Implant Dentures

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&

GOLDBERG

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Indications and Procedures

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327 Illustrations

LONDON
PITMAN MEDICAL PUBLISHING CO., LTD.

Published in Great Britain by
PITMAN MEDICAL PUBLISHING CO., LIMITED
45 NEW OXFORD STREET, LONDON, W.C.1

ASSOCIATED COMPANIES
SIR ISAAC PITMAN & SONS, LTD.
PITMAN HOUSE, PARKER STREET, KINGSWAY, LONDON, W.C.2
THE PITMAN PRESS, BATH
PITMAN HOUSE, BOUVERIE STREET, CARLTON, MELBOURNE
27 BECKETTS BUILDING, PRESIDENT STREET, JOHANNESBURG
PITMAN PUBLISHING CORPORATION
2 WEST 45TH STREET, NEW YORK
SIR ISAAC PITMAN & SONS (CANADA), LTD.
(INCORPORATING THE COMMERCIAL TEXT BOOK COMPANY)
PITMAN HOUSE, 381–383 CHURCH STREET, TORONTO

PRINTED IN THE UNITED STATES OF AMERICA
A–(G.9.)

DEDICATION

We dedicate this book to our wives, Miriam and Phyllis, better known as the "implant widows," whose patience and understanding helped greatly in the implant development.

Foreword

The field of complete denture prosthesis is one in which the profession is confronted with many difficult problems, but the most baffling has been the case of the "impossible" lower dentures.

Considerable progress has been made in solving, or at least partly solving, many of our major prosthetic problems, but there still remain, in spite of superior knowledge and excellent technics, those mandibles which are incapable of taking the stress delivered by even the most scientifically constructed artificial dentures.

Patients with such involvement are, of course, extremely unhappy and often unhealthy as well, at least partly because they are unable to masticate food properly.

Doctors Goldberg and Gershkoff, cognizant of the plight of these dental cripples, have evolved a plan of treatment, which, though it may appear to be radical in approach, has been so successful that its value can hardly be overestimated. The technic has been worked out carefully and has proved to be practical, not only in the hands of its originators, but, when applied with precision and care, in the hands of many others as well.

Doctors Goldberg and Gershkoff, like most pioneers, have been subject to criticism in some quarters. This criticism they have met with creditable reserve and with quiet confidence in the methods that they originated. They deserve the thanks of the profession for their contribution, and the publication of this volume should serve to stimulate further interest in this extremely useful and unique treatment of a problem, hitherto without a successful solution.

IRVING R. HARDY, D.M.D.

Preface

The use of full denture implants in restoring the edentulous mouth to a useful function is a comparatively new science. For years extensive hard tissue loss in the skull has been corrected by the use of metal implants. In recent years metal implants have been used in orthopedic surgery to immobilize fractured bones and mobilize ankylosed joints. In oral surgery external fixation appliances have been used to treat fractures of the edentulous mandible. On occasion, dentists have co-operated with neurosurgeons in constructing castings to correct severe defects of the cranial and the facial bones. The principle of using nonirritating metals of the cobalt chromium-molybdenum combination has been well established in general surgery. The application of this principle to dental surgery should not be considered as an extreme or radical procedure.

The concept of incompatibility between foreign bodies and human tissue has been completely revised through the introduction of new materials, which by eliminating technical difficulties have opened to the general, orthopedic and specialized surgeon a wide and promising field.

Practically all branches of dental science, anatomy, physiology, pharmacology, bacteriology, metallurgy, oral surgery, prosthodontia, histology, pathology and radiology are involved in the application of implant denture principles.

Today, most practitioners realize the inadequacies of conventional denture construction for edentulous patients with mouth problems such as: atrophied ridges, mutilated mouth conditions due to extensive surgery or trauma, severe gagging, anatomic defects, psychological intolerance to full dentures and many other conditions that will be discussed further in the text. By the judicious use of the implant denture by the authors and other practitioners since 1948, these many denture problems have been eliminated.

Many pitfalls were and are being encountered by well-meaning dentists who after reading one or more articles have inadvisedly attempted this exacting procedure with this meager information.

The purpose of the authors in this book is to give to the general practitioner, the oral surgeon and the prosthodontist a well-rounded

background and a standardized text by which he may successfully carry out this type of reconstructive dentistry. This textbook will enable the general practitioner to determine and to evaluate more satisfactorily the problems encountered with the difficult prosthetic patient and how these problems can be solved. The technic as described, the do's and the don't's, are well within the realm of the good general practitioner. It will enhance the services rendered by the oral surgeon who can work in closer unity with the general practitioner and the prosthodontist. It will orientate the surgeon in the role that he plays in the over-all picture.

