibular region, as an alternative to the possible disadvantages of conventional autogenous grafts and bone grafts of extra oral origin in the long term.[7]

Intraoral donor areas, besides the proximity of the donor and recipient site, have the advantages of easy surgical access, small morbidity and absence of hospitalization. For bi-or three-dimensional (3D) reconstructions of alveolar ridge

atrophies, corticocancellous blocks are preferred and these may be removed from the mandibular symphysis, retro and paramolar region or edentulous areas.[7]

In addition to the bone availability, its quality represented by physiological aspects, degree of mineralization, morphology and trabecular pattern are important factors to be analyzed for the success of the implant, as well as the diagnosis of diseases characterized by bone loss.[11,12] Several strategies to evaluate the trabecular architecture have been developed, and the microstructure of the bone tissue can be estimated. The fractal analysis uses texture statistical analysis to examine the trabecular bone microarchitecture with a numerical expression of the fractal dimension as a measure of the complexity of the image.[13] Particularly, fractal analysis has proved to be an economical, accurate and efficient method.[12,13] Furthermore, this analysis of the trabecular bone structure using digital radiographs can be used to evaluate the pathological bone alteration and the pre-implant bone quality.[12,13]

Recent studies have shown that in bone graft surgical procedures, the cone bean computed tomography (CBCT) is a viable and accurate method to check the available bone volume and results of bone resorption and neoformation.[14-17] In this context, the purpose of this study was to evaluate the effects of posterior atrophic mandibular reconstructions employing a three-dimensional technique as final bone quality and the final bone gain of the graft, linearly and volumetrically.

Material and Methods

Ethical issues and patients

The study was approved by the Ethics Committee of the Federal University of Minas Gerais (Approval No. 67497617.7.0000.5149). The patients gave written informed consent for the publication of their cases in agreement with the Declaration of Helsinki.

The individuals who were indicated for oral rehabilitation by means of osseointegrable implants, were selected among the individuals attending at the Service of Oral Surgery and Implantology of the School of Dentistry, Federal University of Minas Gerais (MG, Brazil) between July and December 2017. Patients should present posterior edentulous region in mandible with indication of increased thickness and border height for the installation of dental implants in the posterior mandible regardless of the number of teeth determined by visual examination. Also, the patients should have the presence of bone defect in a valley-shaped height, with a minimum depth of 2 mm in relation to the adjacent bone crest. Exclusion criteria were as follows: general contraindications of surgical treatment; being under treatment or taking medications that interfere with tissue repair; smokers and alcohol drinkers; presence of an active infectious process in the region to be operated; pregnant or nursing women; presence of malignant neoplasia and/or radiotherapy or chemotherapy treatment; and a history of surgery for implant or graft installation in the mandibular region.

Surgical protocol

Hemogram, coagulogram, urea, creatinine, fasting glucose, parathyroid hormone, calcium, phosphorus, calcitonin, alkaline phosphatase, vitamin D, and bone densitometry were performed in all individuals in the study.

The surgical procedures were performed under local anesthesia. The procedures were performed by the same maxillofacial surgeon, following the recommended surgical technique.[6,7] To improve the keratinized tissue pattern of the bone graft region, and to avoid possible exposure of the graft, the connective tissue surgery was previously performed in the bone graft receptor bed, according to technique of Langer and Langer.[18] The autogenous bone grafts obtained from the oblique external line were based on the technique described by Khoury et al.[6] with some modifications.

The autogenous bone graft was obtained from the external oblique ridge according to the technique of Khoury et al.[6], with some modifications. Intraoral antisepsis was performed with a 0.12% chlorhexidine gluconate mouthwash for 1 minute, followed by disinfection of the skin with PVPI (1% active iodine). The following medication was used: amoxicillin (875 mg, administered at least 1 hour prior to surgery and twice daily for seven days postoperatively), tenoxicam (20 mg, at least 1 hour prior to surgery and twice daily for five days postoperatively), dexamethasone (two 4 mg capsules, at least 12 hours prior to surgery, and 8 mg at least 2 hours prior to surgery, and 8 mg twice daily for five days postoperatively), and paracetamol (750 mg, at least 1 hour prior to surgery and three times daily for five days postoperatively, and as long as they presented with painful symptomatology).

Local anesthesia consisted of 4% articaine and 1:100,000 epinephrine (Articaine 100, Nova DFL, RJ, Brazil). In the recipient area, analgesia was

obtained by infiltration of the inferior, lingual and buccal alveolar nerves and the incision was performed on the oblique line with a scalpel (NR15, Solidor, SP, Brazil), continuing along the central portion of the margin over the crest; an additional relief incision about 5 mm in length was performed in order to free the flap to be later used to cover the bone graft. When teeth were present between the recipient area and the beginning of the incision on the oblique line, an intrasulcular incision continuing up to the recipient area was performed in order to bypass these teeth. A full thickness flap was then obtained by mucoperiosteal detachment involving the contiguous donor and recipient areas. The periosteal incision was performed in the base of the flap in order to increase its elasticity and to permit passive closure. No type of preparation, such as bone perforation or flattening, was used.

Perforations were punched in the previously anesthetized donor area with an NR699 drill (Solidor Ind., SP, Brazil) in parallel to the external oblique area, reaching the full thickness of cortical bone. Next, two vertical osteotomy lines were performed under constant irrigation with saline chilled to 5ºC, one of them mesial and the other distal to the initial osteotomy, determining the length of the graft. The vertical osteotomies were then joined with a horizontal osteotomy at the basal level with the aid of a diamond disk (5 mm, NeoBiotech, CA, USA). Particulated bone was obtained from a region adjacent to the donor bed with the aid of an ACM drill (NeoBiotech, CA, USA). The bone block obtained was carefully removed with a chisel and divided longitudinally in the middle into two thin parts with a diamond disk. The edges that might damage the flap and consequently expose the graft were removed with spherical diamond tips under constant irrigation with saline. The thin blocks were stabilized in the recipient

regions at a distance from the recipient bone bed maintained with titanium screws (1.5 mm, NeoBiotech, CA, USA). To this end, screws were manually inserted with the aid of a screwdriver key (square active tip, PecLab Ind., BH, Brazil). The grafts were fixed by installing the first block in the occlusal region resting on the bone crest of the adjacent tooth. The space below the first block was filled with particulate bone and the second block was then installed on the vestibular surface. The stability of the structure in the recipient bed was evaluated clinically so that it would remain static.

The surgical wound in the recipient area was then closed with Donati type stitches and simple non-restorable sutures (Nylon 6-0, Ethicon, NJ, USA). The same suture and only simple stitches were used in the donor area. The number of anesthetic tubes used, the surgical time and transoperatory intercurrences were recorded immediately after each surgical procedure.

Tomographic analysis

The CT scans were performed using the I-CAT® Next Generation Model (Hatfield, PA, USA), with field of view (FOV) of 8 cm high by 16 cm in diameter, voxel isotropic of 0.20 mm, acquisition time of 26.9 seconds. To standardize the pre- and postoperative measurements made in the same region of interest (ROI), tomographic guides were made on 1-mm thick acetate plates with 2-mm wide lead sheets, rounding the crown of the teeth, from the diagnostic waxing of the area to be grafted. Steel wires with 1-mm in diameter were also positioned, delimiting the proximal surfaces of waxed teeth.[14,17]

The tomographic examinations were performed in three different moments, i.e., one to four months before the bone graft was performed to confirm

the need for it (T1); 14 days after the bone graft, allowing post-surgical evaluation of the graft bone (T2); and 4 months after the graft surgery, in order to evaluate the neoformed bone tissue and implant installation planning (T3). The images were exported in Digital Image Communication in Medicine (DICOM) format and reconstructed in the following programs Xoran® (Xoran Technologies - Ann Arbor, MI, USA) for linear measurements of height and width of the graft receiving region; IMAGE J (https://imagej.nih.gov/ij/index.html) for fractal analysis of the same region; ITK SNAP (https://www.itksnap.org.) for measuring the initial and final volumes of the bone grafts, and the recipient area. The measurements were performed by an oral and maxillofacial radiologist professor.

Linear analysis

In the sagittal and coronal sections, the positioning of the mandible was reoriented for vertical alignment of the long axis of the tooth adjacent to the edentulous area (graft receptor site), to standardize the examinations in the same position at different examination times. After determined the ROI, we started the measurements. In the orthoradial plane, the width (horizontal) in blue, was measured from one cortical to the other in the buccolingual sense and the height (vertical), in yellow, were measured from the ceiling of the mandibular canal. We used three measurements for width and height (mesial, medial, distal) and performed the mean in the oblique sagittal sections, the anteroposterior dimension, the length of the graft was measured. In the coronal sections, the minimum and maximum thickness of the graft were measured. These measurements were recorded in millimeters.

Fractal analysis

After determined the ROI, a protocol based by Huh et al.[13] in order to finalize the image treatment and to perform a fractal analysis was utilized: 3D filter applied (Gaussian Blur 3D), followed by subtraction of the filtered image of the original ROI, addition of 128 pixels, transformation to binary image, tool application erode, dilate, skeletonize and, finally, fractal analysis by the box count method.

Volume analysis

After the ROI determined, 3D segmentation of the image was performed and the graft volume was demarcated by means of a 0.8 mm radius-shaped cursor, delimiting the grafted area, in each cut of 1 in 1 mm, in the axial, coronal and parasagittal planes.

