

Contributors:

ACKERMAN
BURSTONE
GANS
GRABER
KALLAL
LINDQUIST
MAYNE
NEUMANN
PROFFIT
REITAN
RIEDEL
STONER
SWAIN

CURRENT
ORTHODONTIC
CONCEPTS AND
TECHNIQUES

Volume I

Edited by
GRABER AND SWAIN

T. M. GRABER, D.D.S., M.S.D., Ph.D.

*Professor, Departments of Biological Sciences,
Pediatrics, and Anthropology;
Chairman, Section of Orthodontics,
University of Chicago;
Director, Kenilworth Dental Research Foundation*

BRAINERD F. SWAIN, D.D.S.

*Adjunct Professor of Orthodontics
Department of Orthodontics and Pedodontics
School of Dental Medicine
University of Pennsylvania*

CURRENT ORTHODONTIC CONCEPTS AND TECHNIQUES

Second Edition

1975

W. B. SAUNDERS COMPANY
Philadelphia • London • Toronto

W. B. Saunders Company: West Washington Square
Philadelphia, Pa. 19105
12 Dyott Street
London, WC1A 1DB
833 Oxford Street
Toronto, Ontario M8Z 5T9, Canada

Library of Congress Cataloging in Publication Data

Graber, Touro M.

Current orthodontic concepts and techniques.

Includes index.

I. Orthodontia. I. Swain, Brainerd F. II. Title.
[DNLM: 1. Orthodontics. WU400 G728c]

RK521.G67 1975 617.6'43 74-11686

ISBN 0-7216-4187-3 (v. 1)
0-7216-4188-1 (v. 2)

Listed here is the latest translated edition of this book together with the language of the translation and the publisher.

Japanese (*1st Edition*)—Ishyaku, Tokyo, Japan

Current Orthodontic Concepts and Techniques

Vol. 1: ISBN 0-7216-4187-3

Vol. 2: ISBN 0-7216-4188-1

© 1975 by the W. B. Saunders Company. Copyright 1969 by W. B. Saunders Company. Copyright under the International Copyright Union. All rights reserved. This book is protected by copyright. No part of it may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without written permission from the publisher. Made in the United States of America. Press of W. B. Saunders Company. Library of Congress catalog card number 74-11686.

Last digit is the print number: 9 8 7 6 5 4 3 2 1

Dedication

For our co-editor and fellow author, Tom Graber, one of the significant events of 1975 will be his acceptance of the Ketcham Award from the American Board of Orthodontics and the American Association of Orthodontists. Another will be the publication of the second edition of this text on orthodontic concepts and techniques that he conceived back in the early 1960's.

For the other authors contributing herein, this fortunate coincidence of events enables us to convey our own congratulations and warm admiration to him with the conviction that his three decades of working toward a better level of dental practice are but part of an ongoing effort in which we wish him good luck and God speed. In token of these sentiments we dedicate this edition to our energetic colleague, Tom Graber.

JAMES L. ACKERMAN
CHARLES J. BURSTONE
BENJAMIN J. GANS
ROGER H. KALLAL
JOHN T. LINDQUIST
WARREN R. MAYNE

BEDRICH NEUMANN
WILLIAM R. PROFFIT
KAARE REITAN
RICHARD A. RIEDEL
MORRIS M. STONER
BRainerd F. SWAIN,
Co-editor

About Our Authors

JAMES L. ACKERMAN, D.D.S., is Professor of Orthodontics and Chairman of Orthodontics and Pedodontics at the University of Pennsylvania School of Dental Medicine in Philadelphia and Senior Dentist at the Children's Hospital of Philadelphia. Dr. Ackerman is an inspiring teacher and lecturer and a leader of orthodontic thought for the future. He is dedicated to training orthodontists to meet the increased demand for orthodontic treatment resulting from the growing number of government and other third party payment plans.
Diagnosis and Planning Treatment in Orthodontics

CHARLES J. BURSTONE, D.D.S., M.S., is Professor and Head of the Department of Orthodontics of the University of Connecticut School of Dental Medicine, and Professor in the Department of Mechanical Engineering of the University of Connecticut School of Engineering at Farmington. As a frequent contributor to the literature, including a number of other texts, and an articulate lecturer, Dr. Burstone is considered an outstanding authority on biophysical principles in orthodontics.
Application of Bioengineering to Clinical Orthodontics

BENJAMIN J. GANS, D.D.S., M.S., was formerly Associate Professor of Oral Surgery at Northwestern University Dental School and is now Chairman of the Division of Dentistry and Section on Oral and Maxillofacial Surgery at Michael Reese Hospital and Medical Center in Chicago. Dr. Gans' *Atlas of Oral Surgery* is one of the most widely used in the field.
Surgical Management of Orofacial Deformities