The book is of special interest to the prosthodontist in its compilation of case histories depicting the wide variety of denture problems, particularly in reference to the direct bone impression because it is taken under completely different circumstances and conditions from the conventional procedure. For the first time, upon observance of the exposed bone in vivo, the prosthodontist, as well as other practitioners, will realize why so many problems exist in full dentures and why they could not be overcome by conventional means.

Principles and concepts regarding tissue tolerance, growth and repair are gradually undergoing a metamorphosis due to constant research, experimentation and progress. The prevailing opinion is that mucous membrane must be completely intact, otherwise a fistula is established, allowing bacterial invasion to reach the underlying tissues. This concept has been changed by extensive research and development of the implant denture. There is a tendency to underestimate the ability of tissue to react favorably and regenerate to variable conditions. A condition was imposed upon oral tissues contrary to the principle of unbroken mucous membrane, and the tissues accepted this imposition.

It is the sincere desire of the authors to make this text a valuable aid to the dental practitioner, enabling him to overcome the many problems associated with the edentulous mouth and to understand and serve his fellow man more effectively.

The Authors

Acknowledgements

We are grateful to the many persons whose contributions to medicine, dentistry and allied fields made possible the development of the idea that implant dentures could be applied successfully.

We are especially grateful to Mr. William Soller and Mr. Eric Bausch, of Austenal, Inc., whose foresight, keen judgment, guidance, confidence and technical know-how enabled implants to reach their present stage of development. Their conservatism helped pace the progress which prevented the abuse of implants in the over-all picture.

We desire also to express appreciation to the authors of the various publications from which thoughts and illustrations have been borrowed, especially to the many men in the implant denture field.

To Dr. Isaih Lew, who contributed his technic for the immediate splint and unilateral implant; to Colonel Roy L. Bodine, who contributed his technic in the prosthetic phase; and to Dr. Leon Herschfus, who contributed the chapter on histopathology of implant dentures, we extend our sincere appreciation and thanks.

To Dr. Irving R. Hardy, Professor of Graduate and Post Graduate Prosthetics and Dr. Irving Glickman, Professor of Oral Pathology and Director of Graduate and Post Graduate Studies of Tufts University School of Dental Medicine, we offer our appreciation for their confidence in implant dentures and the realization for the need of establishing an academic course in implant dentures on the post graduate level.

We would like to gratefully acknowledge the work of the members of the American Academy of Implant Dentures who have carried out implant denture procedures on a research and practical basis from which much knowledge has been gained, and to Dr. Arthur C. Jermyn for his practical contributions and his efforts on behalf of implant dentures as editor of the *Journal of Implant Dentistry*.

We gratefully acknowledge the art work contributed by Cy Mitchell of Chicago, Ill., and the valuable co-operation of Mr. J. Brooks Stewart, Medical Editor and Mr. Stanley A. Gillet, Production Editor of the J. B. Lippincott Company.

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History of Metal Appliances in the Body

To understand the progress of implants in dentistry, one must first become familiar with the history of implants in medicine. Since dentistry and medicine have developed side by side, the subject should be approached from that aspect, for the basic factors that affected the development of medicine also influenced the development of dentistry. Man has always been subject to accident and disease, and the need for helping himself taught him early to find means for alleviation and cure; rough and primitive, perhaps, but still in a measure answering his purpose.

Metal appliances have been used in the body in many different ways for various purposes dating as far back as the 16th century. However, it should be understood clearly that all implants, up to the time of Lister's work on antisepsis in the 1860's, had little or no chance of success without even considering the type of material that was used. Even after the time of Lister, many metallic implants still had no chance because little was understood, until recently, of the physiology of bone and the reaction of tissues and body fluids to various metals.

Implants have always been a controversial subject, due mainly to lack of knowledge and materials. These earlier efforts by men who departed from the surgical standards of their time were primitive compared with present-day methods, and these early pioneers never understood exactly why consistent success was beyond their reach. For the most part, they understood the mechanical application and, in fact, did make good mechanical restorations, but they were handicapped by the limitations of the materials available and lack of knowledge of the basic concept of tissue reaction to various metallic appliances.

Variations and discrepancies in concepts existed up until 1936, when Drs. Venable and Stuck[1] conducted extensive research which established the basic understanding of the use of metal in body tissues.