Data analysis

Descriptive statistics analysis, including absolute and relative frequency distributions, were performed with clinicodemographic and tomographic data of the patients. The analysis was performed using the Statistical Package for the Social Sciences software (SPSS), version 22.0 (IBM Inc., New Armonk, NJ, USA). The rates of bone resorption and gain for the linear and volumetric data were calculated by the differences of the measurements obtained at the moments, respectively, T2-T3 and T3-T1. For the linear measures of height and width the mean was calculated from the measurements made in the mesial, medial and distal regions.

The results of the linear analysis, fractal and bone volume were compared in the three moments of the study, using the Friedman's test (α=0.05). Post-hoc tests were performed using the package (PMCMR) in the R software.[19] Fishes' exact test was used to verify association between the groups defined by cluster analysis and other variables (graft between teeth, postoperative complications, osteopenia, vitamin D and time of surgery) in relation to the rate of bone resorption. The following variables were dichotomized: postoperative complications (absent or present), osteopenia (absent or present), vitamin D (altered or normal), surgery time ($\leq$120 or >120 minutes).

Cluster evaluation was performed using the Ward's method on the Euclidian distance scale,[20] using four quantitative variables (initial fractal volume and analysis of the recipient area, initial graft length and thickness). The quantitative results of the bone resorption rate were dichotomized using the median (<10.493% or $\geq$10.493%).

Results

Of the 15 pre-selected patients, two were removed from the study; one due to osteoporosis detected in the bone densitometry examination, and another because of the failure to perform the clinical controls and imaging tests at predetermined times. A total of 15 surgical procedures of bone graft were performed in the mandibular posterior region, totaling 13 patients, i.e., nine women (69.2%) and four men (30.8%). The mean age was 53.4 ($\pm$11.7) years. In two patients the surgeries were performed bilaterally (in different surgical times). The mean time of surgery was 127.6 minutes (range: 95 to 180 minutes) and the mean of number of anesthetic cartridges used in the surgical procedures was 7.7

(range: 6 to 10). Four transoperative intercurrences were recorded (three lingual flap fenestrations and one burn of the oral mucosa). In the postoperative period, four intercurrences were showed (two infections in the donor area, one in which the occlusal screw was released after 3 months postoperatively, and in one patient, exposure of the distal part of the graft was observed) (Table 1).

The results of the linear analysis for the width and height of the recipient area at the different moments of evaluation presented a statistically significant difference ($p<0.001$; Friedman's test) of the bone graft between the different evaluation moments T1-T2 and T2-T3 for width, while height differed for moments in T1-T2 and T1-T3. The mean gains for width were 4.1 mm (±1.58) for T1, 6.6 mm (±0.71) for T2, and 4.4 mm (±1.21) for T3. Regarding height, 7.3 mm (±2.61) for T1, 9.9 mm (±2.52) for T2, and 9.0 mm (±2.58) for T3. Resulting in an initial average growth in height of 2.6 mm and final of 1.7 mm (±0.94). The mean of occlusal block for length and thickness were, respectively, 15.99 mm (±4.03) and 1.0 mm (±0.15).

Regarding the values of the fractal analysis in the different moments of evaluation, there was no significant statistical difference ($p>0.05$, Friedman's test). The mean values of the fractal dimension at the different moments were, respectively, 0.8764 (±0.21) for T1, 0.9712 (±0.15) for T2, and 0.8898 (±0.13) for T3.

The results of the bone volume of the recipient area at the different moments of evaluation presented a statistically significant difference ($p<0.001$; Friedman's test). The mean values of bone volume of the T1 receiving area (5.061 mm^3 ±1.39) differed significantly from the results of T2 (9.161 mm^3 ±2.69), and T3 (8.473 mm^3 ±2.06), respectively. In 71.6% of the individuals showed mean

of final gain volume of 3.412 mm^3 (±1.55) comparing T1 and T3, and 14.4% of the patients showed mean graft reabsorption between T3 and T2 of 0.688 mm^3 (±1.48).

The grouping analysis identified 2 groups of 15 surgical sites presenting the percentage of variables included for the two cluster groups. It was found that group 1 of clusters included participants with mean values of the initial fractal dimension similar to group 2. However, graft length and graft thickness values were higher for group 1, while the volume of the recipient bed was lower in relation to the individuals in group 2 (Table 2).

Table 3 displays the results of the patients regarding bone resorption rate of bone graft between the final moment and after 14 postoperative days and their associations with some clinical variables (graft between teeth, postoperative complications, osteopenia, vitamin D and time of surgery). There was a strong association between the cluster groups and the observed resorption rate (p<0.05; Fisher's test).

Discussion

Autogenous bone grafts are osteoinductive, osteogenic and osteoconductive, presenting great regenerative potential when purchased from other graft types. Thus, autogenous bone remains the gold standard for reconstruction of major lateral or vertical defects in the maxillofacial region.[1,2,6,7] Intraoral bone graft donor sites have the advantage of being extraoral, proximity to the recipient site and low morbidity.[7]

According to Restoy-Lozano et al.[21] that reported a reduced width of the keratinized gingiva is often observed at the level of the ridge, and that soft tissue

treatment can be performed at the time of insertion of the implant, or at the time of healing surgery. In our study, we preferred to perform soft tissue surgery prior to graft installation, improving the soft tissue characteristics of the region where the bone grafts were performed, avoiding the possible exposure of the graft and still providing a soft tissue of quality to prosthetic rehabilitation.

Some systematic reviews[1,2] have reported that several augmentation techniques are capable of increasing the bone in a vertical direction, resulting in a low failure rate of 10-15%; however, there is insufficient evidence to indicate what could be the techniques. Overall these procedures resulted in statistically significantly more complications (rates varying from 20% to 60%) as pain, days of hospitalization, costs and treatment time longer than the use of short implants. Moreover, there are no scientific evidence that justify the vertical bone augmentation procedure for installing longer implants in reabsorbed jaws, however, the long-term prognosis of shorter implants is still unknown.

When chosen the procedure of increase, these should be the simplest, least invasive, involving lower risk of complications within the shortest period of time. Recommending that both the surgeon and the patient should evaluate the pros and cons in relation to procedures and vertical increase of the ridge.[1,2,22] Some investigators[6,7,21] described the combination of a 3D reconstruction using a bone block graft divided into two thinner layers (1 to 2 mm width) filled with particulate bone as a simple and effective treatment that offers good short-term results, low complications and stability over time. The neurosensorial dysfunction of the mental nerve after 3D surgery for vertical increase in this study was found in five operated sites, of which at two sites there was complete recovery after two months postoperatively, as well as in three sites remained in observation period

(three months). Similar rates are also observed by Restoy-Lozano et al.[21] and higher rates were found by Camps-Font et al.[22].

Herein, four postoperative complications were observed (i.e., two donor site infections, one individual with graft angle exposure and one with screw loss). These similar types of intercurrences were also observed elsewhere.[21] However, in a systematic review on bone grafts in atrophic jaws,[22] higher rates of complications (44%) was observed. When we removed the grafts from the ipsilateral retromolar area of the recipient area, avoiding the need for a second donor site, with the advantage of only one surgical field helping to reduce general morbidity rates and postoperative complications. In this line, our findings are in accordance with Khoury et al.[6], Khoury and Hanser[7], and Restoy-Lozano et al.[21].

There are several procedures for vertical bone augmentation and guided bone regeneration presenting vertical bone gains of 2 to 8 mm. The most common complication being membrane exposure. Osteogenic distraction promotes bone gain of 5 to 15 mm; however, it presents a high rate of complications (10% to 75.7%). For onlays bone grafts, the mean gain ranged from 4.2 to 4.6 mm, but a significant resorption rate of the blocks was observed (42%).[23] In the present study, a statistically significant difference was observed between linear measures of width and height compared at different moments of evaluation, proving the effectiveness of the technique. A significant width increase was expected between T1-T3 and not a significant resorption between T2-T3. However, the presence of residual ridge with regions of greater width than the graft and the difficulty of visual identification of the border of the graft after 4 months may have influenced the accuracy of the measurements. However, increase of the linear vertical mean was observed (1.7±0.94 mm). Restoy-Lozano

et al.[21] recorded 5.2 mm increase with the use of a similar technique. Probably, this higher average was due to the form of measurement that used as reference the lowest point of the residual border to the upper edge of the mandibular canal, while in our investigation, the mean of the mesial, medial and distal measurements was used. In addition, the final measurements were performed on panoramic radiographs, while in the present study, initial and final measurements were performed on CT scans. Using a different technique for vertical increase with biomaterial or iliac crest graft interposed to the autogenous bone, Felice et al.[24] obtained an average increase of 5.6 mm and 4.0 mm, respectively, while Domingues et al.[25] acquired 2.10 mm using Bioss® and 2.17 mm with Boneceramic®.

The mean values of the initial and final fractal dimensions showed a small mean increase, with no statistically significant difference. This fact can be explained by the absence of implants or the use of any type of prosthesis, generating no tension in the grafted region. Wilding et al.[26] reported that alveolar bone changes in response to the presence of tension, and this response can be detected with an increase in the texture of the radiological image or its fractal dimension. The use of CBCT images to evaluate the fractal dimension may also have influenced the result of the trabecular structure analysis of the grafted region, due to the lower resolution of the CBT image compared to panoramic radiography.[12] Another factor that may have influenced this result was the short time of bone maturation in the final evaluation, with a little mineralized bone structure that generates a hypodense image.

