EDGAR GARCIA-ZEA, DDS

THE SUCTION SOLUTION

A Step-by-Step Guide to Digital Mandibular Complete Dentures

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Library of Congress Control Number: 2026931914

A CIP record for this book is available from the British Library.
ISBN: 978-1-64724-234-3

QUINTESSENCE PUBLISHING USA

Quintessence Publishing Co, Inc
411 N Raddant Road
Batavia, IL 60510
www.quintessence-publishing.com

5 4 3 2 1

Editorial: Leah Huffman
Design: Sue Zubek
Production: Tracy Tomkowiak

Printed in the USA

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FOREWORD

While the field of dentistry continually seeks equilibrium between those committed to preserving natural teeth and those who classify certain cases as "terminal dentition," my dear friend and colleague Dr Edgar Garcia exemplifies a forward-thinking approach. In these pages, he demonstrates how merging classical complete prosthodontics principles with modern digital technologies can restore both function and esthetics to many individuals who might otherwise be considered occlusally disabled.

Globally, more than 350 million people are edentulous. Most of these individuals are not suitable candidates for dental implants, often due to financial constraints or inadequate supporting oral structures. Dr Garcia's passion has always been to discover and refine methods that serve these patients through more traditional means. He immersed himself in Dr Abe's protocols for treating edentulous patients and recognized a unique opportunity: By integrating these established techniques with digital advancements, he could enhance outcome predictability and make the process more engaging and accessible for future generations of clinicians.

Dr Garcia's commitment over the years has led him to share his innovative techniques in more than 12 countries. He has also contributed significant journal publications that support each clinical procedure he practices. Readers of this text will discover a meticulously organized step-by-step protocol, beginning with the initial functional evaluation and anatomical assessment, followed by preliminary impressions, reliable edentulous scanning, facial scans, tooth selection, Exocad design, prototypes, and final delivery. This comprehensive approach ensures that integrating these methods into daily practice is both straightforward and effective.

Understanding the critical role of denture occlusion in the stability and long-term success of complete dentures, Dr Garcia has sought to incorporate innovative features into his designs. He has developed an easily attachable, fully printed central bearing point device for precise centric relation recording—a technique refined through his extensive experience in private practice.

It is with complete sincerity that I state that Dr Garcia's goal is realized within these pages: to make excellence in digital dentures accessible to all readers.

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PREFACE

Since 2011, I have dedicated my clinical practice and teaching to complete dentures. However, at some point I realized that with the tools I knew at the time, I could not truly offer my edentulous patients a quality of life that met their needs.

About 6 years ago, I discovered the philosophy of Dr Jiro Abe and encountered protocols that were very different from those commonly used in Western practice. This new way of diagnosing, planning, and treating edentulous patients made me fall in love with complete dentures once again.

Driven by this passion, I immersed myself in this field: I acquired the books of Dr Abe, as well as those of Dr Fumiaki Yamazaki and Dr Katsushi Sato, and further enriched my knowledge through online courses and lectures from leading experts such as Dr Kenichi Matsuda, Dr Yuichi Matsumaru, and other distinguished colleagues.

The integration of these protocols with digital technology not only transformed the way I fabricate complete dentures but also transformed the lives of my patients, who experienced remarkable improvements in comfort, stability, and masticatory function. This experience inspired me to begin teaching courses on digital complete denture workflows, with a special focus on improved retention of mandibular complete dentures. Over the years, I have had the privilege of sharing these protocols, visiting more than a dozen countries and working alongside colleagues eager to embrace these advances.

With this book, my goal is to raise awareness that there are alternative, more predictable approaches than what have long been practiced for rehabilitating edentulous patients—especially in the mandible. The incorporation of digital tools provides an immense range of possibilities, and my purpose here is to synthesize, in a clear and structured way, the step-by-step protocol I follow based on these concepts so that every clinician can apply this knowledge in daily practice.