T. M. GRABER, D.M.D., M.S.D., Ph.D., is Professor of Biological Sciences, Pediatrics, and Anthropology at the University of Chicago; Chairman of Orthodontics at the Walter G. Zoller Memorial Dental Clinic; and Director of the Kenilworth Dental Research Foundation. Dr. Graber is a recipient of the Albert H. Ketcham Award and combines teaching, clinical practice, research, and writing for a rather full professional life. His text, *Orthodontics: Principles and Practice*, is widely used by both students and practitioners.
Dentofacial Orthopedics

ROGER H. KALLAL, D.D.S., is Assistant Professor of Orthodontics at Northwestern University Dental School, and Oral Surgeon in the Dental Deformity Unit of Northwestern University Dental School, Northwestern Memorial Hospital, Michael Reese Hospital, and Cook County Hospital. Dr. Kallal conducts a busy clinical practice in addition to his teaching responsibilities.
Surgical Management of Orofacial Deformities

JOHN T. LINDQUIST, D.D.S., M.S., Visiting Lecturer in the St. Louis University Graduate Department of Orthodontics, is one of the most popular and erudite lecturers and clinicians in orthodontics. He has also played the roles of teacher and author and is eminently qualified to discuss mechanotherapy. *The Edgewise Appliance Today*

WARREN R. MAYNE, D.D.S., M.S.D., is a Lecturer in the Graduate Department of Orthodontics of Tufts University School of Dental Medicine in Boston. Dr. Mayne has a full-time orthodontic practice in Salem, Massachusetts, a suburb of Boston. In addition to this, he writes, does research, and tours the lecture circuit on his favorite subject—serial extraction. *Serial Extraction*

BEDRICH NEUMANN, M.D., is Chief Orthodontist at the Regional Hospital in Ostrava, Czechoslovakia. He is another member of the writing team for these volumes who is not satisfied with clinical practice alone. He carries on important research in cleft palate and writes for several foreign journals. His latest effort, with T. M. Graber, is a new book, *Removable Orthodontic Appliances*.

Removable Appliances

WILLIAM R. PROFFIT, D.D.S., Ph.D., is Professor and Chairman of the Department of Orthodontics at the University of North Carolina School of Dentistry in Chapel Hill. Dr. Proffit is known particularly for his superb diagnostic acumen. He has lectured abroad in both Europe and Asia. *Diagnosis and Planning Treatment in Orthodontics*

KAARE REITAN, D.D.S., M.S.D., Ph.D., is a Research Fellow on the Dental Faculty of the Institute of Experimental Research and Lecturer in Applied Histology in the Graduate Department of Orthodontics at the University of Oslo, Norway. Dr. Reitan, who is to be a recipient of the Ketcham Award, has had a distinguished career in orthodontics as both a researcher and a clinician. His training, both in the United States and in Norway, and his prolific research and writings make him the foremost spokesman of his specialty—tissue changes. He has personally trained a number of his confreres in orthodontic clinical procedures, while carrying on his research and private practice. *Biomechanical Principles and Reactions*

RICHARD A. RIEDEL, D.D.S., M.S.D., is Professor and Chairman of the Department of Orthodontics of the University of Washington in Seattle and a Consultant at the University Hospital. Teacher, writer, lecturer, and researcher, but, above all, clinician, Dr. Riedel has appeared on many programs in this country and abroad. *Retention*

MORRIS M. STONER, D.D.S., M.S., is Professor of Orthodontics at Indiana University School of Dentistry in Indianapolis. Like Dr. Lindquist, he is from Indianapolis and has an extremely demanding professional career as teacher, clinician, and author. His work, like that of the other contributors, is internationally recognized. *The Edgewise Appliance Today*

BRAINERD F. SWAIN, D.D.S., is Adjunct Professor of Orthodontics at the University of Pennsylvania School of Dental Medicine in Philadelphia and a Consultant at the Morristown Memorial Hospital in New Jersey. He qualifies in the expert category as clinician, teacher, author, and developer of more efficient armamentaria and methods of using them. He has found time to do all these things well and still be active in guiding the affairs of orthodontic societies.

The Begg Technique

Preface

Textbooks are written these days for a number of reasons. One of the more important is the "publish or perish" dictum that haunts the academic community. In some areas, textbooks are good business, with a substantial financial return for both the author and the publisher. But these were not the reasons for the present two-volume work. The simple fact is that there has been no total graduate orthodontic text and the profession needs one badly. The undergraduate dental student is well supplied with several good texts that provide excellent and current information on growth and development, oral physiology, etiology and classification of malocclusions, and minor tooth moving techniques. But 400 graduate orthodontic students each year, not to mention the orthodontic practitioners, must "make do" with a collection of the same texts, augmented by several of the cult-oriented, esoteric "systems" books that have been published in the last ten to fifteen years. At present there has been no single text which adequately serves the needs and interests of clinicians, orthodontic specialists, and students, except the first edition of this work.