As far as it has been determined, Petronius, in 1565, was one of the first men to attempt the use of a metal appliance as an implant for closure of a cleft palate. He devised a gold plate for this purpose.

The *J. de méd. Chir. et pharm. de Roux* of August, 1775, contained the first recorded controversy regarding the use of metal as an appliance for the internal fixation of fractures. M. Pujol, physician of Castres, criticized M. Icart because the latter performed an open operation on a fractured humerus with disastrous results.

> It was nine years ago that the nephew of a certain Seguier, mason of this village, had his arm broken by a cart and that they despaired of being able to save it for him, so great was the shattering. Then the surgeon, equally brave for conserving as for chopping off, presented himself to take charge of this treatment, and in order to hold in place the fractured pieces without the aid of any trying and cumbersome apparatus, he made deep sections longitudinally through the soft part and introduced immediately around the bone, in piercing the flesh, some brass wires of which he formed several rings that were not at all delicate, and the ends of which he took care to twist together well. This beautiful maneuver had the result that one should expect, and gangrene occurred, of which the patient died two days later.

M. Icart replied by stating that the operation took place 14 years ago instead of 9, and that Pujol

> was at Toulouse . . . at the time of the treatment of Seguier you would then have in two days' time, after an accident of this sort, gangrene succeed inflammation and this gangrene kill the patient like a pistol shot—I have seen brass wire put to use with success by the famous Lapeyode and Sicre, surgeons of Toulouse, whose lights and talents you have yourself respected; I myself would not be averse to believing that this wire of brass, silver, or gold would be applicable in certain cases, such for example as when in a fracture with the complications of large wounds, the bone is found denuded of flesh and its periosteum—sometimes it is necessary to bring the pieces of bone together and to hold them either by means of a wire or a little band.[2]

To further his argument that the implantation of brass wires was not responsible for a patient's death, Icart stated that a patient died 12 days after wire had been inserted for fixation of a fracture, and not 2 days, as claimed by Pujol.

The fact that this controversy existed and was discussed at that time had no actual bearing on the success or the failure of the implant used. Both men were wrong in their conclusions. These men were arguing for and against the use of metal appliances in the body. The fact that the patient died had no direct bearing on

whether or not the metal was used; more than likely, death resulted from crude surgical intervention, shock and pathologic involvements. These different opinions prevailed for the next century among all concerned because nothing was understood of infection or infectious processes.

An early observation was made of tissue reaction to the use of dissimilar metals by Benjamin Bell,[3] in 1804, who described his use of metal pins which pierced a wound and about which threads were twisted in a figure-of-eight fashion. He used steel-tipped silver pins which readily showed corrosion.

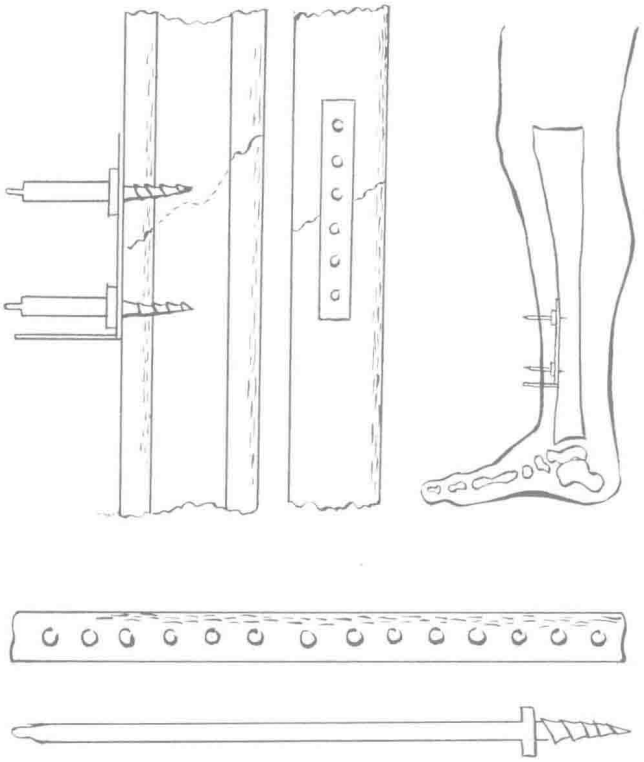

FIG. 1. Drawing of Hansmann's original bone plate which was bent so that the end of the plate projected from the wound. Coarse-threaded screws were used with ends also projecting. This photograph, made from Hansmann's article (1886), shows the first bone plate found to be practicable. (Venable, C. S., and Stuck, W. G.: The Internal Fixation of Fractures, ed. 1, Springfield, Ill., Thomas)