ACKNOWLEDGMENTS

I am deeply grateful to God, the greatest source of strength and inspiration in my life. To my parents, Edgar and Rocio, the best parents I could ever wish for, who taught me from an early age that everything is possible. To my beloved wife, Nicole, my companion in every sense, whose love, sacrifice, and unwavering support have been the foundation of my personal and professional growth. None of this would have been possible without her constant encouragement and the way she has stood by me in every challenge and every achievement. To my children, Gustavo and Joaquín, who fill my days with joy and are the driving force that motivates me to never give up and always move forward. To my brother, Jorge, whom I admire deeply as an example of creativity and perseverance. To my parents-in-law, Gustavo and Consuelo, whose constant support and encouragement have been a blessing to our family.

I sincerely thank Quintessence for giving me the opportunity to write this book, and particularly Leah Huffman for her constant support. I am also especially grateful to Dr Jiro Abe and Dr Fumiaki Yamazaki for allowing me to share the way I have applied their philosophy in my clinical practice.

To those who trusted me from the very beginning of this journey—Dr Carlos Garaicoa, Dr Stephanie Jaramillo, Dr Ting-Wei Tung, Dr Alberto Gutierrez, Raul Villafuerte, Cristina Teran, Dr Mauricio Tinajero, Dr Juan Carlos Gallardo, Dr Jorge Garaicoa, and Cesar Muñoz—thank you for your confidence and encouragement.

I would also like to express my gratitude to the University of Iowa, specifically my colleagues Dr Aaron Cho, Dr Clark Stanford, Dr Galen Schneider, Dr Christopher Barwacz, Dr Mateus Bertolini, and Dr David Johnsen. I extend thanks to all my fellow faculty members, students, and staff, who have supported me since my very first day.

A special acknowledgment goes to my friend Scott Hendricks, whose constant support played a crucial role in making this book possible.

Finally, I owe a special acknowledgment to my friend Dr Mario Romero, who not only encouraged me to begin writing and publishing scientific articles but also challenged me to step outside my comfort zone and pursue goals that once seemed like distant dreams—goals that today have become reality.

CHAPTER 1

INTRODUCTION:
REDEFINING COMPLETE DENTURE THERAPY

The Digital Era and the Return of Removable Excellence

Digital dentistry has transformed the way we diagnose, plan, and execute treatments. Intraoral scanners, facial scanners, desktop scanners, design software, milling machines, and 3D printers have become routine elements in modern clinics and laboratories. Their accuracy, accessibility, and reproducibility have pushed nearly every specialty forward—implantology, orthodontics, esthetic dentistry, and more. Yet perhaps one of the most unexpected beneficiaries of this digital revolution has been the field of complete removable prosthodontics.

Complete dentures, particularly mandibular ones, have long been regarded as the most challenging treatment modality in daily clinical practice. Many general practitioners avoid them altogether, discouraged by their perceived complexity, the anatomical limitations of the edentulous mandible, and the historically low satisfaction rates among patients. The notion that only surgical intervention—usually with implants—can provide true stability in the mandibular arch has become deeply ingrained in both clinical culture and academic teaching.

But things are changing. The expansion of digital workflows has unlocked new possibilities for clinicians who once felt ill-equipped to manage fully edentulous cases. Now that they have accessible intraoral scanners, printable base designs, guided jaw relation systems, and the ability to design and prototype custom trays or full prostheses in-house, the treatment of edentulous patients has become not only more predictable but also more approachable (Fig 1-1). Dentists who once dreaded mandibular dentures are now finding that with proper protocols and digital support, delivering a stable, retentive prosthesis is achievable. Digital tools have not replaced good clinical judgment, but they have made that judgment easier to apply consistently (Fig 1-2).