The editors of this book feel strongly that there is more than one way to arrive at what Berçu Fischer called the "achievable optimum." Too often, the orthodontist has been looking for the solution to his orthodontic problems like a horse with blinders. After all, dentists are applied biologists . . . or we would like to think we are. Even if we prefer a particular mechanism or technique to achieve our therapeutic objectives, we should be aware that there are "other ways to Rome." One of the dangers of an orthodontic bible and cookbook combination is that we find too many men attempting to find all their answers in the same recipe. Too many of us have been guilty of overzealously striving to "out-Tweed" the master, or practicing 200 per cent Begg technique, without that ingredient of discretion that the master himself used to develop his technique.

Dogma fosters the Pied Piper syndrome of "following the single leader." By contrast, we have made a sincere effort to present a team approach in these two volumes. It is our hope that the net result will be a real contribution to orthodontics by virtue of presenting a broad spectrum of mechanotherapy measures through objective analyses of the current "popular and choice" techniques by orthodontists who are recognized by their conferees as distinguished clinicians. Each man on this team has literally searched his orthodontic soul in an effort to show both sides of the coin, the potentials and the limitations, the good and the bad, the sequential steps and the precautions—stripping away the "Chamber of Commerce" aura. The result of this coordinated conjoint endeavor is a compendium of orthodontic knowledge that is uniquely complete and practical.

For those who might conceive of orthodontics as a series of mechanical maneuvers, Chapter 1, *Diagnosis and Planning Treatment in Orthodontics* by James L. Ackerman and William R. Proffit, should clearly establish that the order of the day requires the synthesis of manifold factors into a discrete list of problems, each defined so clearly that the plan of treatment becomes evident.

Chapter 2, *Biomechanical Principles and Reactions* by Kaare Reitan, is the most complete and current contribution on tissue changes that exists. This is just one of several chapters in the book that would stand by themselves as a text. Dr. Reitan is both a renowned researcher and a clinician. The material has potent clinical implications in the discussion of the reaction of teeth and investing tissues to different types of force, to varying amounts of force, and to varying periods of force application.

Chapter 3, *Application of Bioengineering to Clinical Orthodontics* by Charles J. Burstone, elucidates the broad application of the physical sciences to living tissues. This chapter concerns itself with the biophysics of the orthodontic appliance as we ask ourselves the question, "Can theoretical mechanics help us in the design and the clinical manipulation of an orthodontic appliance?" It is here as well as in Chapter 2 that many of the common denominators of all orthodontic techniques are found.

Chapter 4, *Serial Extraction* by Warren R. Mayne, demonstrates convincingly the phenomena of self-adaptation and homeostasis as well as the application of principles developed in the first three chapters. The tissue system orientation organizes the thinking of the reader for all mechanotherapies. Clinical results are profusely illustrated to demonstrate how biologic guidance and appliances may be successfully combined to produce the best possible result.

The last six chapters are largely oriented on a complete "how to do it" basis, applying the principles propounded in the first four.

Chapter 5, *Dentofacial Orthopedics* by T. M. Graber, recognizes that we are working with more than the tooth system—that the bone system and neuromuscular systems are equally important, with the tooth system often reflecting basal bone morphology and spatial relationships as well as neuromuscular activity. The author presents a pragmatic approach to growth and development guidance for two thirds of the cases being treated by the average orthodontist.

Chapter 6, *The Edgewise Appliance Today* by John T. Lindquist and Morris M. Stoner, incorporates the latest clinically tested modifications of the technique that was originally introduced by Edward H. Angle. As far as we know, when combined with the first four chapters on this text, the Stoner-Lindquist section provides the most complete presentation anywhere on the most widely used fixed appliance philosophy today. Careful study by both the clinician and the graduate student will provide immediate practical benefits and prevent many of the problems encountered by the novice.

Chapter 7, *The Begg Technic* by Brainard F. Swain, again would stand as a book by itself. It is a meticulously objective clinical analysis of the intimate details of a major orthodontic mechanotherapy. The essential details of all three stages of therapy are presented and profusely illustrated by twenty-three case studies. As with the other chapters, the finished product is the result of long personal clinical experience and teaching.

Chapter 8, *Removable Appliances* by Bedrich Neumann, demonstrates that removable appliances follow the same rules and seek essentially the same goals as fixed appliances. An objective and analytic appraisal of the prime

"schools of thought" will prepare the practitioner to interpret and meet the current socioeconomic and third party demands for increasing orthodontic services. As an "elder statesman" of European orthodontics, Dr. Neumann is admirably qualified to discuss the potential of removable appliances in the United States today.