The results of the bone volume of the recipient area presented a statistically significant difference between the moments of evaluation T1-T2 and

T1-T3, demonstrating the volumetric bone increase provided by the graft. The final volume gained of 71.5% and mean graft reabsorption of 14.4% were observed in the present study. Few studies have used the volumetric measurement of bone gain and reabsorption after 3D grafting in the posterior region of the mandible. Using biomaterial interposed to the autogenous bone, Domingues et al.[25] described a final volume gain (82% and 58%) and reabsorption rate (11% and 22%) for Bioss® and Boneceramic®. Moreover, Barone et al.[27] reported final volume gain (61% and 40%) and reabsorption rate (29% and 35%) for biomaterial of equine origin of inlay form and iliac crest of onlay form, respectively.

The association between the groups defined by cluster analysis and other variables (graft between teeth, postoperative complications, osteopenia, vitamin D and time of surgery) in relation to the rate of bone resorption demonstrated that a receptor bed with a lower volume allied to one graft with greater length and thickness is associated with a greater resorption. Despite the speculation that the association between receptor bed with lower volume and greater graft may favor reabsorption, due to the lower nutrition of the graft, it was the thickness of the occlusal bone board that determined the degree of graft resorption. perhaps for the reason that a thicker bone board is able to suffer a lower influence of soft tissue pressure. It was expected that the other variables investigated had a significant association with the rate of graft resorption, but the reduced sample size may have made this observation difficult. Despite this limitation, the present study was careful to standardize the sample regarding the systemic conditions that can influence the incorporation and resorption of the bone graft, with the exclusion of participants with diabetes, hypo or hyperthyroidism and

osteoporosis. In addition, the variables osteopenia, vitamin D, calcium, phosphorus, alkaline phosphatase, parathyroid hormone and calcitonin were checked and analyzed for changes.

Conclusion

In summary, the 3D reconstruction of vertical defects in the posterior atrophic mandible is a viable and predictable procedure with a low number of complications. Short-term clinical and tomographic follow-up demonstrated excellent bone gain and low resorption rate, demonstrating stability of the reconstructions and allowing adequate positioning of the future implant as well as a satisfactory crown/implant relationship.

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Table 1. Characteristics of patients and clinical variables

Variables	*Patients undergoing bone surgeon*‡
Gender	
Female	9 (69.2)
Male	4 (30.8)
Age (years) *	53.4 (11.7)
Surgery Time (minutes) **	127.6 (95;180)
Anesthetic tubes**	7.7 (6;10)
Interoperative Complications	
No	11 (73.34)
Yes	4 (26.66)
Postoperative Complications	
No	11 (73.34)
Yes	4 (26.66)
Neural Disturbances	
No	10 (66.66)
Temporary	2 (13.34)
Present	3 (20.0)

‡Values in parentheses are expressed as percentage

*Mean value (standard deviation).

**Mean value (confidence interval).

Table 2 – Cluster groups considering some variables of tomographic measures (n=15).

Cluster groups	Initial volume (mm^3)	Initial graft length (mm)	Initial graft thickness (mm)	Initial fractal dimension
1	4,547	17,017	1,186	0,889
2	5,404	15,306	0,905	0,868

Table 3 - Association between variables and reabsorption (α=0.05).

	Reabsorption%						
	<10,493%		≥10,493%		Total		
Cluster	*N*	*%*[a]	*N*	*%*[a]	*N*	*%*[b]	*P Value*[†]
1	5	83,3	1	16,7	6	33.3	0.041[*]
2	2	22,2	7	77,8	9	66.7	
Graft Between Teeth							
No	2	50.0	2	50.0	4	26.7	1.000[ns]
Yes	5	45.5	6	54.5	11	73.3	
Postoperative Complications							
Absent	7	63,6	4	36,4	11	73.3	0.200[ns]
Present	0	0	4	100	4	26.7	
Osteopenia							
Absent	4	50.0	4	50.0	8	53.3	1.000[ns]
Present	3	42.9	4	57.1	7	46.7	
Vitamin D							
Normal	5	55,6	4	44,4	9	60.0	0.608[ns]
Altered	2	33,3	4	66,7	6	40.0	
Surgery Time							
> 120 min	3	37,5	5	62,5	8	53.3	0.619[ns]
≤ 120 min	4	57,1	3	42,9	7	46.7	
Total	7	46.7	8	53.3	15	100.0	

[a]Values in parentheses are expressed as percentage in line.
[b]Values in parentheses are expressed as percentage.
[†]Fisher test: . [ns]Non-significant; $P > 0.05$; [*]Significant; $P < 0.05$.

Figure Legends

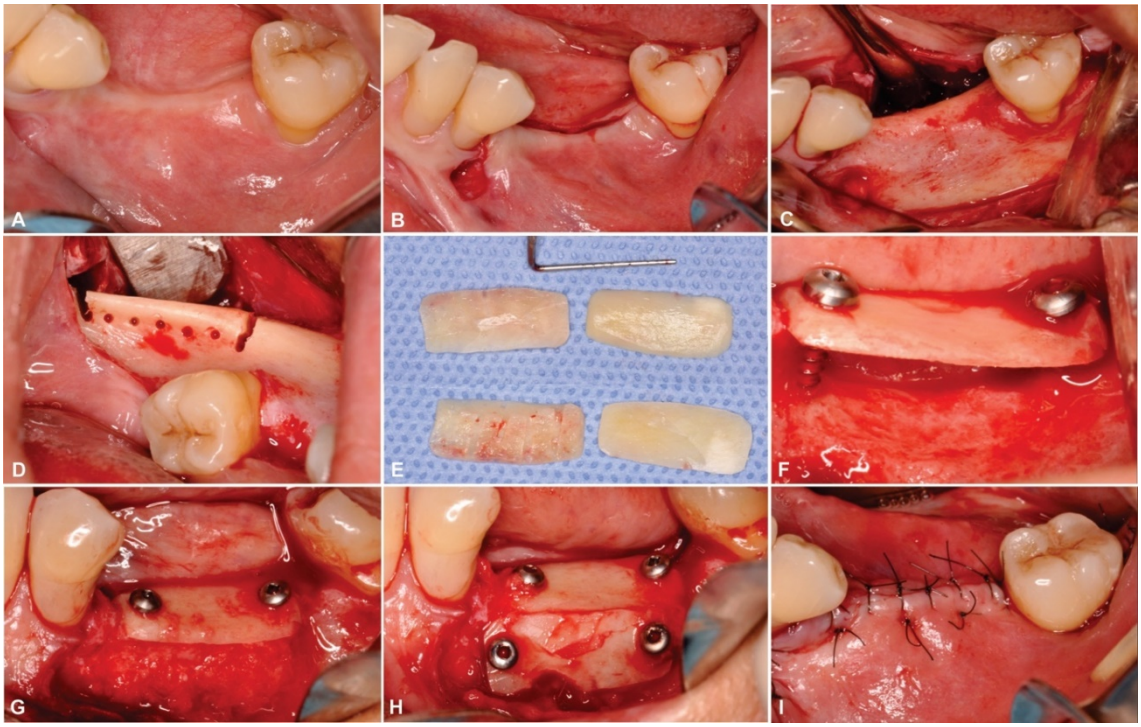

Figure 1. Posterior atrophic ridge (A), Incision of the recipient area (B), Total thickness detachment of the flap (C), Donor area incised and detached with the osteotomies present (D), Divided bone block internal and external view (E), Occlusal blade of the graft stabilized with two screws (F), Filling of the space with particulate bone (G), Bone graft with the bone tabs stabilized in position (H), Sutured recipient area (I).

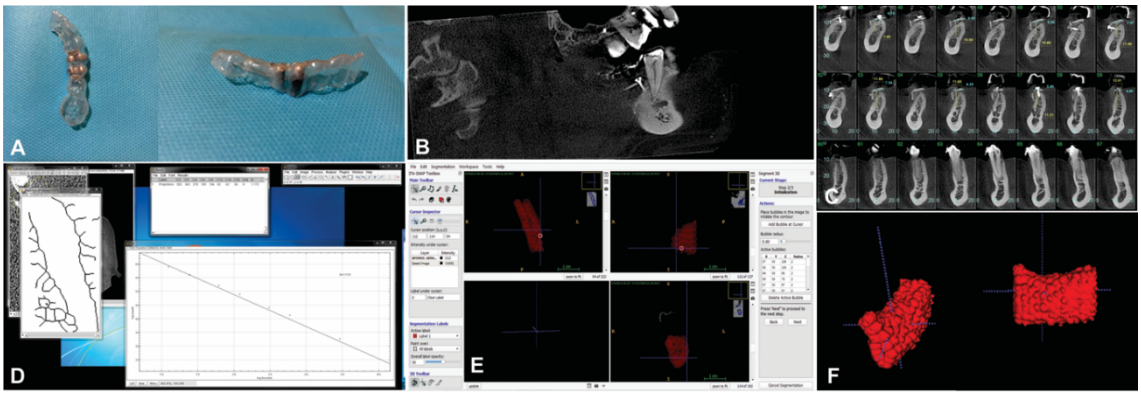

Figure 2. Vestibular vision tomographic guide and occlusal (A), Reorientation by the vertical alignment of the tooth adjacent to the receiving area (B), Markings in orthoradial sections for linear analysis (C), Final image treatment and fractal analysis (D), Marking ROI for volumetric analysis (E), Volume generated after ROI marking in anterior superior, Vestibular vision (F).