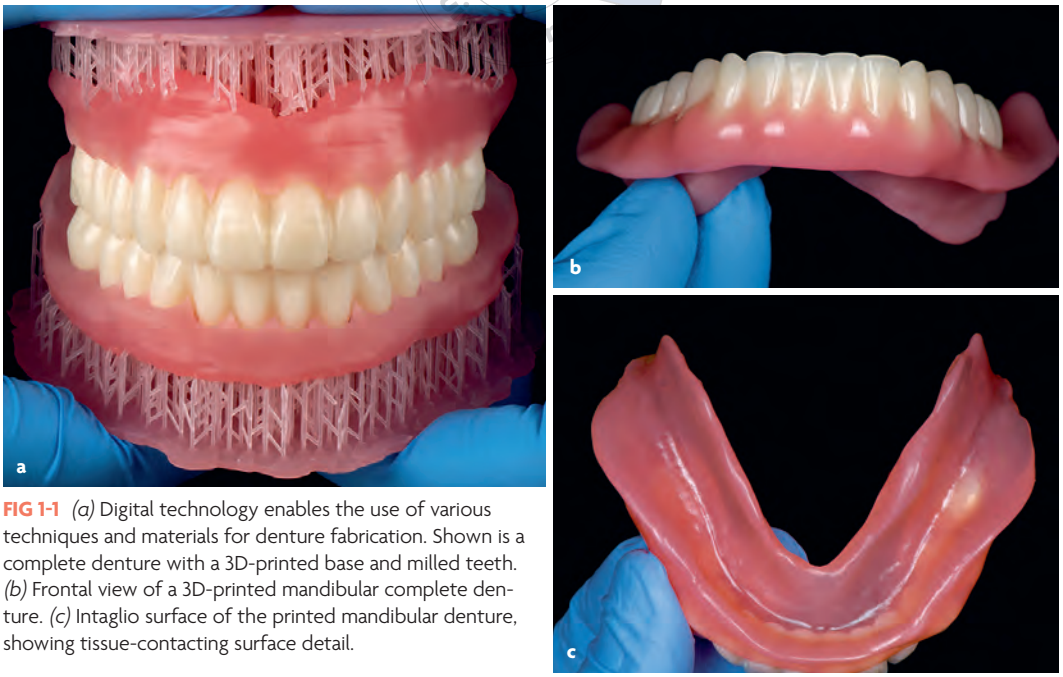

FIG 1-1 *(a)* Digital technology enables the use of various techniques and materials for denture fabrication. Shown is a complete denture with a 3D-printed base and milled teeth. *(b)* Frontal view of a 3D-printed mandibular complete denture. *(c)* Intaglio surface of the printed mandibular denture, showing tissue-contacting surface detail.

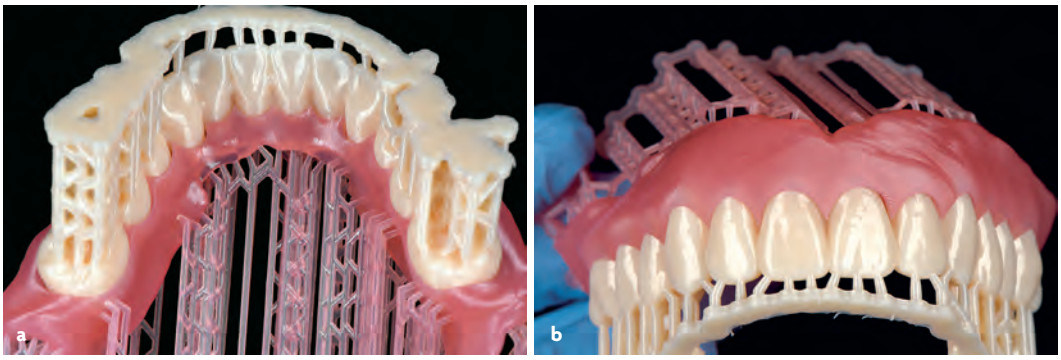

FIG 1-2 *(a)* 3D-printed mandibular denture base with printed denture teeth placed in position, demonstrating the high accuracy and fit between base and teeth. *(b)* 3D-printed maxillary denture base with printed teeth. The detailed reproduction of anatomical structures highlights the precision of modern impression and printing techniques.