Chapter 9, Surgical Management of Orofacial Deformities by Benjamin J. Gans and Roger H. Kallal, stresses yet another essential facet of patient service in our "face conscious" society. Orthognathic surgery has "come of age" with the tremendous advances of the last decade. It is entirely proper that the two specialties of dentistry most concerned with orofacial deformities and improvement of function work hand in hand on the advancement of this fascinating field, permitting correction of jaw relationships, facial contours, abnormal proportions and dimension of facial structures that would not be amenable to orthodontic procedures alone.

Chapter 10, Retention by Richard A. Riedel, accepts the challenge of Albin Oppenheim who said, "Retention is the most difficult problem in orthodontics; in fact, it is *the* problem." Riedel combines clinical experience, research endeavors, and a lifetime of teaching graduate students in orthodontics, to give significant guidance, not only in the "after treatment" but also in actually achieving the treatment objectives.

The first edition of this book required eight years of writing and rewriting, coordination, and exhaustive study of many areas, so that we were able to include those aspects we felt most important for the graduate student. An additional five years has been spent in continuing the process of nurturing, pruning, weeding, and incorporating the latest and the best, so that we can say in all sincerity, "We have done our best. But this is only the beginning. Use this book well and make it live." Since the publication of this two-volume work coincides with the celebration of the 75th anniversary of the American Association of Orthodontists, those words that appear on the cornerstone of the Bureau of Archives in Washington seem most appropriate: "The heritages of the past are the seeds that bring forth the harvest of the future."

The authors express their appreciation to the staff of W. B. Saunders Company, with special thanks to Mrs. Donna Musser, who managed to initiate herself simultaneously into orthodontic treatment and the editing of an orthodontic text.

T. M. GRABER
B. F. SWAIN

Contents

Volume I

Chapter 1	
DIAGNOSIS AND PLANNING TREATMENT IN ORTHODONTICS	1
<i>James L. Ackerman and William R. Proffit</i>	
Chapter 2	
BIOMECHANICAL PRINCIPLES AND REACTIONS	111
<i>Kaare Reitan</i>	
Chapter 3	
APPLICATION OF BIOENGINEERING TO CLINICAL ORTHODONTICS	230
<i>Charles Burstone</i>	
Chapter 4	
SERIAL EXTRACTION	259
<i>Warren R. Mayne</i>	
Chapter 5	
DENTOFACIAL ORTHOPEDICS	365
<i>T. M. Graber</i>	
Chapter 6	
THE EDGEWISE APPLIANCE TODAY	453
EVOLUTION AND DEVELOPMENT OF THE EDGEWISE APPLIANCE ...	453
<i>John T. Lindquist</i>	
THE CONCEPT OF THE IDEAL ARCH	456
<i>Morris M. Stoner</i>	
THE IDEAL ARCHWIRE	461
<i>Morris M. Stoner</i>	
ORTHODONTIC BANDS	475
<i>John T. Lindquist</i>	

ATTACHMENTS	502
<i>John T. Lindquist</i>	
WIRE: CLINICAL CONSIDERATIONS	514
<i>Morris M. Stoner</i>	
TOOTH MOVEMENT	543
<i>Morris M. Stoner</i>	
FORCE SYSTEMS	556
<i>Morris M. Stoner</i>	
EXTRACTION TREATMENT	572
<i>Morris M. Stoner</i>	
TREATMENT OF CLASS II NONEXTRACTION CASES	615
<i>John T. Lindquist</i>	

Volume II

Chapter 7	
THE BEGG TECHNIC	665
<i>Brainerd F. Swain</i>	
Chapter 8	
REMOVABLE APPLIANCES	992
<i>Bedrich Neumann</i>	
Chapter 9	
SURGICAL MANAGEMENT OF OROFACIAL DEFORMITIES	1049
<i>Benjamin J. Gans and Roger H. Kallal</i>	
Chapter 10	
RETENTION	1095
<i>Richard A. Riedel</i>	
INDEX	1139

Diagnosis and Planning Treatment in Orthodontics

1

JAMES L. ACKERMAN and WILLIAM R. PROFFIT

Diagnosis in orthodontics requires the synthesis of manifold factors into a discrete list of problems each defined so clearly that the plan of treatment becomes evident.