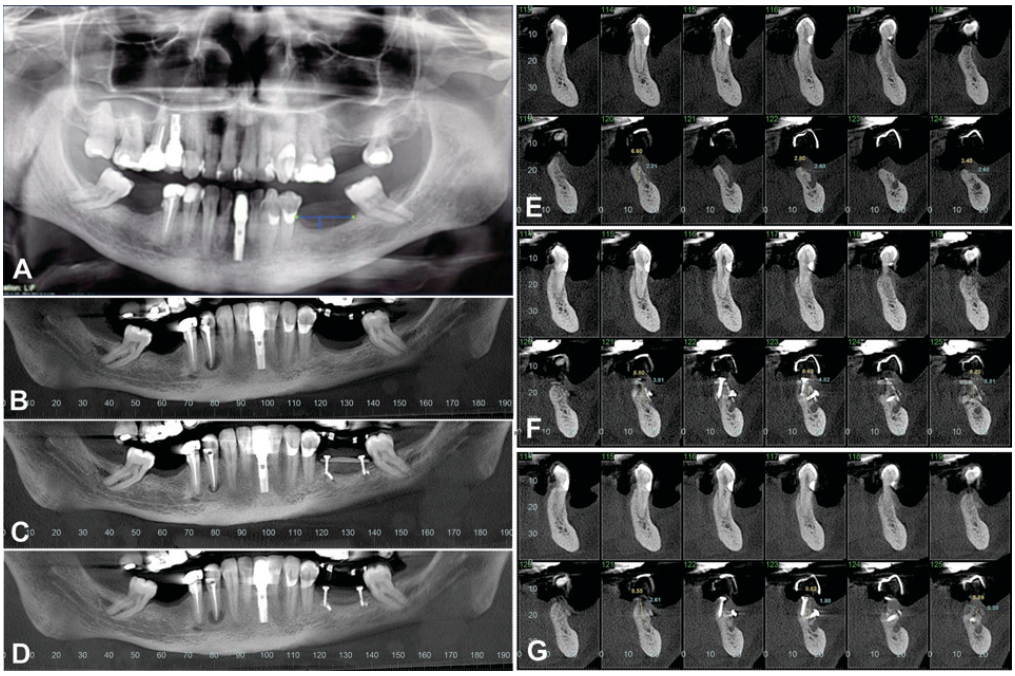

Figure 3. Initial panoramic radiography (A), Initial cone bean CT (CBCT) (B and E), CBCT with 14 days after surgery (C and F), CBCT with 4 months after surgery (D).

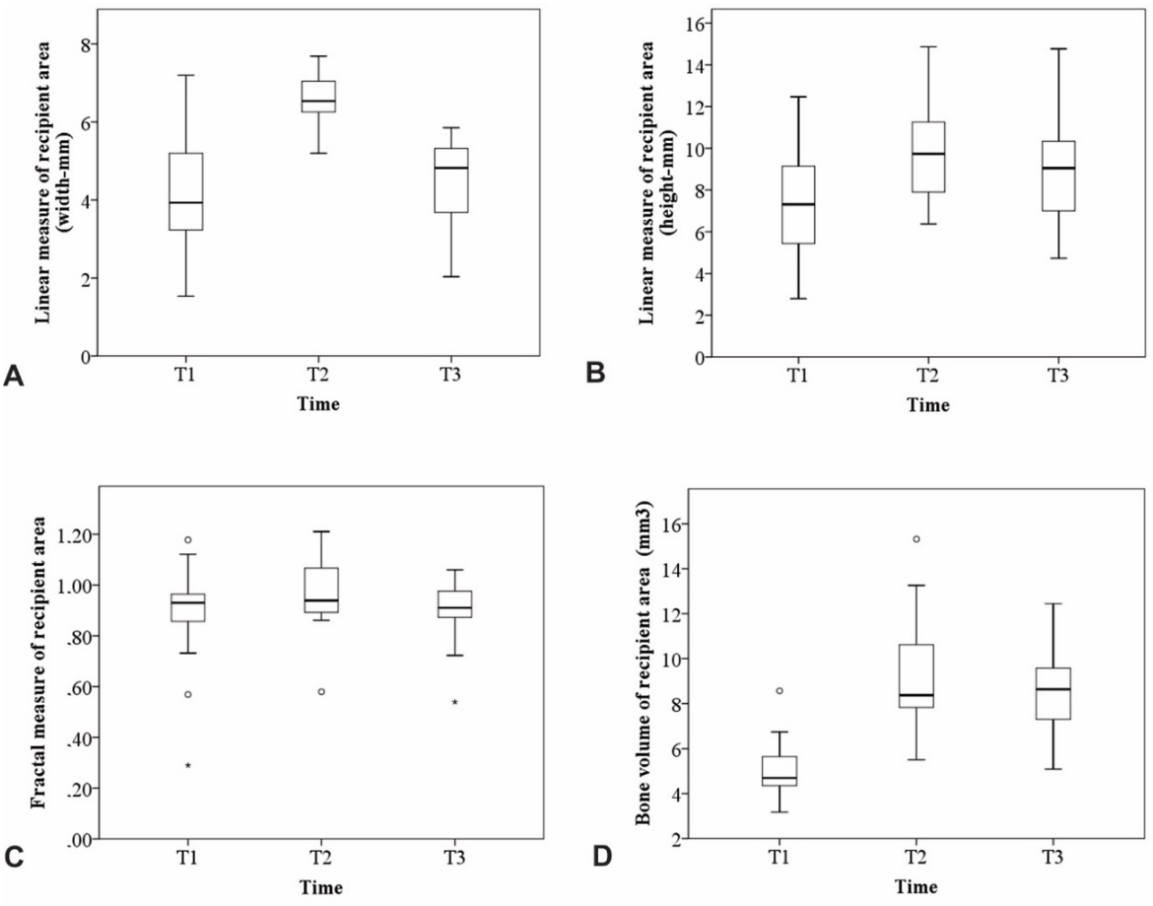

Figure 4. Box Plot in different time points of recipient area, Friedman test (α=0.05). Linear measure analysis (width-mm) (A), Linear measure analysis (height-mm) (B), Fractal measure analysis (C), Bone volume analysis (mm^3) (D).

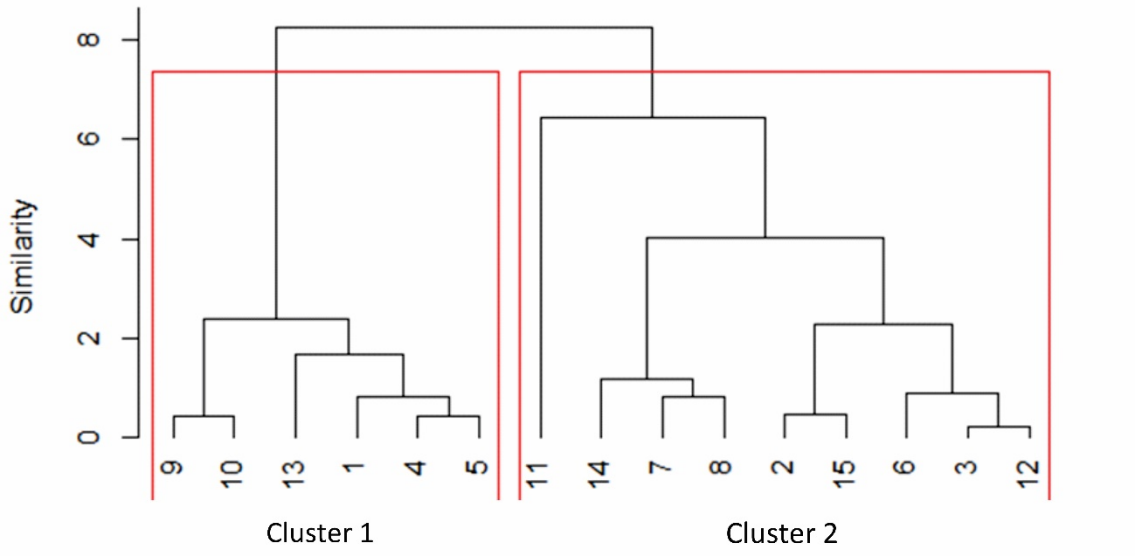

Figure 5. Cluster dendogram for cluster groups: cluster 1 (n=6); cluster 2 (n=9); Each number on horizontal line represents each person allocated into specific group.

4.2 ARTIGO 2 - Anxiety and pain perception in patients undergoing mandibular autogenous block bone surgery

Abstract

This study investigated pain perception and anxiety within the context of surgery for the placement of mandibular block bone using questionnaires and evaluated the causality effect between theses variables. A total of 13 patients were recruited for the study and were submitted to mandibular autogenous block bone surgery. Demographic data were collected and the anxiety level was determined using the State-Trait Anxiety Inventory (STAI). The STAI was first administered on the day of surgery and again on the 14th postoperative day. Pain was determined using the visual analogue scale (VAS) and limitation of daily activities and postoperative symptoms were also reported. Data were analyzed statistically using parametric tests (α=0.05) and cross-lagged analysis was performed to verify a causality effect. Few patients reported interference with daily activities or the presence of postoperative symptoms. A significant difference in the association of bad breath/taste was detected on the 14th postoperative day with STAI-State. No evidence of causality between STAI and VAS was detected in the cross-lagged analysis. The patient's self-evaluation seems to indicate that the pain and anxiety level felt during treatment was not directly associated with the clinical aspects of the surgical procedure or with the limitations of postoperative activities/symptoms.

Keywords: anxiety pain; questionnaires; autogenous bone block; treatment; outcomes.

Introduction

Intraoral surgical procedures are common for individuals who require oral rehabilitation with the installation of implants or after surgeries for bone grafts[1]. Autogenous intraoral bone grafts have been widely employed in order to increase the bone volume of the alveolar crest due to their advantages in terms of reliability and predictability[2-4]. The use of autogenous block grafts for vertical and horizontal bone augmentation has been reported, with a low rate of complications and satisfactory bone regeneration at the donor site[5,6].

