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BONE GRAFTS AND BONE SUBSTITUTES

Basic Science and Clinical Applications

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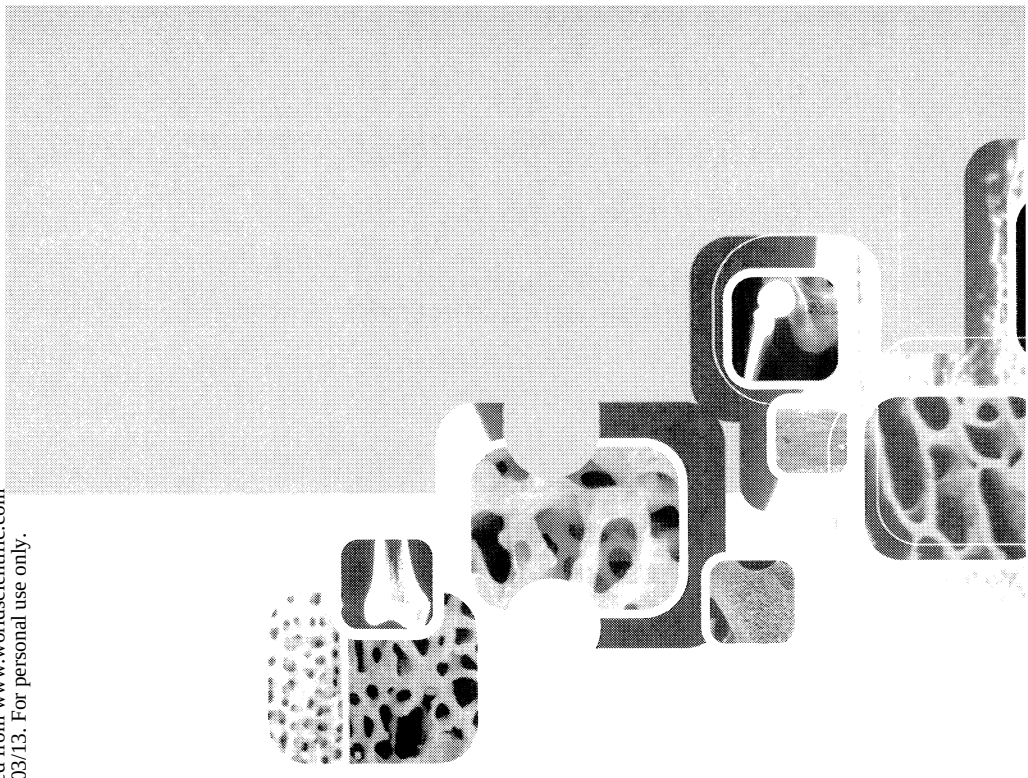

BONE GRAFTS AND BONE SUBSTITUTES

Basic Science and Clinical Applications

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World Scientific

NEW JERSEY • LONDON • SINGAPORE • BEIJING • SHANGHAI • HONG KONG • TAIPEI • CHENNAI

Published by

World Scientific Publishing Co. Pte. Ltd.

5 Toh Tuck Link, Singapore 596224

USA office: 27 Warren Street, Suite 401-402, Hackensack, NJ 07601

UK office: 57 Shelton Street, Covent Garden, London WC2H 9HE

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British Library Cataloguing-in-Publication Data
A catalogue record for this book is available from the British Library.

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ISBN 981-256-089-0

Typeset by Stallion Press
Email: enquiries@stallionpress.com

Printed in Singapore by World Scientific Printers (S) Pte Ltd

Contents

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Preface

This book discusses Bone Grafting using autografts from non-vascularised grafts to pedicled ones and free vascularised bone grafts and the various options to bone grafting ie. the use of bone substitutes. The latter ranges from Allografts, Genomics in Orthopaedic Practice with particular reference to Bone Formation, Tissue Engineering including all 3 elements of the triad — Cells, Scaffolds and Signalling Molecules to Ceramics and Prostheses. The section of Ceramics include some results from the ten million ringgit Multi-Centre Research Project in Malaysia namely the fabrication of Malaysian Hydroxyapatite and the development of Malaysian Coral.

This book is useful to clinicians and clinician scientists in the field of Orthopaedics, Plastic and Reconstructive Surgery and Maxillo-Facial Surgery who are commonly presented with the clinical problem of reconstructing large bone defects. It is also useful to research scientists namely tissue engineers and biomedical engineers pursuing the field of research on bone substitutes in the field of allograft transplantation, genomics of bone, bone tissue engineering and the development of new generation bioceramics and new prostheses.

Associate Professor Aziz Nather

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Introduction

A Nather

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Bone Grafting is one of the commonest operations performed in Orthopaedics. Its indications include non-union, delayed union, packing bone cysts and cavities, elevating depressed articular fractures and reconstruction of large bone defects. Autografting from the iliac crest is the gold standard. However, due to limitations as to amount, size and shape of the graft that could be procured as well as associated donor site morbidity, bone substitutes have become extremely important and useful for Orthopaedic Surgery, Plastic Reconstructive Surgery and Maxillo-Facial Surgery.

Section I first addresses the Basic Science of Bone including the structure of bone and the biomechanics of bone and the repair process that occurs in fracture healing.

Autografts are discussed in detail in Section II including the method of performing autogenous bone grafting and its diverse clinical applications.The ipsilateral pedicled bone graft and also the free vascularised bone graft are covered in detail. The healing of large non-vascularised cortical bone transplants is also described.

Section III deals with a common bone substitute — Allografts. Allografts have served this function very well for the last 5 decades. A useful chapter especially for Universities who have not set up a tissue bank is the chapter on "Setting Up a Tissue Bank" which serves as a useful guide to all wishing to establish a new bone banking facility. Issues of quality control for allografts, value of gamma irradiation to sterilize the bone grafts and the training of tissue bank operators are addressed in detail. Biology

and biomechanics of healing of cortical allografts and the future of bone allotransplantation is also described.

Section IV introduces the field of Genomics and discusses the use of Genomics in Orthopaedic Practice with particular reference to bone formation.

Bone Tissue Engineering is covered in depth in Section V including methodology for culturing Mesenchymal Stem Cells, types of scaffolds used and types of carriers employed for transplantation of cells.

In Section VI the third element of the Tissue Engineering Triad is addressed, namely signalling Molecules or Growth Factors. The role of BMPs and PRP are discussed.

Section VII covers Ceramics. Its scope ranges from the need of new biomaterials to the role of Hydroxyapatite, Coral and Coralline Ceramics as bone substitutes. The fabrication of the Malaysian Hydroxyapatite and the Malaysian Coral recently developed are also described.

Finally, this book on Bone Graft Substitutes would not be complete without discussing one other option, namely Prostheses. Rapid prototyping techniques and the use of Custom MegaProstheses are described in Section VIII.

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