The Decision Making Process in Orthodontics

DEFINITION OF ORTHODONTICS

The definition of orthodontics currently accepted by the American Association of Orthodontists states that:

Orthodontics is that area of dentistry concerned with the growth, guidance, correction and maintenance of the dento-facial complex, with special emphasis on developmental disturbances and those conditions that cause or require movement of teeth. The area of orthodontic practice includes the diagnosis, prevention, interception and treatment of all forms of malocclusion of the teeth and the associated alterations in their supporting structures; the design, application, and control of functional and corrective appliances; and the guidance of the developing dentition to attain optimum occlusal relations in physiologic and esthetic harmony with other facial and cranial structures.¹

In a general sense this is an excellent description of the scope of orthodontics as a modern specialty, and it emphasizes the biologic basis of orthodontics. It will be assumed in this chapter that the reader has a good understanding of the life sciences as they relate to orthodontics. *The Nature of Orthodontic Diagnosis* by Horowitz and Hixon² and *The Biologic Basis of Orthodontics* by Gianelly and Goldman³ are recommended reading in this regard. The major difference today between the orthodontist and the expanded-function orthodontic therapist is in the orthodontist's ability to utilize fundamental background information in assessing an orthodontic problem

and planning treatment based on this assessment.

The above definition of orthodontics does not serve as a very useful operational guide when planning treatment, however, because the explicit goals of orthodontic therapy are not emphasized. A more operational definition might be that the goal of orthodontic treatment is to obtain optimal proximal and occlusal contact of the teeth (occlusion) within the framework of acceptable facial esthetics and self-image, normal function (physiologic adaptation), and reasonable stability. Of course, each of these concepts has its own inherent problems of definition.

NORMAL OCCLUSION

Fundamental to orthodontic diagnosis is understanding the concept of "normal occlusion." Traditionally, any deviation from "ideal occlusion" represents what Guilford termed *mal-occlusion*.⁴ Of course, ideal occlusion rarely exists in nature and so perhaps it is better to call this concept the "imaginary ideal" (Fig. 1-1). Unfortunately, there is no clear-cut or acceptable definition of "normal occlusion," and thus much of our diagnosis in orthodontics is based on this highly arbitrary concept of the "imaginary ideal." For the orthodontist's view of ideal occlusion, the reader is referred to a recent paper by Andrews.⁵

Normal occlusion and malocclusion must

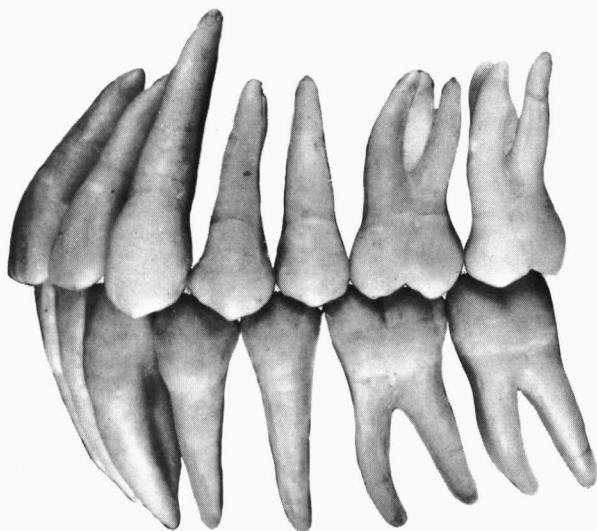


Figure 1-1 Buccal view of the teeth in "ideal" occlusion. This concept has not changed measurably in the last two centuries. (From Kraus, B. S., Jordan, R. E., and Abrams, L.: *Dental Anatomy and Occlusion, A Study of the Masticatory System*. Baltimore: Williams and Wilkins, 1969.)

be visualized as overlapping frequency distributions of various morphological traits (Fig. 1-2). Thus, varying degrees of occlusal harmony or disharmony must be understood as portions of a continuum rather than as discrete entities. For this reason the term malocclusion should not be interpreted as the antithesis of normal occlusion. Perhaps the concept of degrees of occlusal disharmony should be utilized rather than the polar terms of occlusion and malocclusion. The term malocclusion should be used more in a generic sense to refer to those occlusal disharmonies that require orthodontic intervention rather than to every deviation from ideal occlusion.

Malocclusion should not be thought of as a pathologic condition but merely as human morphologic variation. (An exception to this occurs in genetic disorders of the face and jaws such as craniofacial dysostosis and cleft lip and/or palate.) In biological systems, variation is the rule, not the exception.

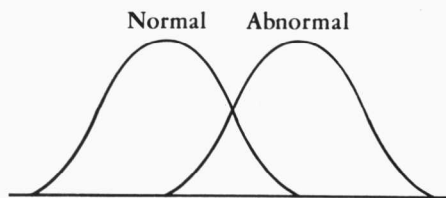


Figure 1-2 Normal occlusion and malocclusion, each as a composite of several possible combinations of traits (deep bite, crowding, protrusion, etc.), represented as frequency distributions. Note the overlap between normal occlusion and malocclusion. (From Moorrees, C. F. A., and Grøn, A. M.: *Principles of orthodontic diagnosis*. Angle Orthod., 36:258-262, 1966.)

