





---

Hugo L. Obwegeser

# Mandibular Growth Anomalies

**Terminology – Aetiology**  
**Diagnosis – Treatment**

Histology by H. U. Luder

Forewords by P. Tessier and W. R. Proffit

With 107 Figures in 1228 Illustrations,  
some in Color



Springer

Hugo L. Obwegeser, M.D., D.M.D., F.D.S.R.C.S. (Eng.)  
Hon. F.D.S.R.C.P.S. (Glas.) Hon. F.F.I.R.C.S. (Ind.)  
Dr. h.c. Univ. of Detroit, USA; Dr. h.c. Univ. of Ferrara, Italy  
Emeritus Professor of Oral Diagnosis and Oral Surgery, Dental School,  
and Director of the Clinic of Maxillofacial Surgery at the University Hospital,  
Zürich, Switzerland

Hans G. Luder, PD, Dr. med. dent.  
Senior Research Associate in Oral Structural Biology  
Dental School, University of Zürich, Switzerland

ISBN 978-3-642-08655-7

Library of Congress Cataloging in Publication Data

Obwegeser, Hugo L. *Maxillofacial growth anomalies: terminology, etiology, diagnosis, treatment, histology.* / Hugo L. Obwegeser.

— 1st ed.

Includes bibliography of references and index.

ISBN 978-3-642-08655-7      ISBN 978-3-662-04551-3 (hbk)

DOI 10.1007/978-3-662-04551-3

1. Jaw—Growth. 2. Jaw—Abnormalities. 3. Jaw—Surgery. 4. Tooth—Growth. 5. Face—Abnormalities. 6. Face—Surgery. 7. Skull—Growth. 8. Skull—Abnormalities. 9. Skull—Surgery. I. Human. II. Child. III. Title. [DNLM: 1. Maxillofacial Development. 2. Jaw Abnormalities. 3. Maxillofacial Development. WFO 975 (746, 7002) .R03598 .A295 2007 .S73.5.22 .d62.]

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only for private, non-commercial use, in the German Copyright Law of September 9, 1965, in its current version, and in its place of use in any other country that may be permitted from Springer-Verlag Berlin Heidelberg GmbH.

Verboten zur Preisverbreitung unter dem German Copyright Law.

© Springer-Verlag Berlin Heidelberg 2009

Originally published by Springer-Verlag Berlin Heidelberg New York in 2009

Softcover edition of the hardcover 1st edition 2009

The work of periodical, descriptive names, registered names, trademarks, etc. in this publication does not implicate, in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

**Product liability:** The publisher cannot guarantee the accuracy or the completeness of any information contained in this work. Every use is allowed even though a liability limitation by contract may be relevant. Inquiries

Product group: P.02.019. 410311.09126 Heidelberg, Germany

Cover design: G. Kirschner, 68123 Heidelberg, Germany

Typesetting: Zethtner<sup>®</sup> Datenservice und Druck, 68726 Speyer, Germany

Printed on acid-free paper. ISBN: 9783642086557 24/5130/hs 5455110

---

*To my family and my profession.  
Both have made my life worthwhile.*

## Foreword

Was ever a foreword requested for God's words? It is not ideal to write a preface for Hugo's "Growing Mandible"? After training in the Jaw's Old Testament, Hugo is writing the New One that he taught for 30 years long. Indeed, the last decade has been fertile in mechanical gadgets which have made diagnosis and surgery easier, such as, accurate CT 3-D images, and absorbable plating or ostendistractor, which brings a fine touch to treatment timing in children. However, all of this does not encompass the intellectual process, basic principles, tactics and procedures.

In his well-deserved retirement, Hugo has found enough time to write about a small window made through his immense experience. The present book is a unique chance for maxillofacial surgeons to enter into his experience.

This book is not the usual tedious and anonymous compendium of a 40-contributor encyclopedic squadron, bouncing one over the other without clear conclusions, but rather represents a tiny part of one man's life dedicated to patient care and teaching within a high-level Swiss organization, driven by a clear-minded alpine Austrian who has taught two full generations of enthusiastically motivated oral and maxillofacial surgeons.

No dogmatism at all and far from being a case-based chapter after chapter, the descriptions and discussions are strongly supported by the analysis and treatment planning of clinical cases. The reader has the certainty of finding "the case" he is searching for for his own use.

I could not summarize all the terms of all chapters, and how could I have the competence to present a pertinent analysis of Hugo's "Growing Mandible"? When he concentrated mostly on the mandible and maxilla, I concentrated mostly on the maxilla, orbits, and cranium. Rather than pass rough judgement on Owegeser's book, I am pleased to recall some anecdotes from Hugo's behavior, as distinctive as the footprints of the wild goose belongs to track so ethus, serically in the Alps and abroad.

### Anecdotes

#### *Personal Regrets: September 1967*

I made personal acquaintance with Hugo in Rome in the fall of 1967. However, several years earlier, Jacques Dsu-

rey had recommended me to pay a visit to Zurich. I could not do this at that time, but I must say that after my first visit to him in 1968 I deeply felt that I had lost years by not being far from his various easy ways of handling the mandible.

#### *Tact: December 1967*

A "peer review committee" had been invited to Foch Hospital for a debate on the validity of the newly born craniofacial surgery. Demonstrations were provided for one week to 6 sharp judges among the head and neck specialties (see illustration). They confirmed the viability of the newborn. Upon his departure, Hugo left me a heavy parcel to open after take off. Inside was the golden "Gros" perpetual clock, which for 33 years accurately and silently informed me that it's time to get up and work.

#### *Friendship: May 1968*

The country was in chaos, on strike for two weeks. Air traf: did not fly, trains were stationary, and theatres were deserted. Hordes of anencephalic huffons were preaching the sixth revolution at street barricades and there was no prospect of it ending. I telephoned Hugo, asking if I might come and see him working with Jean Paul Dubet, my charming assistant. Affirmative. I left an emergency team running my service. A pilot friend poured the last gallons of gasoline into his Piper Cub tank and flew to Zurich. For a whole week we lived a surgical festival. Hugo had beaten the weekly schedule of his Department in an intensive, attractive fashion. When we returned to Paris, the burlesque "revolution" was out of breath but we were both rejuvenated by Hugo's fresh breeze.

#### *Personal Pride: September 1968*

Hugo was spending three weeks in Paris when I operated liberally in two operating theatres and took away some grafts for orbital fractures and upper jaw deformities. Hugo looked at some of these harvested bodies; then he escaped from the operating theatre for a while and returned. At a break I met him smoking a cigarette in the locker room.

Hugo: Do you know, Paul, how long it takes you to take an iliac graft?

Paul: No Hugo; I don't care. I take time with my perfect tools and do not have a Swiss cuckoo singing every 15 minutes.

Hugo: Paul, it takes you exactly the time you need to smoke a cigarette.

Paul: ??? (Cuban cigar smoker).

Hugo: Yes! 10 minutes.

Paul: As usual!

#### *Lucidity: June 1969*

A workshop in Poch Hospital. After 6 days of surgical demonstrations and follow-up clinics, Hugo said "Paul, what you have shown to 50 of us 2 years now is quite worthwhile. Without more delay you must write your book about the new specialty that you have built up, otherwise you will soon be cheated". PERSPICACITY.

#### *Fair Plays: Spring 1970*

After a meeting in Paris and a splendid dinner, five friends were smoking down Blvd. Saint Germain: Kar Eric Hogeman, Bengt Johanson, Jack Mustardé and Hugo Obwegeser: four smokers.

"Paul! You ought to publish your mid-facial advance-ment-technique!"

"Paul! You must publish your intracranial approach in hypertelorbitism and orbito-orbital lesions".

"Paul! You must publish your procedures for rare facial clefts and Treveschetti deformities soon!"

"Paul! Please publish your original works in the original region. — OH I A T A! Why so much writing?"

Unanimously: Paul! Please do realize that we have now acquired our own experience with what you have taught for 3 years and we would like to present our results. But WE cannot write a single page until YOU have published your basic procedures.