These procedures are known to involve mild to moderate pain, causing stress and short-term limitations of daily activities, especially during the first postoperative days[7,8]. In addition, previous studies have demonstrated an impact of patient anxiety regarding factors related to surgery for dental implants[9,10]. The control of anxiety levels in patients submitted to oral and maxillofacial surgical procedures may be directly related to the subjective control of pain and its impact on daily activities, with a consequent reduction of morbidity in the operated region[11-13].

Dental anxiety has not been clearly defined in the literature, ranging from the mildest feeling of apprehension that an individual may feel in the presence of a clinical procedure to the strongest panic attack with impairment of dental treatment[14]. Spielberger et al[15] described the difference between anxiety as a transitory state in the face of threatening stimuli and as a personality trait. State anxiety is based on subjective and conscious feelings of apprehension and tension accompanied by, or associated with, activation of the autonomic nervous system. In contrast, trait anxiety seems to imply a motive or an acquired behavioral disposition that predisposes an individual to perceive as threatening

circumstances that are not objectively dangerous and to respond with a state anxiety reaction of disproportionate intensity in relation to the magnitude of danger[15].

Within this context, the emotional status of an individual who undergoes surgical dental treatment may generate or worsen a degree of anxiety that will have some type of impact on the effectiveness of treatment. Although the effect of anxiety on patient pain after dental implant or extraction procedures has been investigated[8,16], to our knowledge, no reports of the effects and relations of these evaluations on patients submitted to bone graft surgeries are currently available. These specific intraoral surgical procedures may be affected by various factors such as duration of surgery, trans- and postoperative intercurrences, duration of pain, and recovery, which contribute to a state of stress. Thus, the aim of the present study was to evaluate the pain perception and anxiety related to autogenous mandibular block bone surgery using visual analog scales (VAS), the State-Trait Anxiety Inventory (STAI), and information about treatment and follow-up data. Also, we evaluated the causality effect of anxiety on pain perception during the treatment period.

Material and methods

Study design and ethical issues

A prospective cohort study was conducted on individuals seen at the Service of Oral Surgery and Implantology of the School of Dentistry, Federal University of Minas Gerais (MG, Brazil) between July and December 2017. The study was approved by the Ethics Committee of the Federal University of Minas Gerais (Approval No. 67497617.7.0000.5149). The patients gave written

informed consent for the publication of their cases in agreement with the Declaration of Helsinki.

Patients

A total of 13 individuals were included in the study according to the following inclusion criteria: adult and/or elderly persons; need for a thick bone graft in the posterior mandible regardless of the number of teeth present as determined by visual examination and palpation and confirmed by cone beam computed tomography (CBCT); remaining bone height of 3.0 to 8.0 mm above the mandibular canal roof; valley-shaped bone defect with a minimum depth of 2.0 mm in relation to the bone crest, with indication of oral rehabilitation with bone integrable implants; and cognitive ability in order to understand and answer the questionnaires applied.

Exclusion criteria were as follows: general contraindications of surgical treatment; being under treatment or taking medications that interfere with tissue repair; smokers and alcohol drinkers; presence of an active infectious process in the region to be operated; pregnant or nursing women; presence of malignant neoplasia and/or radiotherapy or chemotherapy treatment; and a history of surgery for implant or graft installation in the mandibular region.

The sociodemographic data (i.e., gender, age, household income, reason for the dentist's appointment) of the subjects selected were obtained. Intraoral physical examination was performed, and preoperative laboratory tests and CBCT images were requested and evaluated, and the responses to two self-applicable questionnaires were collected.

Surgical procedures

Initially, connective tissue grafts 1 with a mean thickness of 1.5 mm were obtained from the hard palate and inserted into the posterior mandible under local anesthesia three months before the bone graft surgery. The objective of this step was to prevent later exposure of the bone graft.

The autogenous bone graft was obtained from the external oblique ridge according to the technique of Khoury et al[6], with some modifications. Intraoral antisepsis was performed with a 0.12% chlorhexidine gluconate mouthwash for 1 minute, followed by disinfection of the skin with PVPI (1% active iodine). The following preoperative medication was used: amoxicillin (875 mg, administered at least 1 hour prior to surgery), tenoxicam (20 mg, at least 1 hour prior to surgery), dexamethasone (two 4 mg capsules, at least 12 hours prior to surgery, and 8 mg at least 2 hours prior to surgery), and paracetamol (750 mg, at least 1 hour prior to surgery).

Local anesthesia consisted of 4% articaine and 1:100,000 epinephrine (Articaine 100, Nova DFL, RJ, Brazil). In the recipient area, analgesia was obtained by infiltration of the inferior, lingual and buccal alveolar nerves and the incision was performed on the oblique line with a scalpel (NR15, Solidor, SC, Brazil), continuing along the central portion of the margin over the crest; an additional relief incision about 5 mm in length was performed in order to free the flap to be later used to cover the bone graft. When teeth were present between the recipient area and the beginning of the incision on the oblique line, an intrasulcular incision continuing up to the recipient area was performed in order to bypass these teeth. A full thickness flap was then obtained by mucoperiosteal detachment involving the contiguous donor and recipient areas. The periosteal

incision was performed in the base of the flap in order to increase its elasticity and to permit passive closure. No type of preparation, such as bone perforation or flattening, was used.

Perforations were punched in the previously 1 anesthetized donor area with an NR699 drill (Solidor Ind., SP, Brazil) in parallel to the external oblique area, reaching the full thickness of cortical bone. Next, two vertical osteotomy lines were performed under constant irrigation with saline chilled to 5ºC, one of them mesial and the other distal to the initial osteotomy, determining the length of the graft. The vertical osteotomies were then joined with a horizontal osteotomy at the basal level with the aid of a diamond disk (5 mm, NeoBiotech, CA, USA). Particulated bone was obtained from a region adjacent to the donor bed with the aid of an ACM drill (NeoBiotech, CA, USA). The bone block obtained was carefully removed with a chisel and divided longitudinally in the middle into two thin parts with a diamond disk (Supplementary Fig. 1). The edges that might damage the flap and consequently expose the graft were removed with spherical diamond tips under constant irrigation with saline. The thin blocks were stabilized in the recipient regions at a distance from the recipient bone bed maintained with titanium screws (1.5 mm, NeoBiotech, CA, USA) (Supplementary Fig. 2). To this end, screws were manually inserted with the aid of a screwdriver key (square active tip, PecLab Ind., BH, Brazil). The grafts were fixed by installing the first block in the occlusal region resting on the bone crest of the adjacent tooth. The space below the first block was filled with particulate bone and the second block was then installed on the vestibular surface. The stability of the structure in the recipient bed was evaluated clinically so that it would remain static.

The surgical wound in the recipient area was then closed with Donati type stitches and simple non-restorable sutures (Nylon 6-0, Ethicon, NJ, USA). The same suture and only simple stitches were used in the donor area. The number of anesthetic tubes used, the surgical time and transoperatory intercurrences were recorded immediately after each surgical procedure.

Follow-up and daily activities/postoperative symptoms

Medication were to be continued postoperatively with amoxicillin (875 mg twice a day for 7 days postoperatively), tenoxicam (20 mg for 5 days), dexamethasone (8 mg twice a day for 5 days), and paracetamol (750 mg four times/day for two days). After the third postoperative day, the patients were instructed to perform mouthwashes with 5 mL 0.12% chlorhexidine gluconate for 1-minute half an hour after oral hygiene, three times a day for 7 days.

All participants were evaluated 7 days after surgery, with the sutures being removed only after 10 days, when clinical reevaluation was performed. The patients were instructed not to apply a direct load to the reconstructed region with the use of dental prostheses throughout the phase of bone regeneration. After the 14^{th} postoperative day the patients were asked whether they experienced interference with their daily activities such as chewing, full mouth opening, speaking, sleeping, job, social life, or favorite activities. The patients were also asked to report postoperative symptoms such as the presence of facial swelling, nausea, and the perception of bad breath/taste.

STAI

For the assessment of anxiety, the patients were asked to respond to two selfassessment Spielberger et al[15] questionnaires: STAI-State (STAI- S), and STAI-Trace (STAI- T), 7 days before bone graft surgery (phase 1), immediately (30 minutes) before bone graft surgery (phase 2) and 14 days after surgery (phase 3). The Portuguese version of the STAI used in this study was elaborated by Biaggio et al[17]. The state anxiety scale consists of 20 statements that assess how the respondent feels “at this time”. The trait anxiety scale consists of 20 statements that assess how the respondent “generally feels”. Both scales evaluate feelings of apprehension, tension, nervousness and worry. The patients were instructed to express each statement using a 0 to 4 Likert type scale.

VAS

Each patient was asked to perform the VAS test, which consisted of recording the perception of pain on a scale from 0 to 10, with 0 corresponding to “no pain” and 10 to “the worst pain ever felt”. The patient was asked to perform this test 30 minutes after bone graft surgery (phase 2), and again 14 days after surgery (phase 3).