Johnson⁶ suggested that biometric occlusal norms such as those proposed by Hellman⁷ and later by Simon⁸ could be thought of as a "species norm," whereas the normal variations found in specific subjects could be understood to represent an "individual norm." Unfortunately, no one has yet been able to translate adequately the idea of the "individual norm" into practical terms for orthodontic diagnosis.

Part of this dilemma stems from our inability to measure or quantify the various characteristics of occlusion. One of the first and only biometric studies of occlusion was Hellman's.⁷ However, his was a rather static approach to occlusion; he believed that in the maximum intercuspal position, specific landmarks in the opposing dental arches should contact. As long as the orthodontist's view of occlusion remains largely in the realm of static descriptive morphology, orthodontic diagnosis will contain this problem of not being able to define "individual norm." This, of course, is because function and physiologic adaptation must be considered in deciding whether a given individual's occlusion is normal. Although there has been research over the years, such as that of Manly and Yurkstas⁹ in which an attempt was made to measure effective occlusal area, total occlusal contact, and masticatory efficiency, the fact is that the concept of normal occlusion, which is the very basis of the specialty of orthodontics, has not changed markedly since the original definitions by Angle.¹⁰

By default, clinical orthodontics has accepted a therapeutic goal which Bercu

Fischer called the "achievable optimum."¹¹ In this approach the orthodontist attempts to achieve the "imaginary ideal" occlusion for each patient, knowing that only after treatment and retention are completed can he truly ascertain the norm for that individual. We have previously called this "therapeutic diagnosis," and it will be discussed in more detail under "Treatment Planning" later in this chapter. Moorrees and Grøn¹² have suggested that "therapeutic modifiability" be estimated prior to treatment, so that the treatment plan will reflect modifications based on realistic individualized goals. Because the factors responsible for tooth position, arch form, and occlusal relationships are poorly understood, it is not often possible to assess the therapeutic modifiability on any basis other than an intuitive one.

EPIDEMIOLOGY OF MALOCCLUSION AND ASSESSING THE SEVERITY OF MALOCCLUSION

Diagnosis and treatment planning for individuals will continue to be somewhat enigmatic until we fully understand occlusion not only from an anatomical and physiological point of view but also from an epidemiological vantage point. In the future it will be necessary to know the *prevalence* of problems relating to occlusal disharmony, the actual *need* in a biologic as well as a practical sense for the treatment of these problems, and the recognition or *demand* for this attention on the part of the patients.

The incidence of malocclusion varies widely in different countries of the world. In primitive and isolated societies there is less variation in occlusal patterns than is observed in more heterogeneous populations. Among Australian aborigines, for example, the incidence of malocclusion is usually low. Dental crowding and malalignment are rare in nearly all primitive populations. This implies selective evolutionary pressure eliminating dental malocclusion. Sometimes such evolutionary pressure has not resulted in our "imaginary ideal" occlusion, however. In certain Melanesian islanders, the usual condition is what we would call a skeletal Class III malocclusion, with good dental alignment. Thus incisal guidance, cuspid protection, and the like, which are useful therapeutic concepts, are apparently not biologic necessities. Some writers have theorized that the increased attrition of teeth caused by primitive diets

prevents the development of crowding.¹³ It can be observed, however, that teenage Australian aborigines whose modern diet has prevented significant attrition still do not develop crowding of incisors¹⁴ (Fig. 1-3).

The reported rate of malocclusion is higher in developed than in primitive countries and is higher in the United States than anywhere else. It is difficult to escape the implication that our high rate of dental malocclusion in the United States is a price we pay for our genetic heterogeneity. There has been great variability in estimates of the prevalence of malocclusion in the United States in previous epidemiologic studies.¹⁵ This fact is related to varying definitions of normalcy and varying samples of the population.

Recently the National Center for Health Statistics published a study of dental relationships in a sample of some 7400 children in the United States between ages 6 and 11.¹⁶ The sample was carefully selected to represent the 23.8 million American children of those ages, excluding only those on Indian reservations.

Based on the United States Public Health Service figures, it appears that 75 per cent of American children have some degree of occlusal disharmony. Thus it would seem that occlusal disharmony is the *usual* finding rather than the deviant finding. The extent of the disharmony determines whether there is a resulting problem of malocclusion. In the USPHS study, the TPI index¹⁷ was used to indicate degree of disharmony. This index is calculated from a detailed evaluation of the occlusal relationships of the teeth. Figure 1-4 displays the percentages of children with given TPI scores: the higher the score, the greater the disharmony.