In 50 years of medical practice I have never met such a quartet of surgeons singing so well in tune. Therefore, I published in 1970 and 1971 and they did so in 1971 and 1972. That was a group of famous men, three on Rue Street, Hambred! All these four ages were the generation an endangered species, nowadays!

#### *Premonition: 1971 in New York City*

There was a discussion about the timing of the reconstruction of the skeletal defects in cto-mandibular dysplasia (I.C.M.). Jack Converse pleaded for the correction of the skeletal anomalies in childhood, Hugo Obwegeser argued for delay until adolescence and he was right. Ironically, 20 years later the bone distraction method has made an average mixture of both.

In recording his experience with the growing mandible, but Hugo has accomplished his duty, which I myself have not fulfilled for the upper facial segment. Let us ask Liu to write another book for more mandibula and the upper jaw.

Paul Tessier



Illustration: Dr. Paul Tessier with his special foreign guests at his "peer review committee" meeting at Poch Hospital in December 1967. From right to left: Paul Tessier, Mr. X, Jack Mustardé, Carl Schuchardt, Blair Sulgus, James Irving Cross, and Baya M. M. P., Mr. X, Hugo Obwegeser.

## Foreword

The diagnosis and treatment of growth anomalies of the mandible improved markedly in the late twentieth century, and the work of Hugo Obwegeser played a large part in that progress. This book is a welcome addition to the literature on the subject, especially because it brings Obwegeser's contributions into a single well-documented source.

Because the author is a renowned surgeon, it is not surprising that the focus of the book is strongly on surgical correction. Professor Obwegeser presents an interesting series of principles that encompass the author's point of view and summarize a wealth of clinical wisdom. In addition to the presentation of surgical techniques and case illustrations, the book also provides a summary of etiologic factors in mandibular deformity and Obwegeser's classification of these problems. His differentiation of major types of excessive mandibular growth has had a considerable impact on thinking about problems of this type and is very well presented here.

Mandibular growth problems, of course, are of great interest to orthodontists as well as to maxillofacial surgeons. For the most part, the less severe problems are treated by orthodontists, with a combination of growth guidance and compensatory tooth movement, while the more severe problems require surgical intervention. Almost always, integrated surgical and orthodontic treatment is needed for the more severe cases. This book focuses, appropriately, on the more severe problems that Prof. Obwegeser has treated throughout the course of his long and distinguished career and on the surgical management of these problems, with the role of the orthodontist in the background, not so much ignored as taken for granted.

The primary indication for mandibular surgery in children is a progressive deformity, one that becomes steadily worse as growth continues. The goal of surgery in these children is primarily to establish an environment in which more normal growth can occur, and post surgical, orthodontic growth guidance usually is needed. In this book, Obwegeser reviews growth principles for the mandible, which summarize current views of mandibular growth and its control. The biology of cartilages in mandibular growth anomalies is covered

more thoroughly than in any other source of which I am aware. Clinical experience with surgery for severe growth problems at an early age is presented in a series of cases in which the surgical intervention is well documented, but the use of orthodontics for management of subsequent growth is not. The orthodontist and surgeon who work together in these cases will need to be aware of techniques for growth management that are not presented here.

For older patients in whom little postsurgical growth is expected, the goal of surgery is correction of skeletal defects and major distortions of the alveolar process. Pre-surgical and postsurgical orthodontic tooth movement usually is needed. Prior to surgery, the goal is to establish an appropriate relationship between the teeth and their bony support. Removal of dental compensations for the skeletal deformity allows more complete correction of the skeletal problem. Postsurgically, orthodontics to bring the teeth into their final position has two purposes: it allows greater precision in establishing the dental occlusion than is possible with jaw surgery, and perhaps more importantly, it allows compensation for the small post-surgical changes that usually occur with surgical healing. Because the orthodontic management of these cases is well established and presented elsewhere, the omission of the orthodontic methodology from this book should present little problem.

This book is a valuable reference for orthodontists for several reasons. It provides a unique insight into the thought processes of a creative surgeon, documents the changes that can be produced in a great variety of cases, and illustrates very well the current state of the art in the treatment of mandibular growth anomalies. Orthodontists can enjoy and appreciate the overview of treatment that is presented here, and even more importantly, have a better understanding of the etiology, diagnosis, and clinical course of these problems. The descriptive terminology of jaw anomalies can contribute also to better communication among orthodontists, maxillofacial surgeons, and other dental and medical practitioners involved in the management of these conditions.

W. R. Proffit



---

## Acknowledgements

There are many people who have helped me to write this book, since of all I want to express my gratitude to my wife Luise for her understanding and willingness to let me work on the book for so long, almost 3 years, after for 6-7 h a day, instead of helping her in the garden and to fulfil my promise regarding what we would do together once I had retired. No less I want to thank my very good friend and colleague, Mr. Peter Clarke from Aberdeen, Scot and for his great help in correcting my English. He has done a tremendous job. Without his help I would have had to write the book in German and then have it translated into English, which is hardly really good. I also want to thank my successor and former pupil, Professor H. Sailer, for making the records of my former patients available to me. Without my former secretary, Mrs. A. Svenda, this book would never have seen the light of day. She helped me to find as many records and radiographs as possible and she did all the tracing and measuring of all the panoramic view radiographs and many other things. I am also no less thankful to Mrs. S. Fretz, also a former secretary at my clinic. She did an unbelievable job in typing the text in English, including the often rather large corrections. I am also thankful to the photographers, Mr. Ph. Hatzema of the clinic and Mrs. L. Brandenberger of the Dental School, and the artist, Mr. M. Hach, for their kind assistance. I am also very grateful to Dr. R. Caduff from the Institute of Clinical Pathology for his efforts to find as many of the histological specimens as possible, enabling Dr. H.U. Luder to write his part on the histology of mandibular growth anomalies. To him also goes my special thanks for finding the time during the very busy work at his institution in order to produce the histological part of the book. I want to thank Dr. Käß at the Klinik und Poliklinik for Nuclear Medicine for his very valuable help on the chapter on radiography.

Last but not least, I want to thank my friend and colleague, Professor P. Stöckli, Head of the Department of Orthodontics and Paediatric Dentistry at the Zürich Dental School, for his permission to use some of his cases and for his continual support during the preparation of this book. I also want to thank specially his Assoc. Prof. U. Teuscher for his assistance and agreement with my text regarding the principles and terminology and orthodontic considerations.

A very special expression of my thanks goes to my former co-workers, Prof. P. Egeyedi from Utrecht, Holland, and to Dr. B. Terry from Chapel Hill, North Carolina, a friend of mine since he trained with me for some months in 1967, for his kindness in reading the whole book and giving me his opinions and suggestions. To my good friend, Dr. Frank Javel from San Diego, goes a special thank you as he sent my chapter on "Descriptive Terminology for Jaw Anomalies" to Dr. E. Kohnert and Dr. M.A. Shampo, Ph.D., at the Mayo Clinic for their editorial help. They did an excellent job and my most grateful thanks and appreciation goes to both of them. Furthermore I want to thank all those colleagues who have referred so many interesting cases to me and for the enthusiastic cooperation in preparing the cases for surgery. I also want to express my thanks and appreciation to Mrs. H. Eschle, in charge of the library at the Zürich Dental School, for her help and efficiency in finding the very old literature I needed. There are many more I have to thank, too many to name them all personally. To all of those who have so willingly given me their help and assistance I want to include in my declaration of my gratitude and appreciation.

Finally, I wish to thank the publisher for accepting my manuscript with so many illustrations and for the excellent appearance of the printed book.

Hugo L. Obwegeser

## Preface

The actual spur to write a book on the subject of mandibular growth anomalies came after I lectured on abnormal mandibular growth regulation to the Californian Angle Society in the summer of 1991 in San Diego. The then President of that Society, Dr. Richard B. Laughlin, convinced me of the necessity to have a try. And so did my very good colleague and friend, Fritz Paul Stöckli, chief of the Department of Orthodontics and Paedodontics at the Dental School of the University of Zürich. With time, I have discussed and treated many actual cases. From these discussions I have learned a great deal.