Statistical analysis

Patient demographic data and the reasons for seeking dental treatment were submitted to descriptive statistical analyses (including frequency distributions and percentages) using the Statistical Package for the Social Sciences software (SPSS), version 22.0 (IBM Inc., New Armonk, NJ, USA). For STAI, we calculated the sum of scores for all questions for each patient, with a

score of 20-40 representing a low level of anxiety and a score of 41-80 representing an average to high level of anxiety[19]. The responses to the VAS were dichotomized as “without pain” for zero scores and “with pain” for scores from 1 to 10. The hypothesis of association between clinical variables and STAI was tested at phase 2; between daily activities/postoperative symptoms and VAS at phase 3, and STAI at phase 3. Fisher’s exact test of independence (α=.05) was used to verify the hypothesis of association when the sample size was small.

STAI sums of scores were compared at 3 time points (phases of our study) using the Friedman test. A post-hoc test (α=.05) was employed according to Nemenyi[19] using the PMCMR package[20] of the R software (R Core Team, Vienna, Austria). The hypothesis of no association between the patients’ STAI and VAS were tested by crosslagged analysis using the COCOR package[21,22] of the R software. Thus, three types of correlations were performed: autocorrelations (between two measures of a variable at different times), synchronous correlations (between different variables at the same time) and cross-lagged correlations (between different variables at different times). The difference between cross-lagged analyses was determined by the modified Pearson-Filon ZPF test.

Results

The sociodemographic data of the individuals are shown in Table 1. The sample consisted of nine women and four men (mean age: 53.4 years). Approximately 50% of the individuals had household incomes lower than 3 times the Brazilian minimum wage, and the other 50% had incomes higher than this

level. The main reason for the dental appointment was the recovery of missing teeth (69.2%).

No significant association between clinical variables and STAI (p>0.05) was observed at phase 2 (Table 2). Some factors such as duration of surgery (p=0.078), complications during surgery (p=0.070) and number of anesthetic cartridges used (p=0.098) may have been influenced statistically by anxiety considering an interval estimate with a 90% confidence level (Table 2). Considering some influence of anxiety state duration of surgery, seven (53.8%) subjects whose surgery lasted more than 120 minutes showed average to high anxiety on STAI-S at phase 2, in contrast to one (16.7%) patient whose surgery lasted less than 120 minutes (p=0.078). Only three patients showed complications during surgery, also showing average to high anxiety on STAI-S at phase 2 (p=0.078) (Table 2).

In addition, regarding daily activities/postoperative symptoms, an association was detected between bad breath/taste and STAI-S at phase 3 (p=0.014). Three of the four (30.8%) patients who reported bad breath/taste (75.0%) showed average to high anxiety on STAI-S at phase 3 (p=0.014). There was no significant association between STAI at phase 3 and other variables (p>0.05) (Table 3).

Regarding association between activities/symptoms and VAS at phase 2, four (30.8%) patients complained of interference with their favorite activities and two (50%) reported some level of pain (Table 4). Also, there was no significant difference for STAI between the three phases of this study (p>0.05, Friedman test) (Fig. 1). Regarding VAS, six patients reported pain at phase 2 compared

with two patients at phase 3, with a statistically significant difference between phases 2 and 3 (p=0.014, Wilcoxon test).

The autocorrelations in the STAI responses between phases 2 and 3 were significant (r=0.76, p=0.003 to STAI-S; r=0.79, p=0.001 to STAI-T). There were no significant differences in synchronous correlations at phases 2 or 3 between STAI responses and VAS. Cross-lagged analysis showed significant causality only between VAS at responses phase 2 and STAI-T responses at phase 3 (r=0.57; p=0.044). In general, cross-lagged analysis of the data did not show significant causality between STAI and VAS responses (ZPF test, p>0.05) (Fig. 2).

Discussion

Marked bone loss in the edentulous region of the posterior mandible requires surgical procedures in order to obtain vertical and horizontal bone gain before treatment with dental implants[4,23]. Since surgical procedures are considered to be negative by involving pain, the present study revealed that 69.2% of the patients studied sought oral rehabilitation in order to restore the lost posterior teeth, whereas a minority of the sample seemed to already have been informed about surgery for dental implants and to be willing to undergo such treatment. Moreover, the emotional status of medium to high anxiety of same patients at phase 2 was associated with some factors inherent to the procedure such as surgical time, complications and number of anesthetic cartridges during the operation. This fact may be related to evidence that more anxious patients are usually restless and interfere with the progression of the surgical procedure[10,24].

Interference with routine activities (e.g, working or studying) has been reported during the first three postoperative days, followed by reduced pain along the first postoperative week[7]. These findings agree with the results of the present study, since most patients submitted to bone graft surgery reported pain during the immediate postoperative period, with a significant difference compared to 14 days after surgery. However, this fact may be probably due to the comfortable condition provided by the surgical procedure. Also, the fact that most limitations of daily activities and the postoperative symptoms do not show an association with anxiety is due to the good oral and systemic conditions provided by graft surgery. Similar studies have reported that patients experience pain of mild to moderate intensity in surgeries for dental extraction or for surgical implants, usually showing a good recovery, including monitoring for future procedures[7,10,25]. However, bad breath may be observed in association with STAI-S. Our findings agree with the study of Muglali et al[25], who reported that some underestimated factors related to oral health may be associated with the presence or absence of a reduction of patient anxiety before and after oral surgery.

In the present study there was no significant difference during the phases of evaluation of anxiety, a fact that supports the permanence of the emotional status and the expectation about the treatment received. Although cross-lagged analysis did not show a statistically significant difference in causality, it can be seen that the pain occurring in phase 2 may have influenced the anxiety during phase 3 in the STAI-T. Within this context, the sum of the factors that may be involved in anxiety are the age of the subjects, their psychological conditions, previous medical experiences, different degrees of sensitivity to, or tolerance of, pain, influence of the family or of the peer group regarding the potentiation or

minimization of the personality status, as well as the reaction to the local situation of care[26]. In this respect, previous studies have investigated the theme of origin of dental anxiety, its main causes and consequences related to the fear previously shown by the patient[27-29]. In addition, dental fear and anxiety may have generalized psychosocial consequences, explaining the permanence or increase of anxiety during treatment[29].

Some studies have detected a positive association between anxiety and the perception of pain in surgical dental procedures[30,31]. In addition, the technical procedure and the surgical skill of the operator are important factors for the success of intraoral bone graft surgery, considering the fact that the emotional control of the patient has become a requisite for surgical success[31]. Thus, it is important for the professionals to understand that a painful experience can influence anxiety and that the anxiety state is related to changes in the execution of future treatments.

The limitations of the present study are due to the aspects inherent to the design of a prospective study, so that the evaluations of the subjects must be systematically understood and controlled. Suggested perspectives for future investigations are longitudinal studies monitoring patients submitted to bone graft surgeries in order to perform a qualitative analysis of these individuals when facing these procedures. In addition, questionnaires should be applied in order to obtain new data regarding the worries and catastrophization of the complications due to the procedures. Multicenter studies involving a larger population of adults and elderly subjects could be considered for the assessment of individuals submitted to various surgical modalities preceding implant installation. Future investigations are also needed to assess the conditions of social vulnerability of

the patients, permitting a more detailed analysis of their oral and environmental conditions within society.

We may conclude that some clinical variables related to surgical treatment and to the limitation of activities/postoperative symptoms appear to be associated with the level of anxiety during surgical treatment for autogenous bone block graft. The perception of pain immediately after surgery did not predict the STAI-S after treatment, and there was an indication of causality regarding the STAI-T.

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Table 1. Sociodemographic data of the participants undergoing bone surgery.

Variables	*n(%)*
Gender	
Female	9 (69.2)
Male	4 (30.8)
Age (years) *	53.4 (11.7)
Marital Status	
Single	3 (23.1)
Married	10 (76.9)
Household income	
<3 times the Brazilian minimum wage	6 (46.2)
Between ≥3 and 5 times the Brazilian minimum wage	7 (53.8)
Reason for the dentist's appointment	
Posterior teeth	9 (69.2)
Performng implants	4 (30.8)

Table 2. Association between State-Trait Anxiety Inventory (STAI) scores and clinical variables.

Clinical characteristics	*STAI-S phase 2*						*STAI-T phase 2*					
	Low		Average to High		Total		Low		Average to High		Total	
Medical care	*N*	*%*[a]	*N*	*%*[a]	*N*	*%*[b]	*P Value*[†]	*N*	*%*[a]	*N*	*%*[a]	*N*	*%*[b]	*P Value*[†]
No	6	60.0	4	40.0	10	76.9	0.437[ns]	7	70.0	3	30.0	10	76.9	0.315[ns]
Yes	1	33.3	2	66.7	3	23.1		1	33.3	2	66.7	3	23.1	
Continuous-use medicines														
No	4	66.7	2	33.3	6	46.2	0.383[ns]	5	83.3	1	16.7	6	46.2	0.179[ns]
Yes	3	42.9	4	57.1	7	53.8		3	42.9	4	57.1	7	53.8	
Anesthetic tubes														
≤ 6	2	50.0	2	50.0	4	30.8	0.657[ns]	4	100.0	0	0	4	30.8	0.098[*]
> 6	5	55.6	4	44.4	9	69.2		4	44.4	5	55.6	9	69.2	
Duration of surgery														
≤ 120 minutes	5	83.3	1	16.7	6	46.2	0.078[*]	4	66.7	2	33.3	6	46.2	0.587[ns]

> 120 minutes	2	28.6	5	71.4	7	53.8		4	57.1	3	42.9	7	53.8	
Complications during surgery														
No	7	70.0	3	30.0	10	76.9	0.070*	7	70.0	3	30.0	10	76.9	0.315ns
Yes	0	0	3	100.0	3	23.1		1	33.3	2	66.7	3	23.1	
Complications after surgery														
No	2	33.3	4	66.7	6	46.2	0.209ns	3	50.0	3	50.0	6	46.2	0.413ns
Yes	5	71.4	2	28.6	7	53.8		5	71.4	2	28.6	7	53.8	
Total	7	53.8	6	46.2	13	100.0		8	61.5	5	38.5	13	100.0	

†Fisher test. nsNonsignificant; *P*>0.1; *Significant; *P*<0.1.

