

TEXTBOOK OF  
**DISTRACTION  
OSTEOGENESIS**  
IN ORAL AND MAXILLOFACIAL  
SKELETON  
PRINCIPLES AND APPROACHES



**DR. PUSHPENDRA SINGH**  
**DR. RAJAT MOHANTY**



# **“Textbook of Distraction Osteogenesis in Oral and Maxillofacial Skeleton: Principle and Approaches”**

**Dr. Pushpendra Singh**

**Dr. Rajat Mohanty**

**ISBN: 978-93-342-8797-4**

**Anthologized by,**

**“The Legal Lock”**

**in association with,**

**“Penchant Publications”**



**May, 2025**

First impression: 2025

**“Textbook of Distraction Osteogenesis in Oral and Maxillofacial Skeleton: Principle and Approaches”**

Copyright © 2025, Penchant Publications. All rights reserved.

**ISBN: 978-93-342-8797-4**

**Editorial Board:**

- **Dr. Pooja Roy Dasgupta**
- **Mr. Varun Agarwal**
- **Mr. Paarth Jain**
- **Dr. Vanshika Agarwal**

**Disclaimer**

The views and opinions contained in the testimonials belong solely to the individual user and do not reflect our views and opinions. Fabrication of information pertaining to the contents in the book is strictly prohibited and will lead to consequences.

No part of this publication may be reproduced, distributed or transmitted in any form or by any means without prior intimation to the publisher, except in the case of brief quotations embodied in critical reviews and other non-commercial uses permitted under the copyright law. Any perceived slight of any individual or organisation is purely unintentional. The resources in this book are for informational purposes only and the publishers and editors do not own any liability arising out of any claim whatsoever. The contents of the book remain factual and any changes in the names of people, places or organisations have been made in order to protect their identity.

Published by:

**Dr. Pooja Roy Dasgupta**  
**‘Penchant Publications’**

## **About 'The Legal Lock'**

Legal Lock Journals LLP was born out of a vision to bridge the gap between legal knowledge and accessibility. Recognizing the challenges faced by students and professionals in navigating the complexities of law, we set out to create a platform that simplifies legal learning while fostering innovation and excellence.

From organizing national and international competitions to publishing high-quality journals and hosting webinars, our mission is to empower individuals with the tools and opportunities they need to excel in the legal field. Through partnerships with leading law schools and institutions, we have cultivated a global community dedicated to driving meaningful change in legal education and practice.

At Legal Lock, we believe in comfortable and convenient learning, actionable and transformative for everyone. Together, we strive to inspire the next generation of legal minds and redefine the future of legal education.



[www.thelegallock.com](http://www.thelegallock.com)

## **About ‘Penchant Publications’**

“Penchant Publications” is formed to provide a platform to all avid writers to showcase their talent in the form of books, journals, conference proceedings, etc. along with proper guidance to streamline and ease the process of publication. Along with the publication of books under the able guidance of national and international editors, Penchant Publications also offers publication in its flagship journals “Pen Acclaims” and “International Journal of Integrated Studies and Research (IJISAR)”.

Pen Acclaims represents a refereed, peer reviewed exponential journal publication (bearing ISSN 2581-5504) with the aim of providing a platform for academia, researchers and students from various fields like management, commerce, law, humanities, social science and general. Excelling the familiar periphery of routine substance, Pen Acclaims is offering to unfurl a new-fangled panorama in the contemporary management study. This search can reach a culmination only with authors’ as well as readers’ cooperation at large.

International Journal of Integrated Studies and Research (IJISAR) (bearing ISSN 2582-743X) is precisely meant to be an exploratory analysis over the given topics to stimulate the budding genius into aspiring eminent management personalities and present an international platform for interactive pleasure and argumentative progression. It is designed as a forum for broad philosophical, social and practical thought. In order to enhance the knowledge in multi-disciplinary areas, IJISAR serves as a resource to address the interface between theoretical insight and practical implementation.