Although orthodontists may differ with both the TPI method and the suggested interpretation of scores, this index does give a known starting point for assessing malocclusion. Using this approach, 37 per cent of American children are judged, by a score of 4 or more, to have definite or handicapping malocclusion. (Many of those with scores of 2 or 3 would benefit from treatment.) Forty per cent of all children have some malalignment of teeth; 17 per cent have significant protrusion of maxillary incisors and 20 per cent have a Class II molar relationship; less than one per cent have lower overjet, although five per cent have a Class III molar

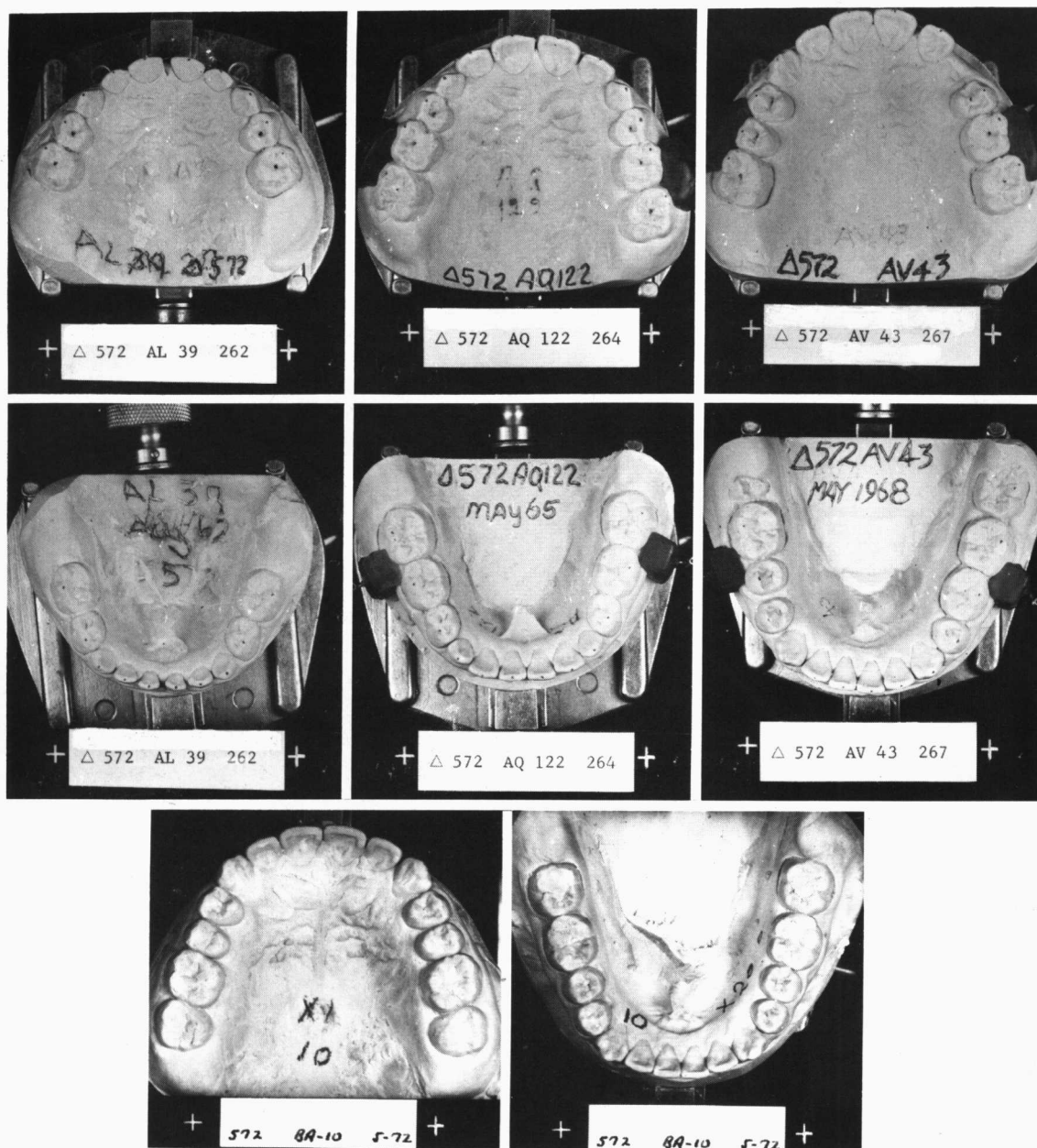


Figure 1-3 Dental casts of Australian aborigines at age 5 years, 8 years, 11 years, and 15 years. (Courtesy of Dr. M. J. Barrett, University of Adelaide.)