Table 3. Association between State-Trait Anxiety Inventory (STAI) score and daily activities/postoperative symptoms.

Activities/Symptoms	*STAI-S phase 3*							*STAI-T phase 3*						
	Low		Average to High		Total			Low		Average to High		Total		
Chewing	*N*	*%*[a]	*N*	*%*[a]	*N*	*%*[b]	*P Value*[†]	*N*	*%*[a]	*N*	*%*[a]	*N*	*%*[b]	*P Value*[†]
No	4	66.7	2	33.3	6	46.2	0.437[ns]	4	66.7	2	33.3	6	46.2	0.437[ns]
Yes	6	85.7	1	14.3	7	53.8		6	85.7	1	14.3	7	53.8	
Mouth opening														
No	7	77.8	2	22.2	9	69.2	0.706[ns]	7	77.8	2	22.2	9	69.2	0.706[ns]
Yes	3	75.0	1	25.0	4	30.8		3	75.0	1	25.0	4	30.8	
Communication														
No	6	75.0	2	25.0	8	61.5	0.685[ns]	6	75.0	2	25.0	8	61.5	0.685[ns]
Yes	4	80.0	1	20.0	5	38.5		4	80.0	1	20.0	5	38.5	
Sleep														
No	9	90.0	1	10.0	10	76.9	0.108[ns]	8	80.0	2	20.0	10	76.9	0.580[ns]

Yes	1	66.7	2	33.3	3	23.1		2	66.7	1	33.3	3	23.1	
Job														
No	8	72.7	3	27.3	11	84.6	0.577^{ns}	8	72.7	3	27.3	11	84.6	0.577^{ns}
Yes	2	100	0	0	2	15.4		2	100.0	0	0	2	15.4	
Social life														
No	7	77.8	2	22.2	9	69.2	0.706^{ns}	7	77.8	2	22.2	9	69.2	0.706^{ns}
Yes	3	75.0	1	25.0	4	30.8		3	75.0	1	25.0	4	30.8	
Favorite activities														
No	6	66.7	3	33.3	9	69.2	0.294^{ns}	6	100.0	3	0	9	69.2	0.294^{ns}
Yes	4	100.0	0	0	4	30.8		4	100.0	0	0	4	30.8	
Facial swelling														
No	7	77.8	2	22.2	9	69.2	0.706^{ns}	7	77.8	2	22.2	9	69.2	0.706^{ns}
Yes	3	75.0	1	25.0	4	30.8		3	75.0	1	25.0	4	30.8	
Nausea														
No	8	72.7	3	27.3	11	84.6	0.577^{ns}	8	72.7	3	27.3	11	84.6	0.577^{ns}

Yes	2	100.0	0	0	2	15.4		2	100.0	0	0	2	15.4	
Bad breath/taste														
No	9	100.0	0	0	9	69.2	0.014*	8	88.9	1	11.1	9	69.2	0.203ns
Yes	1	25.0	3	75.0	4	30.8		2	50.0	2	50.0	4	30.8	
Total	10	76.9	3	23.1	13	100.0		11	84.6	2	15.4	13	100.0	

†Fisher test. nsNonsignificant; *P*>0.05; *Significant; *P*<0.05.

Table 4. Association between visual analog scales (VAS) and daily activities/postoperative symptoms.

Activities/Symptoms	*VAS phase 3*						
	No		Yes		Total		
Chewing	*N*	*%*	*N*	*%*	*N*	*%*	*P Value*†
No	6	100.0	0	0	6	46.2	0.269ns
Yes	5	71.4	2	28.6	7	53.8	
Mouth opening							
No	8	88.9	1	11.1	9	69.2	0.538ns
Yes	3	75.0	1	25.0	4	30.8	
Communication							
No	7	87.5	1	12.5	8	61.5	0.641ns
Yes	4	80.0	1	20.0	5	38.5	
Sleep							
No	9	90.0	1	10.0	10	76.9	0.423ns
Yes	2	66.7	1	33.3	3	23.1	
Job							
No	10	90.9	1	9.1	11	84.6	0.295ns
Yes	1	50.0	1	50.0	2	15.4	
Social life							
No	8	88.9	1	11.1	9	69.2	0.538ns
Yes	3	75.0	1	25.0	4	30.8	
Favorite activities							
No	9	100.0	0	0	9	69.2	0.077*

Yes	2	50.0	2	50.0	4	30.8	
Facial swelling							
No	8	88.9	1	11.1	9	69.2	0.538[ns]
Yes	3	75.0	1	25.0	4	30.8	
Nausea							
No	9	81.8	2	18.2	11	84.6	0.705[ns]
Yes	2	100.0	0	0	2	15.4	
Bad breath/taste							
No	8	88.9	1	11.1	9	69.2	0.538[ns]
Yes	3	75.0	1	25.0	4	30.8	
Total	11	84.6	2	15.4	13	100.0	

[†]Fisher test. [ns]Nonsignificant; $P>0.1$; [*]Significant; $P<0.1$.

Figure Legends

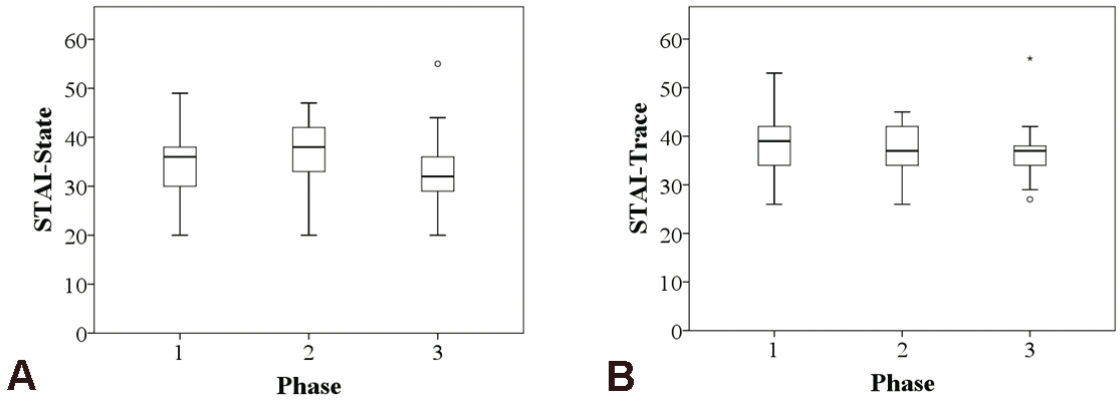


Figure 1. Box Plot of STAI-S (A) and STAI-T (B) at different phases of the study.

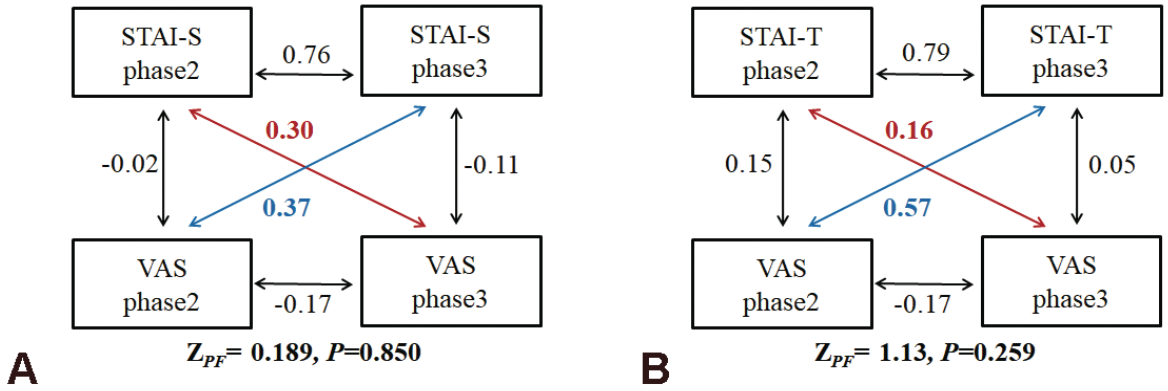
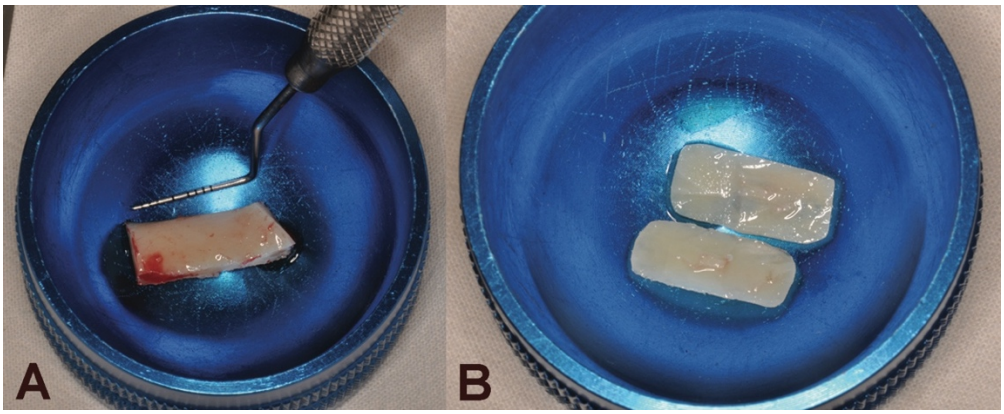
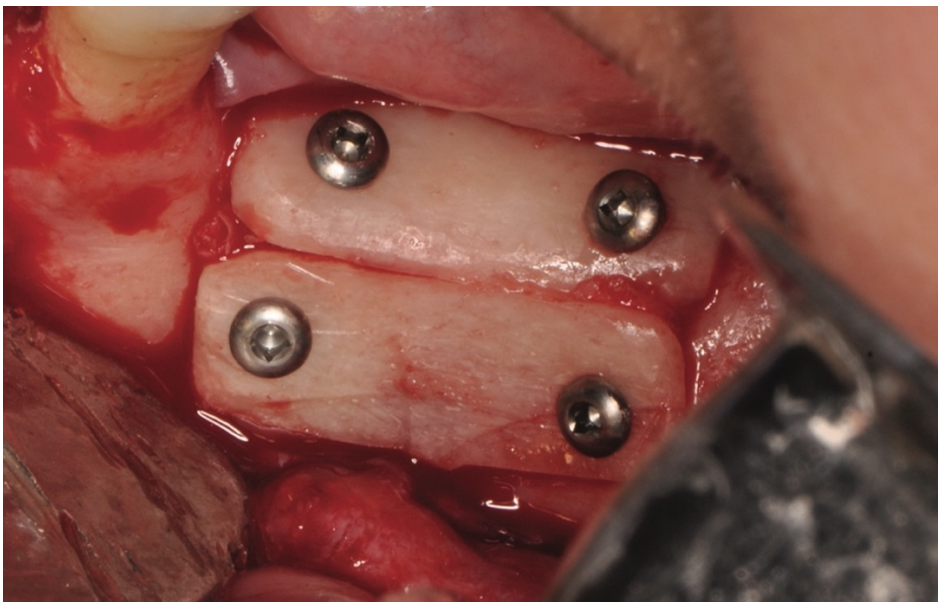