Why Suction Matters

Clinicians have long known that fabricating a maxillary complete denture is more predictable than fabricating its mandibular counterpart. The broad, stable palatal vault and lack of muscular interference allow for a natural seal and greater surface area for adhesion.[1,2] The mandibular arch, by contrast, presents a dynamic and unstable foundation—narrow ridges, muscular attachments, floor-of-mouth movement, and the tongue all conspire to make retention difficult. The challenge is not simply to place a denture that sits, but one that stays in place during function.[3]

In 2002 this discrepancy was formally recognized in the McGill Consensus Statement, which concluded that the standard of care for edentulous patients should include two mandibular implants to support an overdenture.[4] This recommendation, though beneficial to many, inadvertently reinforced the idea that surgical intervention was the only acceptable way to stabilize a mandibular denture.

However, there is another way.

Historically, four main impression philosophies have guided the fabrication of complete dentures[5–10]:

- **The mucostatic impression technique,** in which tissues are captured without pressure, maintaining their natural resting position
- **The mucocompressive technique,** whereby tissues are intentionally recorded under compression, assuming that the denture will seat more fully under function
- **The functional impression technique,** where the patient performs movements while the impression material sets, thus recording borders in dynamic function
- **The neutral zone impression technique,** which focuses not only on tissue form but also on muscle balance, capturing the space where muscular forces neutralize, guiding tooth position

The closed-mouth functional impression technique has been used since the early 20th century, with Dr Alfred Gysi among the first to describe this approach.[11] However, it was not until the 1940s that the closed-mouth technique was formally adopted as the primary method for complete denture impressions in the work of Dr Merrill G. Swenson, where emphasis was placed on recording the denture-bearing tissues under functional conditions using a closed-mouth approach.[12] This concept was based on capturing the dynamic behavior of the oral tissues rather than their static form.

A similar concept was later described by Dr Earl Pound; however, his approach differed in that it was performed using a previously fabricated denture relined with a tissue conditioner, allowing functional movements to shape the impression material over time.[13] These movements molded the material in a manner that closely replicated the functional form of the soft tissues (Fig 1-3). The objective was to obtain a denture base that adapted naturally to the patient's dynamic anatomy, thereby enhancing retention and comfort.

In contrast, since the 1970s, prosthodontics has increasingly adopted a technique that relies on the use of green stick compound for border molding.[14] This method is considered a "provider-dependent" approach, as it depends on the clinician's manual manipulation to precisely shape the borders and achieve an effective peripheral seal. The technique focuses on static anatomical landmarks and controlled clinical procedures.

In 1999, a major turning point occurred with the introduction of the suction-effective mandibular complete denture (SEMCD) by Dr Jiro Abe.[15] His paradigm-shifting functional technique enabled the creation of a peripheral seal, even in the presence of mobile soft tissues in the denture-bearing area. Over the years, this method has been widely replicated due to its high predictability and consistent success in fabricating mandibular dentures that

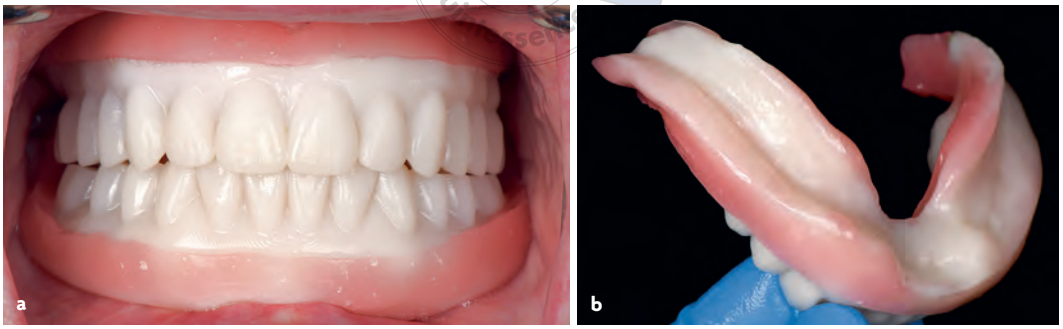

FIG 1-3 Techniques derived from the principles described by Pound have evolved over time while preserving the concept of functional impression recording in closure. *(a)* Intraoral view of a closed-mouth functional impression using a soft liner material applied over printed denture prototypes. *(b)* Intaglio view of a mandibular functional impression obtained with a soft liner material.