With an Editorial Board of eminent personalities from different countries across the globe, we are dedicated to provide quality publication services to all authors in multidisciplinary fashion.



[www.penacclaims.com](http://www.penacclaims.com)



[www.ijisar.com](http://www.ijisar.com)



[www.penchantpublications.com](http://www.penchantpublications.com)

## **Acknowledgement**

While a completed research bears the single name of the student, the process that leads to its completion is always accomplished in combination with the dedicated work of other people. I wish to acknowledge my appreciation to certain people.

First and foremost, praises and thanks to the God, the Almighty, for his showers of blessings throughout my research work to complete it successfully.

On the very outset of this book, I would like to extend my sincere and heartfelt obligation towards all the personages who have helped in this endeavour. I extend my gratitude to Prof. Dr. Achyuta Samanta, Founder of Kalinga Institute of Industrial Technology (KIIT) and Kalinga Institute of Social Sciences (KISS), Bhubaneswar for giving me this great opportunity.


I also acknowledge with a deep sense of reverence, my gratitude towards Dr. Jugajyoti Pathi, Director and Prof.(Dr.) Aswini Kumar Kar principal, Kalinga Institute of Dental Sciences. Besides I would like to thank my guide, Prof.(Dr.) Rajat Mohanty, HOD, Dept of Oral & maxillofacial surgery for providing me his invaluable guidance, support and motivation throughout this entire work. His dynamism, vision, sincerity and motivation have deeply inspired me. It was a great privilege and honour to work and study under his guidance.

I am grateful to my teachers Dr. Banibrata Lahiri, Dr. Asutosh Das, Dr. Kiran Mishra, Dr. Shibabrata Behera, Dr. Sasank Annaluru & Dr. Anita Mohanty for their timely advice which was always taken with a welcome note towards making the boulders of obstacles appear as mere stepping-stones. I genuinely appreciate the contributions of my seniors Dr. Anwesha Pattanayak, Dr. Chitrita Mondal, Dr. Gayatri Moharana & Dr. Shubham Kumar Sinha for their advice and their willingness to share bright thoughts with me, my co-pg Dr. Jharna for successful completion of this research work. Nobody has been more important to me in the pursuit of this book than the members of my family. I would like to thank my parents, whose love and guidance are with me in whatever I pursue. They are the ultimate role models. My parents Mr. Rakesh Yadav and Mrs. Shakuntala Devi are the guiding force behind me since my childhood and the ones who have sincerely raised me with their care and gentle love. I dedicate this work to my brother Mr. Rupesh Yadav who has been always there for me to support me in all the circumstances. Lastly, I wish to express my deepest and heartiest appreciation for my dearest friend Dr. Vanshika for helping me sort out my observations and aiding in my hard work to make this project proceed to its completion, all the while providing me with constant motivation and support since the very beginning.

## **Foreword**

It gives me immense pleasure in writing the foreword to this outstanding book on dentistry for a legend and doyen of the field, under the mentorship and advisory of the most brilliant minds in the field. Developed by one of the most prominent scholars in this noble area, 'Distraction osteogenesis in Oral and Maxillofacial Skeleton: Principle and Approaches' is a fantastic book that rises from the foundations, is thorough in its construction, is up to date and authoritative in its approach, and is hands-on in its core. It is well known that one indicator of a medical curriculum's efficacy is the extent to which students have learnt it. Empirical study and innovation, as one of the most important areas of development, has the potential to significantly impact the course of oral and general health evolution. Their comprehensive grasp of the current state of oral and maxillofacial surgery, the historical treasures and well-kept secrets, and the current fruition of this tree of knowledge paving the path for the future are all reflected in the work. This is a thorough yet summarized book that satisfies the requirements of the comprehensive dental curriculum for graduates and postgraduates at all universities, incorporating the best care methods of all time. The work is a tree of knowledge, nurtured with experiential learning, and carries wonderful blossoms of practical wisdom. It walks you through the ins and outs of preventive, curative, and restorative dentistry, including behavioural challenges, cariology, endodontics, traumatology, para-surgical themes like the use of conscious sedation and general anaesthesia at that age, and the management of medically compromised.