Figure 2. Cross-lagged analysis for STAI-S and VAS (A) and STAI-T and VAS (B).



Supplementary Figure 1. (A) Harvesting two bone blocks from the mandible and (B) splitting them into two thinner blocks.



Supplementary Figure 2. Placement of bone blocks in the occlusal and vestibular bone cortices.

5 CONSIDERAÇÕES FINAIS

Pode-se concluir com os achados desta pesquisa que:

(1) A reconstrução tridimensional de defeitos verticais na mandíbula posteriormente atrófica é um procedimento viável, previsível e com baixa quantidade de complicações.

(2) Pode-se verificar diferença estatisticamente significante entre as medidas lineares de largura e altura comparadas nos diferentes momentos de avaliação, e aumento médio vertical linear final de 1,7 mm (±0,94).

(3) Os valores médios da dimensão fractal demonstraram baixo valor de aumento entre os momentos inicial e final.

(4) Para os resultados do volume ósseo da área receptora verificaram-se diferença estatisticamente significativa entre os momentos de avaliação T1 e T2 e T1 e T3. O aumento ósseo volumétrico proporcionado pelo enxerto pode gerar ganho de volume final de 71,5%, e reabsorção média do enxerto de 14,4%.

(5) Pode-se observar a partir da autoavaliação dos pacientes submetidos à cirurgia de enxerto que alguns fatores clínicos do tratamento cirúrgico, limitação das atividades/sintomas pós-operatórios, parecem estar associados ao nível de ansiedade durante o tratamento.

(6) A experiência de dor no dia do tratamento não foi capaz de predizer o estado de ansiedade dos pacientes após o tratamento no estado de ansiedade, enquanto no traço de ansiedade houve alguma indicação de correlação.

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ANEXOS

ANEXO A - APROVAÇÃO DO COMITÊ DE ÉTICA

UNIVERSIDADE FEDERAL DE MINAS GERAIS
COMITÊ DE ÉTICA EM PESQUISA - COEP

Projeto: CAAE – 67497617.7.0000.5149

Interessado(a): Profa: Amália Moreno
Departamento de Clinica, Patologia e Cirurgia
Faculdade de Odontologia - UFMG

DECISÃO

O Comitê de Ética em Pesquisa da UFMG – COEP aprovou, no dia 10 de maio de 2017, o projeto de pesquisa intitulado "**Avaliação óssea de indivíduos com mandíbula posteriormente atrófica submetidos a cirurgia de enxerto autógeno tipo 3D por meio de tomografia computadorizada**" bem como o Termo de Consentimento Livre e Esclarecido.

O relatório final ou parcial deverá ser encaminhado ao COEP um ano após o início do projeto através da Plataforma Brasil.

Profa. Dra. Vivian Resende
Coordenadora do COEP-UFMG

Av. Pres. Antonio Carlos, 6627 – Unidade Administrativa II - 2º andar – Sala 2005 – Cep:31270-901 – BH-MG
Telefax: (031) 3409-4592 - e-mail: coep@prpq.ufmg.br

ANEXO B – ESCALA VISUAL ANALÓGICA (EVA) PARA DOR

ESCALA - DOR

Dados do Paciente:

Nome completo: _____

Sexo: ☐ Feminino / ☐ Masculino Idade: _____

01. Escala Analógica Visual - EVA

Assinalar com X

EVA	**DOR**		
Escala	**Antes (7 dias) da cirurgia de enxerto**	**No dia da cirurgia de enxerto**	**Após (14 dias) a cirurgia de enxerto**
0 (sem dor)			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10 (pior dor já sentida)			

ANEXO C – QUESTIONÁRIOS TRAÇO-ESTADO (IDATE)

Questionário Auto-Aplicavel do "Inventário de Ansiedade - Traço" (IDATE)

Nome..... Data.....Ano.....

INSTRUÇÕES: A seguir são dadas algumas afirmações que tem sido usadas para descrever sentimentos pessoais. Leia cada uma e faça um círculo ao redor do número, à direita , que melhor indicar como você *geralmente* se sente. Não há respostas certas ou erradas, não gaste muito tempo numa única afirmação, mas tente dar uma resposta que mais se aproximar de como você geralmente se sente.

Quase nunca.....1 Frequentemente 3
Às vezes .....2 Quase sempre.....4

1.Sinto-me bem.....	1	2	3	4
2. Canso-me facilmente.....	1	2	3	4
3. Tenho vontade de chorar.....	1	2	3	4
4. Gostaria de ser tão feliz quanto os outros parecem ser.....	1	2	3	4
5. Perco oportunidades porque não consigo tomar decisões rapidamente.....	1	2	3	4
6. Sinto-me descansado (a).....	1	2	3	4
7. Sou calmo (a).....	1	2	3	4
8. Sinto que as dificuldades estão se acumulando de tal forma que não consigo resolver	1	2	3	4
9. Preocupo-me demais com coisas sem importância ..	1	2	3	4
10. Sou feliz.....	1	2	3	4
11. Deixo-me afetar muito pelas coisas.....	1	2	3	4
12. Não tenho muita confiança em mim mesmo.....	1	2	3	4
13. Sinto-me seguro.....	1	2	3	4
14. Evito ter que enfrentar crises ou problemas.....	1	2	3	4
15. Sinto-me deprimido (a).....	1	2	3	4
16. Estou satisfeito (a).....	1	2	3	4
17. Às vezes, idéias sem importância me entram na cabeça e ficam me preocupando.....	1	2	3	4
18. Levo os desapontamentos tão a sério que não consigo tirá-los da cabeça.....	1	2	3	4
19. Sou uma pessoa estável.....	1	2	3	4
20. Fico tenso (a) e perturbado (a) quando penso em meus problemas no momento.....	1	2	3	4

Questionário Auto-Aplicavel do "Inventário de Ansiedade - Estado" (IDATE)

Nome.....Data..... Ano.....

INSTRUÇÕES: A seguir são dadas algumas afirmações que tem sido usadas para descrever sentimentos pessoais. Leia cada uma e faça um círculo ao redor do número, à direita da afirmação, que melhor indicar como você se sente agora, *neste momento*. Não há respostas certas ou erradas, não gaste muito tempo numa única afirmação, mas tente dar uma resposta que mais se aproximar de como você se sente neste momento.

Absolutamente não.....1
Um pouco 2
Bastante..... 3
Muitíssimo..... 4

1. Sinto-me calmo (a).....	1	2	3	4
2. Sinto-me seguro (a).....	1	2	3	4
3. Estou tenso (a).....	1	2	3	4
4. Estou arrependido (a).....	1	2	3	4
5. Sinto-me à vontade.....	1	2	3	4
6. Sinto-me perturbado (a).....	1	2	3	4
7. Estou preocupado (a) com possíveis infortúnios.....	1	2	3	4
8. Sinto-me descansado (a).....	1	2	3	4
9. Sinto-me ansioso (a).....	1	2	3	4
10. Sinto-me em "casa".....	1	2	3	4
11. Sinto-me confiante.....	1	2	3	4
12. Sinto-me nervoso (a).....	1	2	3	4
13. Estou agitado (a).....	1	2	3	4
14. Sinto-me uma pilha de nervos.....	1	2	3	4
15.Estou descontraído(a).....	1	2	3	4
16. Sinto-me satisfeito (a).....	1	2	3	4
17. Estou preocupado (a).....	1	2	3	4
18. Sinto-me super excitado (a) e confuso (a).....	1	2	3	4
19. Sinto-me alegre.....	1	2	3	4
20. Sinto-me bem.....	1	2	3	4