Most cases with mandibulo-maxillary discrepancies are symmetrical. They generally present no great problem to an experienced surgeon, although even these "symmetrical" cases are not always all that easy to diagnose properly and to make a generally acceptable treatment plan. The treatment plan may differ quite considerably for a similar case, from one surgeon to another. The making of a proper treatment plan presumes a proper diagnosis: "First diagnosis, then treat" (H.G. Giles 1926, Principle No. 2).

Much more interesting than the symmetrical mandibular anomalies are the asymmetrical ones. In most of them an aetiological factor could be found. It was either congenital or mostly due to the influence of an adverse factor on the condyle or a larger part of the mandible during the growth period, producing a unilateral growth deficiency, but there was also a group for which no aetiology was known for their asymmetric surplus abnormality. These cases had fascinated me since my "professional childhood". Through a lifelong experience with these cases, I found an explanation for their aetiology. I published this together with our pathologist (H. Obwegeser and M. Maček 1986a,b). The reaction of interest to that publication came mainly from the orthodontists.

Since I have been dealing with jaw anomalies I have heard and read many different terms for the same type of jaw anomaly. The fact that experienced surgeons and orthodontists did, and still do, use different terminology for the same type of anomaly caused me to seek a terminology which describes the anatomical substratum of the anomaly. Such a terminology should be acceptable to all specialists involved in the subject of jaw

anomalies. I already suggested such a terminology in 1986 and 1993 and will include it in a chapter of this book.

After I had decided to go deeper into the subject of these mandibular asymmetries, I found it necessary to also include our clinical knowledge and experience of the facts and factors which influence mandibular growth. The cases in Figs. 11-29 have taught me a great deal on the influence of the condyles on the growth of the mandible. This is the reason for presenting them.

As it is very important to know what should be done, and when, it is definitely worthwhile to go deeper into the subject of mandibular asymmetries from the point of view of their aetiology and the diagnosis as well as the treatment. The principal aim of this book is not at all to depict how those mandibular asymmetries develop for which we do not know an aetiological cause, what kind of variations in their appearance can be observed, and what and when something should be done to them. It is my particular intention to demonstrate these variations on a great number of cases and yet I want to avoid using more than one case to demonstrate a specific problem.

I am still often asked how I perform this or that operation and how I avoid one or the other complication. For that reason I will end the book with a chapter on principal standard operation techniques and instruments. In that chapter I will reflect the historical background of these procedures, who, when and how they developed. I will describe how I perform these standard procedures and how modern instruments help to make the work easier for the surgeon and how with them he can avoid the formerly rather often experienced complications.

The various facts of the subject mentioned led to the title of the book "Mandibular Growth Anomalies, Terminology - Aetiology - Diagnosis - Treatment". It is quite a large subject to deal with, but I did so with pleasure and only sadness because it is such a fascinating subject.

As a trustee as well as a teacher I learned how important principles can be in dealing with facial anomalies. Whenever possible I used to formulate important things in diagnosis as well as in treatment planning and execution in the way of clear principles. The main in-

important ones will be put together in a separate chapter. They will also be mentioned repeatedly within the description of the cases.

The cases I am going to use are samples out of the clinical material collected between 1933 and 1967, when I was in charge of the Clinic of Maxillofacial Surgery at the University Hospital of Zürich and of the Department of Oral Diagnosis and Oral Surgery of the Dental School of the University of Zürich. For some of the older cases presented, panoramic radiographs and stereographic examinations and CT scans did not exist. Many of the interesting and rather instructive cases could not be used as there were only some slides and no remaining records and radiographs.

It is not intended that all the published literature on the subject be dealt with. I am sure the reader rather expects me to tell him of my own experience and opinion on the subject, for that reason it is mainly my own pertinent publications that are cited. However, in dealing with the history of the principal surgical procedures I do intend to cite the pertinent literature in every detail. I will purposely also occasionally quote an older publication on a special subject when I am of the opinion that its statement is still valid today, in spite of later "modifications and opinions".

As the great majority of mandibular growth anomalies start at childhood, this subject is primarily of interest to the paediatrician and in particular to the orthodontist, and also to various surgical specialists such as maxillofacial, plastic and ENT surgeons. Other medical specialities may also be involved from the diagnostic point of view such as radiology, nuclear medicine and even endocrinology.

A special remark on the reproduction of patients' photographs: In demonstrating and discussing the various types of growth anomalies of the mandible and their treatment it is unavoidable, for teaching purposes, to show not only radiographs of the patients, but photographs as well. By law, everybody has the right that his photographs are not used for publication without his express permission. Otherwise the photograph of the person's face has to be covered in such a way that it is not possible to recognize him/her. As such regulations make it impossible in medical teaching to pass on knowledge in respect of facial anomalies to others, we have to use patients' photographs, which have not been altered. For that reason, all our patients, private as well as state-financed ones, signed on their registration form the written statement that they permit the use of parts of their records for teaching purposes, as long as their name is not revealed.

The purpose of this book should not be only to present information on the subject to all the various medical specialities which are involved either diagnostically or in the treatment. But it should also stimulate everyone to fully document prospectively as many cases as possible to enhance further knowledge on the subject.

I will start the book with a chapter of gratitude to my most important teachers. Without their influence I would not have gained the background and knowledge to write this book.

Hugo L. Obwegeser

# Contents

<b>Part I The Basics</b> . . . . .	<b>1</b>	<b>1.1</b>	<b>Radiographic Documentation</b> . . . . .	<b>26</b>
How I Became a Cranio-maxillofacial Surgeon . . . . .	3	1.2	Photographic Documentation . . . . .	27
<b>1</b>	<b>9</b>	1.3	Request Form for Radiographs . . . . .	25
<b>2</b>	<b>13</b>	1.4	"Master of Paris Model of the Skull" Facial Mass Model of Plaster of Paris . . . . .	29
2.1 How to Diagnose Jaw Anomalies . . . . .	13	1.5	Stereolithographic Reproduction of the Facial Skeleton . . . . .	25
2.2 Descriptive Terminology for Jaw Anomalies . . . . .	13	<b>5</b>	<b>Scintigraphy, a Diagnostic     and Treatment Planning Aid</b> . . . . .	<b>31</b>
2.2.1 Problems with the Current Terminology . . . . .	13	5.1	Background Knowledge . . . . .	31
2.2.2 What Is Normal? . . . . .	14	5.2	Clinical Consequences . . . . .	33
2.2.3 Need for a Descriptive Terminology . . . . .	15	<b>6</b>	<b>Principles in Treatment Planning     of Facial Skeletal Anomalies</b> . . . . .	<b>35</b>
<b>3</b>	<b>17</b>	<b>7</b>	<b>Philosophy of Corrective     Surgery Planning</b> . . . . .	<b>39</b>
3.1 The Mandible . . . . .	17	<b>8</b>	<b>Mandibular Asymmetries</b> . . . . .	<b>43</b>
3.1.1 Anomalies of the Mandible . . . . .	17	8.1	Aetiology of Mandibular Asymmetries . . . . .	43
3.1.2 The Horizontal Ramus . . . . .	17	8.1.1	Mandibular Asymmetries Due to Embryonic Growth Abnormality . . . . .	43
3.1.3 The Mandibular Body or Base . . . . .	18	8.1.2	Mandibular Asymmetries Due to Atypical Postnatal Events During the Growth Period . . . . .	44
3.1.4 The Ascending Ramus . . . . .	18	8.1.3	Mandibular Asymmetries Due to Misregulation of Growth After Birth . . . . .	44
3.1.5 The Articular (Condylar) Process . . . . .	18	8.1.4	Mandibular Asymmetries Developing After Growth Has Ceased . . . . .	44
3.1.6 The Muscle (Coronoid) Process . . . . .	19	<b>9</b>	<b>What Do We Know About Growth     of the Mandible</b> . . . . .	<b>45</b>
3.1.7 The Angle of the Mandible . . . . .	19	9.1	Body and Ascending Ramus of the Mandible . . . . .	45
3.1.8 The Chin and Its Anomalies . . . . .	19	9.1.1	The Angle of the Mandible . . . . .	46
3.1.9 Measuring the Mandible . . . . .	20	9.1.2	The Chin . . . . .	46
3.2 The Maxilla . . . . .	21	9.1.3	The Alveolar Process . . . . .	47
3.2.1 The Maxillary Base and Its Anomalies . . . . .	21	9.1.4	The Muscle (Coronoid) Process . . . . .	47
3.3 The Alveolar Processes . . . . .	21	9.1.5	The Condyle and Its Function . . . . .	47
3.3.1 Anomalies of the Alveolar Processes . . . . .	22			
3.4 Abnormal Angulations . . . . .	22			
3.5 Long and Short Face . . . . .	22			
3.6 Open Bite Anomalies . . . . .	22			
3.7 Gonionism . . . . .	23			
<b>4</b>	<b>25</b>			
<b>Documentation for Diagnosis,     Treatment Planning and Follow-up</b> . . . . .	<b>25</b>			
4.1 Fundamentals Regarding Case Documentation . . . . .	25			
4.2 Who Provides These Documentation Data? . . . . .	25			
4.3 Clinical Investigations . . . . .	25			