I take this opportunity to congratulate to the author in his exceptional efforts that have culminated into the formation of this wonderful book.



PRINCIPAL  
KALINGA INSTITUTE OF DENTAL SCIENCES

## **Preface**

With the preliminary text designed to provide a comprehensive introduction to the core concepts of oral and maxillofacial surgery, this book builds significant emphasis on the clinical needs of the same by innovations, empirical data and intricate assessment of advances in cognitive sciences. The goal of this book is to provide a distinct perspective as the reader becomes skilled in the techniques and analysis of clinical data.

The primary purpose of this book is to provide in a single accessible format information central to the professional and ethical requirements of Distraction Osteogenesis. It covers the core prospectus for medical aspirants who must obtain a grounding in the elements of what constitutes in the entire procedure.

The purpose of this book is to provide students and clinicians with the techniques for examining body systems as well as an understanding of the underlying basic science and the clinical implications of abnormal data.

The book aims to improve understanding among academics, students, and the medical community at large. It also intends to provide a forum for researchers and scholars to do new research and multi-level analysis on bigger medicine insight-related subjects from both national and inter-disciplinary perspectives. The representation has changed over time to reflect the numerous efforts done. This book aims to improve awareness, communication, and integration among all individuals.



## **Index**

<b>S. No.</b>	<b>Title</b>	<b>Page No.</b>
1	Introduction to distraction osteogenesis	1
2	Biological phases of distraction osteogenesis	5
3	Mandibular distraction osteogenesis	8
4	Maxillary distraction osteogenesis	18
5	Alveolar distraction osteogenesis	26
6	Craniofacial and midfacial distraction osteogenesis	31
7	Distraction osteogenesis in Temporomandibular joint disorders	38
8	Distraction osteogenesis in cleft lip and cleft palate	42
9	Distraction osteogenesis for the treatment of obstructive sleep apnoea	48
10	Complications in distraction osteogenesis and their management	54
11	Innovations and emerging techniques in distraction osteogenesis	61
12	Conclusion and future directions	64

## Chapter 1

### INTRODUCTION TO DISTRACTION OSTEOGENESIS

Bone lengthening through gradual distraction has been utilized intermittently across various medical specialties throughout the past century. However, its application to the craniofacial skeleton is relatively a recent concept, with its indications steadily expanding over the past decade. To address the limitations of traditional bone grafting such as graft resorption, limited effectiveness for large corrections, DISTRACTION OSTEOGENESIS (DO) was introduced. “Distraction osteogenesis (DO) is a method of generating new bone following a corticotomy or an osteotomy and gradual distraction.” [1] This technique enables gradual, precise adjustments tailored to individual needs, offering a less invasive alternative with reduced surgical morbidity and improved outcomes. Its ability to promote both bone and surrounding tissue adaptation makes it particularly valuable in the intricate anatomy of the craniofacial region.

Codivilla in 1903 was the first to document the technique for lengthening long bones. Despite all the advancements, complications like nonunion or fibrous union, infections and wound infections remain common until Gavriel Ilizarov’s pioneering work in Siberia. The concept of DO was formally introduced by **Gavriel A. Ilizarov** in 1969. The adaptation of distraction osteogenesis for use in the craniofacial skeleton came later, around the early 1990s, when **Dr. Joseph McCarthy** and colleagues pioneered its use in the oral and maxillofacial region. They applied the principles of Ilizarov's technique to treat congenital deformities like craniofacial microsomia, significantly expanding the indications and applications of distraction osteogenesis in facial reconstruction.