The next step in the development of implant appliances was that of Hansmann, in 1886 (Fig. 1). Hansmann's bone plate was a

small strip of metal, preferably unhardened nickel-plated sheet steel, into which have been bored holes at short intervals. This strip is fastened into position with nickel-plated steel screws which I have constructed myself. The screw consists of a thread portion about three-fourths centimeters long and a round shaft of varying length with a square top on the free end. With these screws the strip of sheet steel is attached firmly to the bone at both sides of the line of fracture; often holes have been drilled in the bone at the proper places. The *shafts of the screws protrude from the wound.* After fixation of the screws, the end of the sheet steel strips is turned up at right angles near one of the screws in such a way that it protrudes from the wound. This part of the strip is used for a handle for removing later. The period which must elapse before removal of the screw varies, depending upon loosening of the screws and upon the onset of adequate consolidation, the date of which is likewise quite variable. If a screw loosens too early it may be replaced by one with a somewhat larger thread. Generally speaking, four to eight weeks should be adequate allowance of time before removal of the screws. Removal is simple. The screws are removed by means of a watch key and the sheet steel plate is drawn out by pulling on the protruding end.[4] [Fig. 1].

It is interesting to note the resemblance of Hansmann's appliance to the bone plates presently in use. This is the first appliance of record which utilizes one or more screws as a retentive factor, part of which is contained in the bone and part of which breaks the continuity of soft tissue and protrudes to the outside.

Before the discovery of roentgen rays by Wilhelm Konrad Roentgen in 1895, bone plates and screws were used mainly for the reduction of complicated or open fractures. It was deemed unnecessary, for the most part, to use metal appliances for the reduction of simple fractures as that could be accomplished with casts and other external appliances. When x-ray pictures revealed poor position of the bony fragments in uncomplicated fractures, considerable interest was revived in the use of internal-fixation appliances.

In 1909, Albin Lambotte, of Brussels, used many and various appliances made of aluminum, silver, brass, red copper, magnesium and soft steel plated with gold or nickel. Lambotte conceded that

many complaints are lodged against direct fixation of fractured fragments, but it is the author's conviction that all complications attributed to the procedure are due to infection. The larger the foreign body introduced, the greater the opportunity for the introduction of infection.[5]

Lambotte tried intramedullary pegs of gold or silver but found them too expensive or too soft. He said that

copper is not well tolerated by tissues and should be absolutely rejected. If steel is covered with another metal, it corrodes much faster than otherwise, probably due to electrolytic action.[6]

Even though this statement was made in 1927, unfortunately it was ignored for a decade. This is the first recorded statement concerning unfavorable electrolyte reactions by metal appliances in tissue. The observations made by Lambotte in his later works refute the statement he made earlier—that all the complications attributed to the procedure are due to infection.

William Arbuthnot Lane[7, 8] ignored most metals except steel and concentrated more on a strict aseptic surgical procedure. He developed the "Lane technic" about 1900 and maintained that any rarefying osteitis seen with implants was due to septic surgery and was merely a useful term to cover surgical incompetence. Lane emphasized—and it is still true today—that operations on fractures require more aseptic technic than similar operations on soft tissues.

The next outstanding contribution was made in 1912 by William O'Neil Sherman, of Pittsburgh, who introduced the alloy vanadium steel and the proposal of very well-designed plates and screws. These Sherman plates were standardized through the efforts of the American College of Surgeons and were accepted for general use for many years.

VITALLIUM APPLIANCES

Up until the time of Venable and Stuck (who, in 1936, conducted their experiments on the electrolytic action of metals in the presence of body fluids), there were innumerable contributors in all phases of the implant field. Venable and Stuck in their tests determined conclusively that certain metals, when in contact with tissue fluids, produce a galvanic action that ultimately corrodes the metal appliance.

Their studies indicated that, among all metals tested, Vitallium® was the only one which produced no electrolytic action when it was buried in the tissues. In the same year this substance was embedded in human tissues for the first time in the form of screws, stabilizing fragments in a fractured long bone, and the result was highly successful. They reported that

> In this series of 1227 cases, Vitallium appliances were removed in 87 instances after the bone was healed and the need for them no longer existed. Every observer reported that the screws and plates were bright and untarnished and that the tissues about them were normal in appear-