10	<b>Clinical Experience Regarding the Influence of the Condyle on the Growth of the Mandible</b> . . . . .	49	12.2.1	Clinical Appearance of Unilateral H.H.	145
10.1	Condylar Hypoactivity . . . . .	49	12.2.2	Radiographic Findings of Unilateral H.H.	146
10.1.1	Bilateral Condylar Hypoactivity . . . . .	60	12.2.3	Variations in Unilateral H.H.	147
10.1.2	Unilateral Condylar Hypoactivity . . . . .	66	12.2.4	Differential Diagnosis of Unilateral Hemimandibular Hyperplasia . . . . .	148
10.1.3	Unilateral Congenital Mandibular Hypoplasia in Cases of Hemifacial Microsomia . . . . .	74	12.3	Bilateral Hemimandibular Hyperplasia	190
10.1.4	Hemimandibular Hypoplasia Due to Perimandibular Capemous Haemangioma . . . . .	80	12.3.1	Differential Diagnosis of Bilateral H.H.	194
10.1.5	Unilateral Condylar Hypoactivity Due to Condylar Damage by Adverse Factors in Early Childhood	94	<b>13</b>	<b>Hemimandibular Elongation (H.E.)</b> . . . . .	199
10.2	Growth of the Mandible After Removal of Condyle? . . . . .	113	13.1	Main Clinical Features . . . . .	199
10.2.1	Normal Growth of the Mandible After Removal of Condyle Destroyed Excessively Early in Childhood . . . . .	118	13.2	Unilateral Hemimandibular Elongation	199
10.2.2	High Condylar Activity Stops Hyperactivity Producing Excessive Hemimandibular Elongation with an Open Bite . . . . .	122	13.2.1	Nomenclature of H.E. . . . .	199
10.3	Growth Behaviour of Some Grafts to Mandibular Defects . . . . .	170	13.2.2	Radiographic Findings in Unilateral H.E. . . . .	200
10.3.1	Normal Growth of an Ilizarov Crest Graft Replacing the Ascending Ramus with the Condyle and Half of the Body in Childhood . . . . .	125	13.2.3	Treatment Guidelines for Uni- and Bilateral H.E. . . . .	201
10.3.2	Growth Behaviour of RB Grafts to the Mandible . . . . .	128	13.2.4	Differential Diagnosis of Unilateral H.E. . . . .	211
10.4	Deductions Drawn from These Clinical Cases . . . . .	132	13.3	Bilateral Hemimandibular Elongation . . . . .	212
			13.3.1	Differential Diagnosis of Bilateral H.E. . . . .	219
<b>Part II</b>	<b>Condylar Hyperactivity</b> . . . . .	137	<b>14</b>	<b>Hybrid (Mixed) Forms of H.H. and H.E.</b> . . . . .	251
11	Condylar Hyperactivity . . . . .	139	14.1	Treatment Guide Lines for H.H. and Hybrid Forms . . . . .	309
11.1	Introduction . . . . .	139	14.1.1	Treatment During the Hyperactivity Phase . . . . .	309
11.2	Three Types of Condylar Hyperactivity	139	14.1.2	Treatment After Growth Activity Has Ceased . . . . .	310
11.3	Nomenclature for Condylar Hyperactivity Forms . . . . .	140	14.1.3	Orthodontic Treatment . . . . .	310
11.4	Forms of the Condyles . . . . .	140	<b>15</b>	<b>Bilateral Combination Forms</b> . . . . .	311
11.5	Hypothesis of Pathophysiology . . . . .	140	<b>16</b>	<b>Hemifacial Hyperplasia</b> . . . . .	311
11.6	Aetiology of Condylar Hyperactivity . . . . .	141	<b>17</b>	<b>Mandibular Growth Anomalies in Acromegaly</b> . . . . .	319
11.7	General Surgical Treatment Considerations . . . . .	142	<b>18</b>	<b>Histology of Condyles in Mandibular Growth Anomalies</b> . . . . .	347
11.8	General Orthodontic Treatment Considerations . . . . .	143	18.1	General Considerations . . . . .	347
11.9	Prognosis . . . . .	144	18.2	Normal Condyles in Different Age Groups . . . . .	347
12	<b>Hemimandibular Hyperplasia (H.H.)</b> . . . . .	145	18.3	Condyles in Mandibular Growth Anomalies . . . . .	350
12.1	Historical Cases . . . . .	145	18.3.1	Condylar Hypoactivity . . . . .	350
12.2	Unilateral Hemimandibular Hyperplasia	147	18.3.2	Condylar Hyperactivity . . . . .	351
			18.3.3	Hemimandibular Hyperplasia . . . . .	351
			18.3.4	Hemimandibular Elongation . . . . .	352
			18.3.5	Hybrid Forms . . . . .	353
			18.4	Summary . . . . .	353

<b>Part III Principal Surgical Procedures</b> . . . . .	357	21.5.2	The Lower Two Thirds of the Facial Skeleton . . . . .	398	
19	Principal Standard Operation Techniques and Instruments . . . . .	357	21.5.3	The Whole Facial Skeleton . . . . .	361
20	<b>The Sagittal Splitting of the Mandible Procedure</b> . . . . .	359	21.6	My Final Version of the Le Fort I Type Mobilization . . . . .	404
20.1	Historical Background . . . . .	359	21.6.1	Narrowing and Widening the Maxilla . . . . .	407
20.2	My First Two Cases of the Sagittal Splitting Procedure . . . . .	361	21.6.2	Mobilizing and Repositioning the Maxilla in Sections . . . . .	408
20.2.1	My First Attempt . . . . .	362	21.6.3	Advantages for the Nose . . . . .	410
20.2.2	The Best-First Sagittal Splitting Procedure on the Ascending Ramus . . . . .	364	21.6.4	Simultaneous Nasal Correction . . . . .	412
20.3	The First Sagittal Splitting Procedure Under General Anesthesia . . . . .	367	21.7	Principal Complications, How to Deal with Them and How to Avoid Them . . . . .	412
20.4	Modifications and Further Development of the Procedure . . . . .	371	21.7.1	Influence on Speech Quality . . . . .	414
20.4.1	Dr. Point's Alteration of the Direction of the Lateral Cortex Cut . . . . .	371	22	<b>The Transoral Chin Correction</b> . . . . .	417
20.4.2	The Incomplete Sagittal Splitting of the Ascending Ramus . . . . .	372	22.1	Theoretical Background . . . . .	417
20.4.3	The Long Lateral Surface Splitting of the Horizontal Ramus . . . . .	373	22.2	My Final Method . . . . .	418
20.1.1	The Sagittal Splitting Procedure for Elongation of the Mandible for Its Horizontal and Vertical Dimensions . . . . .	373	22.3	Principal Complications, How to Deal with Them and How to Avoid Them . . . . .	421
20.1.2	The Circular Splitting of the Mandible After I. A. Obwegeser . . . . .	375	22.3.1	Problems During Surgery . . . . .	421
20.1.3	The Transoral Angle Osteotomy . . . . .	373	22.3.2	Problems After Surgery . . . . .	422
20.1.4	My Technique for Many Years . . . . .	377	22.3.3	Deep Frozen Bank Bone . . . . .	423
20.1.5	Principal Complications and How to Deal with Them, and to Avoid Them . . . . .	381	23	<b>Masseter Muscle Hypertrophy and Bony Surplus</b> . . . . .	424
20.1.6	Terminology of the Sagittal Splitting Procedure . . . . .	384	23.1	Clinical Findings . . . . .	425
21	<b>The Le Fort I Type Mobilization Procedure</b> . . . . .	387	23.2	Historical Background . . . . .	427
21.1	Terminology . . . . .	387	23.3	My Technique Since 1983 . . . . .	428
21.2	Historical Background . . . . .	387	23.4	Principal Complications, How to Deal with Them and How to Avoid Them . . . . .	431
21.3	Steps in the Development of the Le Fort I Type Standard Operation Technique . . . . .	387	23.4.1	Problems During Surgery . . . . .	432
21.3.1	The All-Decision Case . . . . .	389	23.4.2	Problems After Surgery . . . . .	433
21.3.2	The Final Step: Bone Grafts to the Osteotomy Defects . . . . .	391	24	<b>Tongue Reduction</b> . . . . .	434
21.3.3	Closing the Defect of a Missing Tooth . . . . .	393	24.1	Theoretical Background . . . . .	434
21.3.4	Deep Frozen Bank Bone in Maxillary Advancement . . . . .	394	24.2	Definition and Classification of Macroglossia . . . . .	434
21.4	First Case of Simultaneous Advancement of the Maxilla and Repositioning of the Mandible . . . . .	394	24.3	Surgical Problems . . . . .	435
21.5	Modifications and Further Progress . . . . .	396	24.4	Results . . . . .	436
21.5.1	Kotter's External Osteotomy of the Maxilla . . . . .	397	24.5	As I Always Did It . . . . .	436
			24.6	Complications . . . . .	436
			24.7	Consequences . . . . .	436
			25	<b>Instruments</b> . . . . .	437
			25.1	Where to Obtain the Instruments at Checked Quality . . . . .	439
			References . . . . .	441	
			Subject Index . . . . .	447	

