

QUANTIFICATION OF THE VOLUME OF AUTOGENOUS BONE REQUIRED FOR GRAFTING MANDIBULAR CONTINUITY DEFECTS

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A research report submitted to the School of Oral Health Sciences, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Dentistry in the branch of Maxillofacial and Oral Surgery.

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Declaration

I, Vinayagie Premviyasa, declare that this research report is my own work. It is being submitted for the degree of Master of Dentistry in the University of Witwatersrand, Johannesburg. It has not been submitted or incorporated in another research report, dissertation or thesis for another degree or examination at this or any other University previously. The experimental work was performed in the Department of Maxillofacial and Oral Surgery, School of Oral Health Sciences, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg.

Vinayagie Premviyasa.....

on this day of

I certify that the study contained in this research report have the approval of the Human Research Ethics Committee of the University of the Witwatersrand, Johannesburg. The Ethics no is M 150811.

.....

on this day of.....

Professor Carlo Ferretti (supervisor)

Dr Ephraim Rikhotso (supervisor)

.....

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Date:

Date:

Dedication

In loving memory of my mother

Mrs Kamla Naicker

1950 - 1994

This research report is dedicated to my late mom, my dad, my brothers and my sister, my niece and nephews and to all my very dear friends, who stood by me during this very difficult time.

Abstract

Introduction: The amount of particulate bone and cancellous marrow (PBCM) graft required for mandibular reconstruction is unclear, in particular with regard to the relationship between defect length and volume of bone needed. This often leads to procurement of either too little or too much bone. Although volume guidelines exist, measuring uncompressed bone volume is onerous, and mass measurement is easier.

Aims: A retrospective study to quantify the mass of autogenous PBCM bone required to graft a 1cm continuity defect of the mandible.

Materials and Methods: Patients with mandibular continuity defects who returned for bony reconstruction (6 - 8 weeks post-resection and placement of a reconstruction plate and a spacer) were included in the study. The graft was harvested from the posterior iliac crest, weighed on a kitchen scale and recorded as the wet weight in grams. The harvested bone was milled with a power bone mill. The milled PBCM was transferred to 10 and 20 ml syringes, maximally compressed and the compressed bone volume recorded. After the removal of the spacer, the defect length was measured in centimetres (cm) with a flexible ruler, and the volume of compressed bone used was recorded. The mass of the bone required to produce 1cc of compressed bone was calculated, as was the mass of bone required per centimetre of mandibular defect. Results were analysed statistically to determine whether sexual differences exist.

Results and Discussion: Thirty one patients (11 males and 20 females) with mandibular continuity defects, resulting from resection of benign pathology and trauma were included in the study. The mean age of patients in years was 27.43 ± 10.63 (range 12 - 62). The mean defect length in centimetres was $9.15 \text{ cm} \pm 2.61$ (range 6 - 16 cm). The mean wet bone mass harvested (wet weight) in grams in males was $70.82 \text{ g} \pm 16.73$ (range 47 - 98 g) and in females, $62.2 \text{ g} \pm 15.97$ (range 32 - 100 g). The combined mean compressed bone volume (cc) used was $31.73 \text{ cc} \pm 8.25$ (range 20 - 50 cc). In males, the average wet bone mass used per cm of mandibular defect was $7.4 \text{ g/cm} \pm 2.04$ (range 4.09 - 11.38 g/cm), while the compressed bone volume used per centimetre of mandibular defect was $3.74 \text{ cc/cm} \pm 0.75$ (range 2.27 - 4.88 cc/cm) and the compressed volume of bone produced by 1g of wet bone was $0.54 \text{ cc/g} \pm 0.09$ (range 0.40 - 0.74 cc/g). In females, the mean wet bone mass per cm of mandibular defect was $7.39 \text{ g/cm} \pm 1.84$ (range 4.6 - 10.72 g/cm), while the compressed bone volume per centimetre of mandibular defect was $3.49 \text{ cc/cm} \pm 0.72$ (range 2.2 - 4.67 cc/g) and the volume of compressed bone produced by 1g of wet bone was $0.48 \text{ cc/g} \pm 0.07$ (range 0.37 - 0.63 cc/g). There was a statistically significant difference in the compressed bone volume obtained and the compressed bone volume used in males and females, but this difference was not of clinical significance.

Conclusion: For each centimetre of mandibular continuity defect a wet bone mass of approximately 7.5 g is required to adequately reconstruct a mandible. There was a statistical difference in the compressed bone volume and the compressed bone volume used between males and females but all other variables were not significant. Female bone was 12% more compressible than male bone.

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LIST OF ABBREVIATIONS

BMP.....Bone morphogenetic proteins

cc.....Cubic centimetre

cc/cm.....Compressed bone volume per centimetre of mandibular defect

cc/g.....Compressed bone volume per gram of bone

cm.....Centimetre

DBM.....Demineralized bone matrix

e.g.Example

g.....Gram

g/cm.....Wet bone mass in grams per centimetre of mandibular length

HA.....Hydroxyapatite

IGF.....Insulin -like growth factor

ml.....Millilitre

PDGF.....Platelet-derived growth factor

SD.....Standard deviation

TCP.....Tricalcium phosphate

TGF- βTransforming Growth Factor-Beta

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