(Figure 1-3 continued on opposite page.)

relationship; and four per cent have an anterior open bite. The incidence varies according to social, sexual, and regional groupings. Open bite is four times more common in blacks than in whites, for instance, and slightly more common in girls than in boys. A detailed breakdown of children with scores of 4 or more is given in Table 1-1.

The TPI index which was used in the USPHS study is one of several systems for assessing occlusal status currently being employed primarily for determining eligibility for orthodontic treatment under third party payment schemes. The relative strengths and weaknesses of these systems have recently been summarized by Grewe.¹⁸ It is fair to say that although we

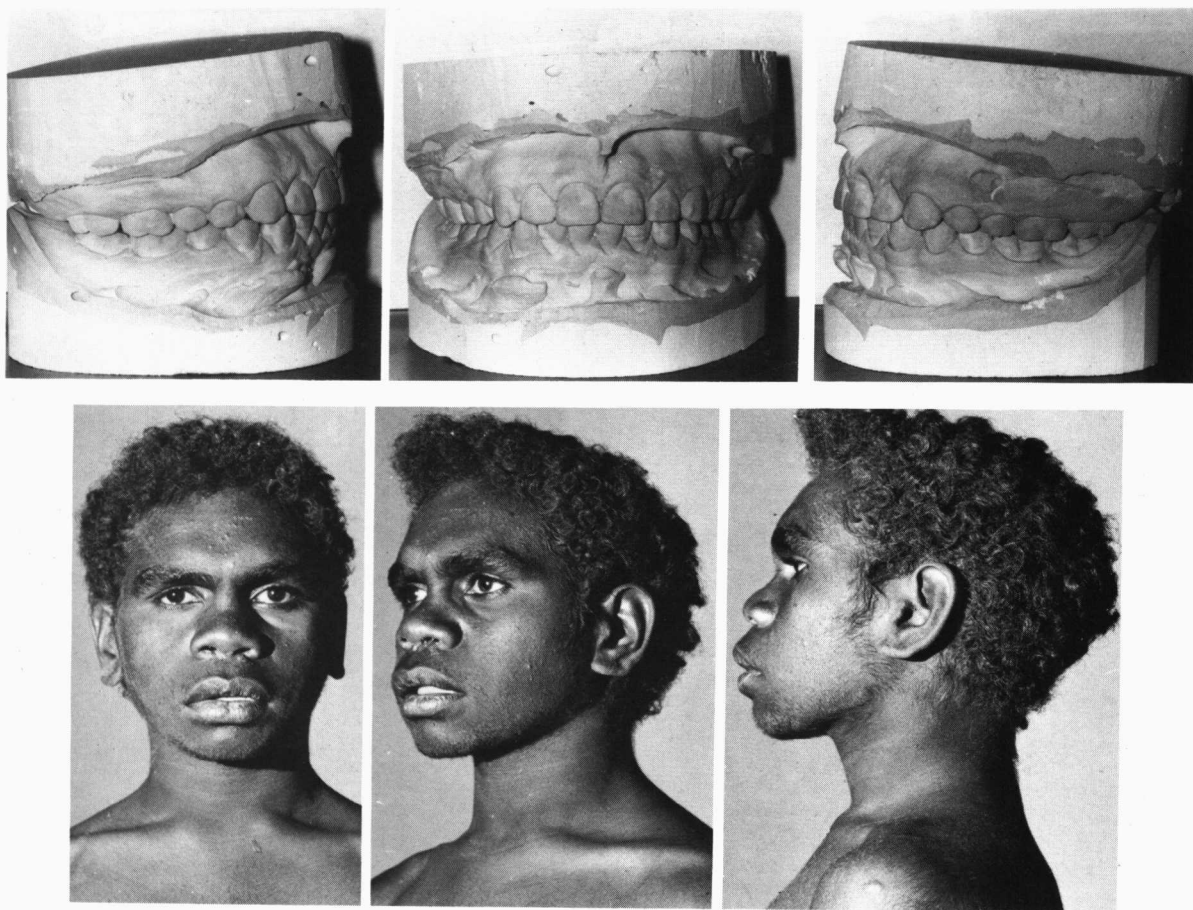


Figure 1-3 Continued.

Figure 1-4 Per cent of children with specified TPI scores. Interpretation of these scores, as suggested by Grainger: 0 = virtually classic normal occlusion; 1 to 3 = minor manifestations of occlusal disharmony; 4 to 6 = definite malocclusion; 7 to 9 = severe handicap, treatment highly desirable; 10 or greater = very severe handicap with treatment mandatory. (From Kelly, J. E., Sanchez, M., and Van Kirk, L. E.: An assessment of the occlusion of teeth of children. Data from the National Health Survey. National Center for Health Statistics, U.S. Public Health Service, 1973. DHEW Publication No. [HRA] 74-1612.)