## The Basics

# How I Became a Cranio-maxillofacial Surgeon

## My Debt of Gratitude to My Teachers

If we had to learn everything by ourselves autodidactically just by reading and watching, a school would never develop. An active teaching school is the most rapid and effective means of transference of skills and knowledge and instillation of motivation to further progress, both for the individual and the profession generally. There may be the occasional genius. But the majority of people need teaching in order to assimilate the basic knowledge or skills for their future profession.

When I had completed my medical studies, I started as an assisting doctor number one in the small hospital of my rather small home town. The director of the hospital in 1945 was the surgeon, not the administrator. I could watch operations in almost all surgical fields including treatment of fractures of the extremities, then followed by excision, repositioning, followed by plaster or Paris immobilization. I did not know in which direction my medical training should go.

## Hermann von Chiari, M.D. (1897–1969) (Fig. A), My Teacher in Pathology and Microbiology

When I discussed my possible future with an uncle of mine, an orthopedic surgeon who had trained in Vienna for more than 10 years, he said: "Whatever you want to become, a general medical practitioner in a small town or a specialist in any field of medicine, you will always need a fundamental knowledge of pathology and pathophysiology." I wanted to follow my uncle's advice and decided to go to the Institute of Pathology in Vienna. This was in October 1945. Austria was divided into four occupied districts. I lived in the most western section, occupied by the French. In travel to Vienna, I had to pass the American and the Russian occupied parts of Austria. Vienna itself was also divided into four sections. It took me 5 full days to travel to Vienna by train. Lodging was offered to me by the grandmother of a little boy, a refugee from Vienna, whom I had taken care of while he was receiving treatment in my small hospital for a metastatic osteomyelitis of a femur without antibiotics which were not available in Austria in those days. Through that connection I was certain to have a bed on arrival in Vienna.

The day after my arrival I went to the world famous Rokitansky Institute of Pathology of the University of Vienna. It is that institute where Landsteiner and Wiener had identified the four blood groups. The old building was very crowded. There was not enough room for all the students who wanted to listen to the lectures of Professor Chiari. The autopsy rooms were crowded with students and Austrian and foreign doctors who had returned from the war.

My intention was to train in pathology and microbiology for about 2 years. When I asked Prof. Chiari whether I could train with him he said yes, but in a limited capacity only, as there were too many applicants. I became applicant number 10 in an unpaid position. I stood around the dissecting tables and watched and listened. I had no chance to do anything myself for more than a month. Then Prof. Chiari and his coworkers would occasionally let me assist or even do a part of the dissection. Most of the cadavers were elderly patients who had died of pneumonia or a cardiac problem or of cancer. A lot had suffered from malnutrition. Every day we received a cup of Russian peas. That was our daily



Fig. A. Professor Hermann von Chiari



position. Whatever was available on the ration cards was not enough to survive on. Additionally, one had to have money to buy something on the black market. As I had no salary I had to find other ways to earn money. The black market was the great chance. It did not take me long to find out that I was absolutely protected for earning that type of income. So, I decided to give extra-education courses to students as a help in preparing them for the final examination in microbiology and general pathology. These courses were, and still are, quite common in Vienna. By doing that I earned the necessary money to pay for the bit of rationed food and for some additional food from farmers.

After working at that institute for a year as a visiting doctor I was promoted to a paid position. Pathology and pathophysiology fascinated me. Prof. Chiari liked my enthusiasm. One morning there was a cadaver of a 66-year-old patient who had died from Henoch-Schönlein purpura. Prof. Chiari invited me to find the aetiology of that disease as it was still unknown. Three possibilities had been discussed. I had to take specimens from every organ and in particular from the intestine with its severe bleedings from which the patient had died. The technicians prepared all the histological sections with the different types of staining which I saw with them in my study studying them under the microscope every day. I couldn't find anything suggestive of a possible cause for the severe bleeding in all organs and tissues. After 3 months Prof. Chiari offered me half an hour to discuss the problem of the case with him. He also searched through many slices. Then he said: "I do not find anything myself either, but the patient died of that disease. Go back into your study and find the aetiology". I looked through these slices every day again and after 5 more months I went to Prof. Chiari once more and told him that I still could not find anything. He himself put a number of slices under the microscope and found nothing either. Again he said: "The patient has died of that disease and you will go back into your study and find the cause". Every day I searched for something which I did not know. After some more months I found, in many slices of all different organs, skin, intestines, brain, kidneys, heart, musculature, etc. all the classic stages of a leugy of the small arteries. Prof. Chiari confirmed my findings and agreed with my diagnosis. I was then very proud of having discovered the aetiology of this disease (Owens 1963).

Pathology and pathophysiology had become like a crime story without an end to me. I wanted to stay on. But circumstances caused me to find another field of interest in medicine. Almost the whole staff of the Institute of Pathology in Vienna became infected by some type of tuberculosis, some of the lungs, as the food available in those days was very insufficient and others acquired skin tuberculosis of their hands as we had no rubber gloves for use when dissecting the cadavers. After

2 interesting years of learning under Professor Chiari I thought I ought to leave before I myself acquired such an infection. In those days (1947) there were still no antibiotics available against tuberculosis in Austria. I had experienced the efficacy of penicillin when I worked in the section of microbiology of that institute. It was in 1946 when an American team demonstrated tubalaser as anaesthesia for the first time in Vienna. The team had also brought penicillin. They injected a dose of 50,000 units to a patient with chronic gonorrhoea from whom the section of microbiology of our institute had cultured the bacterium *Neisseria gonorrhoeae* as proof of the disease. With one dose of 50,000 units of penicillin the patient was cured of his disease. *Unförgesslich!*

I wanted to train in internal medicine. I thought my background in general pathology would give me a good basis for that speciality, which I considered as the queen of all medicine. In spite of my former training in general surgery for almost 1 year and 2 years in pathology and the support of Prof. Chiari I received only a negative reply to my application for a paid training position in one of the two clinics of internal medicine at the University of Vienna. My next choice was gynaecology and obstetrics. I received the same negative reply. Everywhere there was a long list of applicants.