The main types of distraction osteogenesis are as follows:

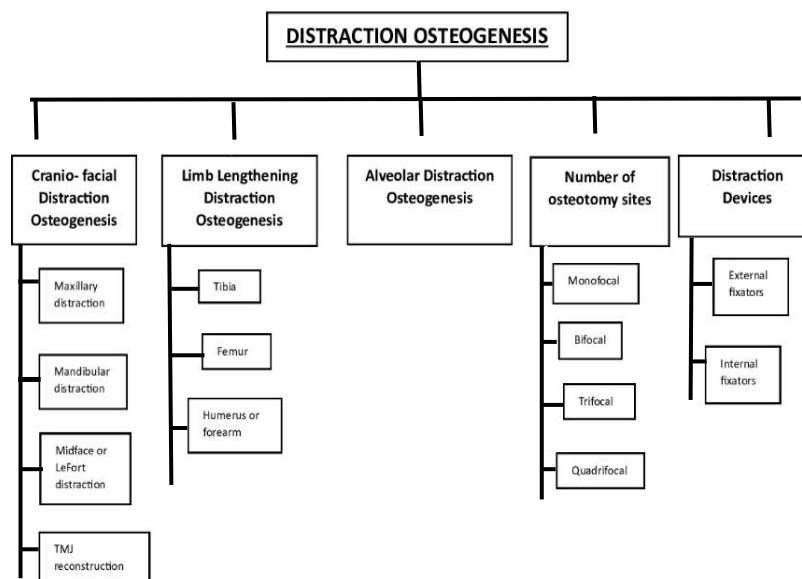


FIGURE 1: CLASSIFICATION OF DISTRACTION OSTEOGENESIS

Following unsuccessful outcomes with both vascularized and avascularized grafts in the

patients with cranio- facial continuity defects, the concept of reconstruction through distraction osteogenesis has been adopted into the clinical practice.

.....  
.....  
.....  
.....  
.....  
.....  
.....

# About the Authors



**Dr. Pushpendra Singh** is a dedicated Oral and Maxillofacial Surgeon with a strong academic background and a growing portfolio of clinical research. He completed his Bachelor of Dental Surgery from Gwalior, graduating with distinction in his final year, and is currently pursuing his Master's in Oral and Maxillofacial Surgery at Kalinga Institute of Dental Sciences, KIIT Deemed to be University, Bhubaneswar.

With a deep interest in craniofacial regeneration and deformity correction, Dr. Singh has contributed to multiple peer-reviewed publications and continues to explore innovative techniques in maxillofacial surgery. His current work focuses on distraction osteogenesis in the oral and maxillofacial skeleton, addressing complex challenges in skeletal reconstruction with an emphasis on functionally and esthetically sound outcomes.

Originally from Kanpur, Dr. Singh aspires to pursue advanced training in craniofacial surgery and is committed to furthering the development of evidence-based, patient-centered surgical practices in India.



**Dr. Rajat Mohanty** is a distinguished Oral and Maxillofacial Surgeon with over 15 years of experience in clinical practice and academia. He currently serves as Professor and Head of the Department of Oral and Maxillofacial Surgery, where he is highly regarded for his surgical expertise, academic leadership, and dedication to mentoring future oral surgeons.

He obtained his Bachelor of Dental Surgery (BDS) from SCB Dental College, Cuttack, and completed his Master of Dental Surgery (MDS) in Oral and Maxillofacial Surgery from the prestigious Sri Ramachandra University, Chennai. Dr. Mohanty has contributed extensively to the scientific literature, with numerous publications in leading PubMed- and Scopus-indexed journals. His primary research interests include craniofacial bone regeneration, biomaterials, and advanced reconstructive techniques.

This book presents a comprehensive exploration of distraction osteogenesis in the oral and maxillofacial skeleton—highlighting its principles, clinical applications, and long-term outcomes. The subject represents a transformative approach in skeletal reconstruction, combining functional rehabilitation with minimal donor site morbidity.