#### **Richard Trauner, M.D., D.M.D (1900–1980) (Fig. 8), My Teacher in Maxillofacial Surgery**

At the Institute of Pathology I was responsible for the photomicrography. In 1946/1947 the equipment was still old-fashioned. Photomicrographs were taken in the



Fig. 8. Professor Richard Trauner.

same way as was done before the war. We also made them for other specialities. Richard Trauner, a surgeon and nephew of Hans Pirkles, the famous pioneer in our speciality, who influenced the development of maxillofacial surgery with his Viennese school, not only in Austria and Italy, but also in all the east European and the Balkan countries, wanted to publish his work on fibrous diseases of the jaws. For that he needed photomicrographs. That was how we met. He had just been appointed chief of the Dental School of the University of Graz with its maxillofacial surgery department. He offered me a paid position for training in maxillofacial surgery if I would agree to come with him to Graz University. Besides, I could do my dental training for the Austrian dental qualification. In those days dentistry in Austria was a sub-speciality of general medicine which required two additional full years of dental training followed by an examination. I accepted Trauner's proposal, as dentistry offered me the fastest way to earn my own living. I had no intention of staying on in maxillofacial surgery. I wanted to go forward. This is why I needed a safe course. As I found more than average training important to establish myself in the profession, I did additional training in all fields of dentistry as well as working in maxillofacial surgery.

R. Trauner opened our eyes regarding the scope of our speciality and stimulated us to see problems and find solutions for them. Through his enthusiasm for the various fields of maxillofacial surgery I also became more interested in it and continued with my training. It had never been my intention to become a university teacher. Finally I was on the road. Trauner was far-sighted. He sent us to other places to watch and learn. He himself had great experience in jaw pathology. He was also well known for his cleft lip and palate work.

At the department of maxillofacial surgery of the University Hospital at Graz, Austria in those days, the main subjects were primary clefts, cancer cases and any number of patients with facial traumas and there were also still some cases with severe facial war injuries. Altogether I trained 6 years with R. Trauner. He was not only a teacher to us residents but also like a father.

### Sir Harold D. Gillies, M.D. (1882–1960) (Fig. C), My Teacher in Plastic and Reconstructive Surgery

To improve the soft tissue reconstructive work on our war and cancer cases, I moved on late to Sir Harold D. Gillies. The British Council enabled me, with a scholarship, to learn from the founder of modern plastic and reconstructive surgery.

In October 1935 I went to Basingstoke, south-west of London, where Sir Harold worked at the Plastic and Jaw Unit at Rooksdown House, an old mental hospital. Pri-

marily he was a specialist in ENT who developed an interest in facial reconstructive work. He worked mainly on the reconstruction of war cases, together with Norman Rose who was in charge of the oral surgery section. My knowledge of the English language was what I had learned at school and never practiced for 13 years. Sir Harold was a New Zealander with a heavy Scottish accent. I could not understand what he said.

There was also a Norwegian oral surgeon, Maynard Kramer, as a trainee who had already been with Sir Harold before for a longer period. He spoke perfect English. I could understand him a lot better. After 3 days he asked me where I came from. When I told him that Richard Trauner from Graz in Austria was my chief he asked whether he was that Trauner who had published three volumes on oral and maxillofacial surgery together with Hans Pirkles. After my positive reply his face became very friendly and from then on he spoke to me in perfect German. He had done his dentistry in Leipzig. Often we played table tennis together and were very good friends until he died, much too early.

At Rooksdown House I also met Ralph Millard and his Pitangy and many other foreigners who later became rather famous plastic surgeons in their home countries where they built up their own schools, passing on to their pupils what they had learned from Sir Harold.

Sir Harold was a genius. He was a brilliant teacher, very clear and systematic. While watching him during his operations, he asked me to write down the principles which came into his mind while doing his work (H.G. Gillies 1952; H.G. Gillies and R. Millard 1957). From him I learned how to plan the reconstruction of a facial defect and how to handle soft tissues. He liked to teach in



Fig. C. Sir Harold Gillies

principles, many of them are still of general value in any field of surgery." *Before planning the reconstruction of a defect, replace into normal position what is normal and stabilize it there. That allows you to see the actual defect.* He hated the use of toothed forceps for holding a skin flap. "Every grip with it will kill you. Use finger hooks only". He taught us how to undermine the skin to create a much larger flap. When I came home I used that undermining technique in producing a new procedure for vestibuloplasty in prosthodontic surgery. I called it "the mucouscous vestibuloplasty procedure". From Sir Harold I learned so many principles and techniques that without the training with him I could not have treated so many difficult cases as successfully as I did.

It was fascinating not only to learn from him professionally but also privately. As I could not afford to travel home to Austria for Christmas he very kindly invited me to his family Christmas party. I was very grateful that I did not need to be alone on Christmas Eve. Occasionally he took me to his house and we worked together on his very small private golf course. For professional reasons I would have loved to have stayed on for a long or period, particularly as he had invited me to join together with him and Ralph Millard in writing the book they had planned on "Principles and Art of Plastic Surgery". After a month I had to leave for home as my child number three was already 3 months old and had not yet seen her father. For it Sir Harold later again several times. I will forever remain grateful to him.

#### **Eduard Schmid, M.D., D.M.D. (1912–1992)** (Fig. D), **My Teacher in Technical Details**

Eduard Schmid had trained with Wassmund for 2 years and started after the war from nothing to build up a department of facial reconstruction at the Marier-Hospital in Stuttgart. Hauser had sent me to him twice for a month. According to the results in reconstruction of facial injuries from the war which he had shown at annual meetings of the German Association of Maxillofacial Surgery, he seemed to be the best man in this field in the German speaking area. He could sit beside a patient for an hour, still seeking the best way to produce what he wanted to achieve. From him I learned that with delay operations the blood supply could be trained to go where wanted.

Unforgettable, how he used the whole covering of the pharyngeal wall to reconstruct a total defect of the soft palate. He placed thin slices of perforated cartilage underneath that pharyngeal mucosa. Three months later he raised the mucosa including the cartilage and an adherent soft tissue layer and put mucosal grafts, taken from the cheeks underneath, as a second lining for that flap which later had to become the soft palate. When a few weeks later he fixed the pharyngeal flap to the pos-

terior rim of the palatal defect, that flap could not shrink, neither in length nor in width. With that type of pharyngoplasty the patient could then speak again. This technique of training the blood supply I used when a patient of mine had managed to damage the whole palatal mucosa in a cleft case so badly that it necrotized completely. He had tried unsuccessfully to mobilize that cleft maxilla with two Rowe's distraction forceps. The cleft was open again the full length of the hard palate. I covered the raw palatal bones with vaseline gauze, kept in place by an acrylic plate.

After some weeks spontaneous secondary epithelialization covered the bony parts. It was a mucosa without any anastomous vessels, of no use to produce flaps to close the open palatal cleft. With the technique of Eduard Schmid I managed, step by step, to get a blood supply to that mucosa from the soft palate. After a few delay operations I was able to raise the secondarily epithelialized mucosa as flaps on both sides to closing the cleft defect.

Eduard Schmid was not only a master in soft tissue matters but also a pioneer in bone work. In maxillary defects, he first reconstructed the missing soft tissue, mostly with local skin flaps and then implanted iliac crest bone via the oral route to build up the maxilla so that it could support a denture again. This was before antibiotics were available to him.

It seems hardly understandable that nowadays an extraoral approach is still frequently used for reconstruction of defects of the horizontal and ascending ramus, producing scars on the face when they are not necessary.



Fig. D. Professor Eduard Schmid

### Paul Tessier, M.D. (Fig. 1), My Last Teacher and Personal Friend

A good way to learn is by watching others. Those I would not call my teachers. My teachers are persons from whom I learned very important practical techniques. From Paul Tessier I have learned the principal technique for advancing the whole middle third of the face and also how to rotate the eye sockets into the planned position. No other surgeon working on the facial skeleton has opened such new important possibilities for correcting anomalies, posttraumatic or congenital, of the upper half of the facial skeleton as he has done. As mentioned later, I worked on the Le Fort III advancement myself and I guess, I might have finally succeeded, but I am not sure whether in such a clean way as Paul Tessier did. In addition to that, his cranial approach to the orbits via the anterior base of the skull has created the possibility of producing a normal appearance and with that a normal life for many patients. Before these new techniques were developed people were condemned to live with the disfigurement they had. His new procedures were the gateways for further ideas and improvements, some by himself and some by others.

What a wonderful gift it is that nowadays we can make normal faces out of many very disfigured ones. This is due to the fact that we can correct any deformity in the lower half of the facial skeleton as well as in its upper half. For the fact that Paul Tessier taught me his procedures shortly after having developed them, I will always be grateful to him and call him my last teacher. Why a surgeon who has created such procedures which enable him and many others to give prerequisites to a normal life to so many patients should not be eligible for a Nobel Prize I do not know. In my and many other surgeons' opinion Paul Tessier's ingenious surgical developments and innovations would well deserve it.

In my opinion it is due to my fundamental basic training in medicine and dentistry and due to my teachers' influence that I was able to produce new ideas and procedures, some of them in contrast to the then existing ones. The influence of my teachers enabled me to become a teacher myself. It enabled me from 1938 until 1987 to establish the so-called Zürich-School of Maxillofacial Surgery.



Fig. 1. Müstean, a Doctor - Paul Tessier and E. Müstean, a group photograph of Maxillofacial Surgery 1979 at Zürich. Photo: E. Müstean, a member of the founding of the European Association of Maxillofacial Surgeons.

## Introduction

The facial appearance is the result of the size and position of its various bones and how they fit together and the investing soft tissues. The mandible plays a special role in this appearance. It is the only moving part of the facial skeleton, and not only of special importance for chewing and speech, but also in the aesthetic appreciation of the face and its expressiveness. Its form in its resting position as well as in its movement is very important in its assessment. The size and position of the maxilla is also very important from the aesthetic point of view as well as function. The growth of the mandible and in particular its growth and developmental anomalies can influence the maxilla in its development and when abnormal can have a very negative influence on chewing and speech function.

It is evident that the zygoma, the nasal framework and the forehead and the covering soft tissues also play a role in the appearance of the face. If they are divergent from the normal, the patient may also feel handicapped. However, they do play a much less important role in form and function than does the mandible, especially in its form and its position relative to the maxilla.

Because of its unacceptable variety in abnormal positions and dimensional possibilities, the main interest in treatment has long been focussed on the mandible. Today we are in a position to correct very satisfactorily almost every anomaly of position and shape of the mandible and the other parts of the facial skeleton with our facial dissections.

Correction of the position and form of the mandible must always lead to a result in which the teeth are in good occlusion with those of the maxilla. For that reason, almost all cases of anomalies in shape and position of the mandible are a surgical as well as an orthodontic problem in treatment planning.

There is no other bone in the whole human skeleton which can produce so many different typical growth anomalies as the mandible. Abnormal growth of the mandible leads to an abnormal shape and position, thus producing a more or less pronounced facial misfigurement. This may be due to the anomaly of the mandible only or, in addition, also due to a secondary abnormality in size, shape and position of the maxilla. While an abnormality of the mandible can have a strong influence on the development of the maxilla, the reverse does

not apply, even a very severely deformed maxilla as occasionally still found in secondary cleft deformities, may not have the slightest influence on the final shape and position of the mandible. This interesting fact makes it even more important to know the variety of the mandibular growth anomalies and to understand their pathophysiology.

The fact that no other bone in the whole human skeleton is capable of producing such a great variety of typical growth anomalies as does the mandible, is partially due to the fact that it consists of two halves which normally develop symmetrically, comparable to the long bones of the two halves of the body. The two halves of the mandible meet in the middle of the face, in the so-called mandibular symphysis, during the second year of life, in such perfection as if the mandible were one single piece of bone, only because of that may abnormal growth and growth development of one side consequently also influence the other side in its form and position. On the other hand, the great varieties of mandibular anomalies definitely depend on the very complex growth mechanism of the mandible. There is no doubt that each half of the mandible has its own independent growth regulation capacity which makes it possible that entirely different halves may develop, even without the influence of any external agent.

As there are several possible causes for the development of an asymmetric mandible, the various aetiological factors are of great interest. However, I do not intend to discuss and demonstrate cases affected by each possible known aetiology.

It is not always easy to make the right diagnosis immediately, although the deformities are so clearly differentiated in their anatomical structure. And yet elongation of the one half of the mandible may be diagnosed as such because the other half is shorter. However, it might be that the reverse is true!

For most mandibular asymmetries an aetiology can be found in the patient's history and in the radiological appearance of the mandible. But also asymmetrical mandible cases have always been observed for which no aetiology was known. Occasionally we saw the case with a mandible in which the affected side of the face was actually clearly longer than the normal side (Fig. 1a) and we saw rather frequently the type then called 'late-

ognathia or asymmetric prognathism (Fig. 1a). And even less commonly we saw the patient with a very twisted mandible producing a really very unpleasant facial appearance (Fig. 1c). This overgrowth may start at any time from childhood up until growth has ceased or even afterwards and these mandibular overgrowth asymmetries may be found in any degree of severity. For all other types of mandibular asymmetry an aetiology could usually be found.

For most of the patients, the reason for seeking help was the anomaly of the shape of the mandible or its asymmetry or even the asymmetry of the whole face. In some cases TMJ clicking or pain was the reason why the patient sought help. Some mentioned a possible trauma as the reason for the mandible to grow asymmetrically. If that were the case, the abnormal growth would have to have started soon after the trauma to the face or the chin and not several years later.

Not in every case to be demonstrated will the patient's general condition be mentioned. Only in those patients in whom there was obviously something wrong with the general health situation will I mention it.

Occasionally a hereditary aetiology was considered possible. This could only be true when the anomaly started during normal growth and not after general growth had ceased. The inherited anomalies of the mandible are never unilateral. The genetically fixed anomalies of the mandible are, in my opinion, not caused by misregulation of growth but are due to the genetic pattern they have to follow.

The cases I am going to use in this book were either operated upon by myself or by one of my trainees according to my planning. In most of the cases created by

corrective osteotomies, intermaxillary fixation and wire osteosynthesis were used as plates and screws for osteosynthesis in maxillofacial surgery were not then available in proper quality. This, however, did not influence the diagnosis nor the treatment planning and the result.

Most of my cases came from clinical seeking diagnosis only or treatment as well. For that reason most of the cases did not receive proper mesurgical orthodontics or even none at all. I still understand that many of those who read this book may want better final occlusal results and better arranged dental arches. I apologize for the fact that for teaching purposes I had to include many cases which I had to operate upon in spite of a lack of or poor pre- and post-surgical orthodontics.

I am certain all readers will agree that for the patient with a mandibular or facial asymmetry the most important wish is to have a normal earer appearance independent of whether he can find and afford a good orthodontist. *Patients with a facial anomaly primarily wish a normal appearance* (H.G.G. Gillies 1952) (Principle No. 1).

The documentation of the patients was done within the teaching programme of quite a large number of trainees. It is therefore understandable that often it is not complete. In many cases or insufficient records, I telephoned the patient in order to obtain more precise details of the patient's age when the anomaly was first noticed and of a possible cause.

The subject of mandibular growth is rather complex. This is also the case with the variety of its manifestations. For these reasons I will use quite a number of cases to demonstrate what is the clinician's experience with the subject of mandibular growth and even a greater

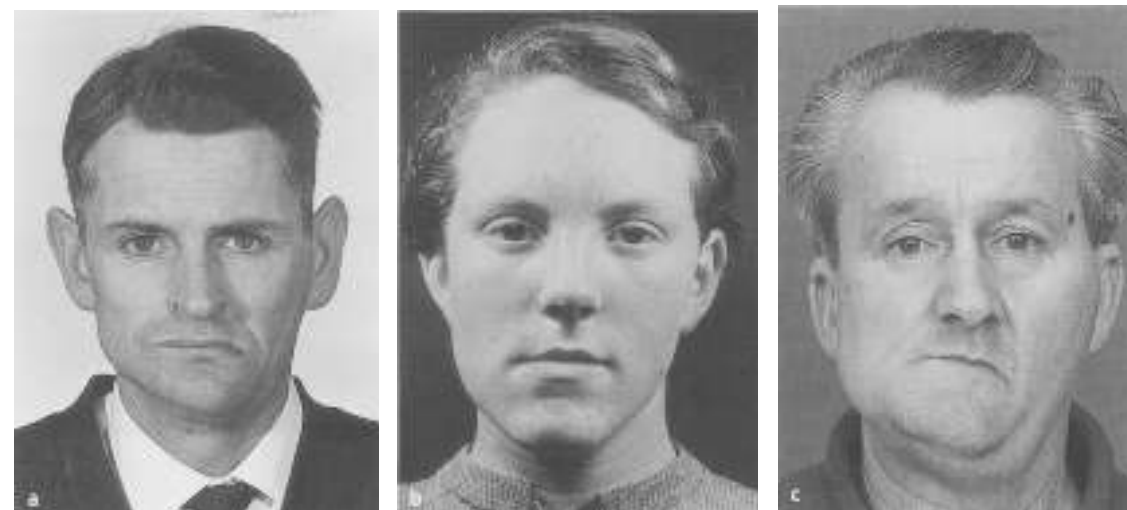


Fig. 1a-c. The three typical forms of mandibular growth misregulation due to an inherited anomaly: hyperplasia (H.H.), retrognathia (R.H.), and asymmetric prognathism (H.H. and H.R.).

number of cases to demonstrate the variety of manifestations of growth anomalies.

In the diagnosis and treatment planning, as well as in the execution of the necessary therapy I have learned from my teachers Richard Trauner, Conrad Selund and in particular from Sir Harold Gibbs, that the ability to adhere to proven principles is a great help. For that reason I have always tried to formulate my knowledge also in principles applicable to our field or world. I have often used them in postgraduate courses, in my daily teaching of trainees and visitors and in lectures. These and some of my teacher's principles will be incorporated in the diagnosis, planning, description of the cases and in the treatment.

The title of the book already defines its purpose. It has four goals. One is a clear terminology. We must have such a clear terminology for the various facial anomalies of the jaws. The terminology used should enable all specialties involved in the diagnosis and treatment to speak to each other in the same language. Secondly we want to know the aetiology of these growth anomalies. That means we want to understand their pathophysiology. I do hope that this subject will become clear for the reader by the demonstration of a great many possible variations. Thirdly, proper diagnosis is mandatory for treatment planning of any case of pathology. The large number of cases included should help to improve the reader's ability in diagnosing these mandibular growth anomalies. The fourth goal is the treatment of these cases. I will only give general treatment guidelines for

both the orthodontic as well as the surgical treatment. In every case which had been operated upon I will indicate what the treatment plan was and what was actually done.

I do not intend to discuss in every case why I planned the surgical correction of the anomaly in the way I executed it. I have learned that almost every surgeon has a better plan than his colleagues and also does the surgery better! Nowadays I might correct some of the cases differently than when I actually treated them. We should not forget that nowadays we often perform a bimaxillary repositioning. Repositioning the maxilla as we do it now has been used for about 40 years and it was in 1966 that I popularized that procedure for the first time during a postgraduate course at the Walter Reed Hospital.

Only in some of the cases will I report all of the details for didactic reasons. In many cases only those findings will be shown which are essential to make the diagnosis.

As the patient generally comes for improvement of his outward appearance it should be the experienced surgeon who suggests what kind of profile line and facial shape he wants to achieve. For that, he will have to move parts of the mandible and/or the maxilla into a position necessary for the desired result. The orthodontist will have to be asked for his help in arranging the dental arches in such a way that the surgeon can achieve a good forward appearance without being compromised in doing so because of the position of the teeth.

## Aetiology of Jaw Anomalies

The shape and position of the jaws is mainly genetically predetermined, although one has to accept a certain latitude in variations from what we may call a "normal" shape and position of the jaws. In spite of this, there are a large number of positions and shapes of the jaws which cannot be called normal. The causes of these anomalies can be classified into a very few groups. Each jaw anomaly can always be diagnosed as belonging to one of these groups:

- Genetic pattern
  - Embryonic disturbance of growth
- Perinatal damage before or after growth has ceased
- Abnormal growth regulation after birth
  - Other aetiology

### 2.1 How to Diagnose Jaw Anomalies

The diagnosis of an anomaly in shape and position of the jaws can not be done in an abstract way. It is only possible in relation to the whole form of the facial skeleton, from the front view as well as from the profile view. The form of the upper and lower jaws and their relationship to each other determine the profile in their relation to the base of the skull and the forehead. The three classical profile types, the Roman-Greek profile, also called the straight retroface (retrognathia), has to be accepted just as well as the so-called straight anteface (anteprofile) or also the middle value face which I call the vertical profile. In these three ideal profile types, the upper and lower jaws in their size and shape are in an ideal relationship to each other, however, in a different antero-posterior relationship to the prominence of the forehead. Which one is the ideal profile? It is mainly a problem unique to the patient, and for the diagnostician and the patient's acquaintances to answer this question. Some may favour the straight anteprofile better than the straight retrognathia or the vertical profile. The form of the face and the profile should always be in harmony with the general skeletal form of that person.

During my long clinical career, I have seen repeatedly the same or very similar deviations from the normal shapes and positions of the maxilla and the mandible in the symmetrical as well as in the asymmetrical forms. For the symmetrical aberrations in size, form and posi-

tion of the jaws, there was always the explanation of genetic predisposition independent of whether it was an ante- or retroposition or of a maxilla or mandible of normal or too large or small a size. With this argument, one could also explain the form of the body of the mandible, its ascending ramus and its gonial angle. The size and shape of the prominence of the chin seems to have the same aetiology and in addition they can be influenced by the anomaly of shape of the symmetrical form aberrations of the mandible.

For the asymmetrical forms, this explanation is not valid. Almost all of them have a clearly recognizable cause as long as they develop postnatally. The aetiology of these developing during embryonic growth is only partially known. However, there are embryogenetic as well as postnatally developing forms for which the aetiology is not known. The clinician has finally to deal with all groups. He is naturally very interested to know the cause in all types in order to be able either to prevent their development prophylactically or to "shift the switch" to allow early normal growth and development in the shape of the jaws to occur. These asymmetrical types are the ones which are so interesting to us because of their great variety.

### 2.2 Descriptive Terminology for Jaw Anomalies

#### 2.2.1 Problems with the Current Terminology

The existing terminology for positional and shape anomalies of the jaws has recently satisfied me. Just a few simple examples prove the unacceptability of the commonly used terms. Early in my career, one learned to speak about prognathism or mandibular prognathism without considering the position and size of the maxilla. This term includes the possibility of a real forward position of the mandible as well as a pseudo-forward position in the case with retroposition of the maxilla. Independent of the fact whether in such a case the maxilla is moved forwards surgically or the mandible backwards, or both towards each other, the resulting occlusion will always be the same but the resulting appearance of the face can differ very markedly. Since, in most



- [The Age of Reform pdf, azw \(kindle\)](#)
- [read online Materiality and Society](#)
- [Dump Cakes and More pdf, azw \(kindle\), epub](#)
- [download Vicious: Wolves and Men in America pdf, azw \(kindle\)](#)
- **[Darth Vader and Friends pdf](#)**
  
- <http://www.wybohaas.com/freebooks/Niceville.pdf>
- <http://conexdx.com/library/Materiality-and-Society.pdf>
- <http://academialanguagebar.com/?ebooks/Made-from-Scratch--Discovering-the-Pleasures-of-a-Handmade-Life.pdf>
- <http://www.celebritychat.in/?ebooks/Vicious--Wolves-and-Men-in-America.pdf>
- <http://econtact.webschaefer.com/?books/Darth-Vader-and-Friends.pdf>