FIG 1-4 *(a)* Intaglio surface of the patient's previous mandibular denture, showing underextended borders and poor adaptation. *(b)* Occlusal view of the same denture, displaying non-anatomical teeth and inadequate tooth positioning. *(c)* Intaglio surface of the new mandibular denture, which was fabricated using the SEMCD impression technique, showing enhanced border extension and tissue adaptation. *(d)* Occlusal view of the new mandibular denture, illustrating improved tooth positioning, flange support, and occlusal harmony. It is important to emphasize that achieving suction does not rely solely on the impression technique but also on accurate maxillomandibular records and proper tooth arrangement.

restore function and chewing efficiency, ultimately improving patients' quality of life[16,17] (Fig 1-4). This book seeks to demystify that method and offer a practical roadmap for applying these principles in a modern, digitally driven clinical setting.

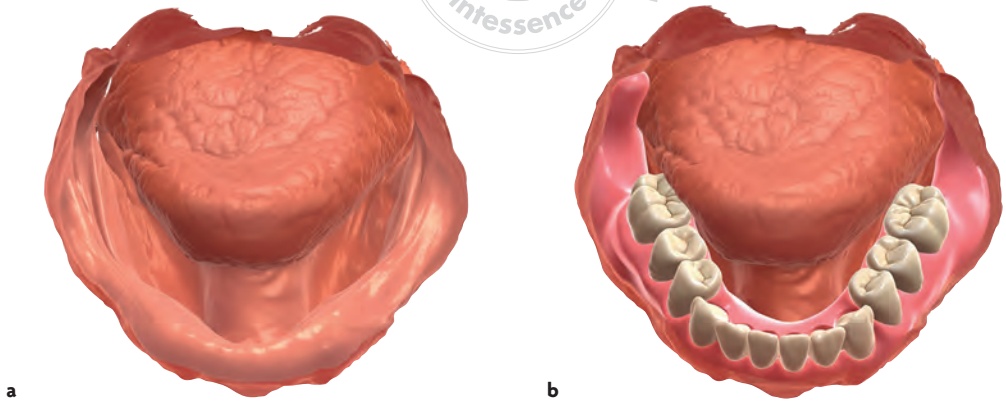

FIG 1-5 *(a)* Representation of the "denture space" in the edentulous mandibular arch as described by Brill et al.[18] This dynamic zone is defined not only by the underlying anatomy but also by the surrounding muscular structures—including the tongue, cheeks, and floor of the mouth—which must be considered during denture design. *(b)* Mandibular denture placed within the denture space. For optimal retention and stability, the denture borders must be in harmonious contact with the surrounding soft tissues during function, without impinging on muscular movement.

How Suction Works in the Mandibular Arch

Suction in complete dentures results from negative intraoral pressure sustained by a continuous and well-adapted peripheral seal. In the maxilla, this seal is often achieved passively through close contact with the immobile palatal vault combined with proper extension and border molding that engage the vestibular and posterior palatal regions. In contrast, mandibular suction requires a more precise and deliberate approach due to the lack of a broad, immobile surface like the palate.

Further insight into the dynamics of mandibular suction comes from the classic work of Brill, Tryde, and Cantor in 1965.[18] In their study, they introduced the concept of the "denture space" as a dynamic zone defined by the interplay of muscle groups and soft tissues (Fig 1-5). They emphasized that retention in the mandibular arch depends not only on tissue contact but also on harmony with the tongue, cheeks, and lips during function. Their research showed that a properly contoured denture within this functional envelope could be *stabilized* by muscular forces rather than displaced by them.

Building on these concepts, Dr Jiro Abe described mandibular suction as a negative pressure effect generated when the patient occludes from the mandibular rest position. This action expels saliva from beneath the denture base. If the denture borders are properly sealed against the surrounding oral mucosa, negative pressure is generated, resulting in strong adhesion.

Three key anatomical and functional factors are critical to achieving effective mandibular suction: *(1)* optimal stability of the denture base over the residual ridge and buccal shelf; *(2)* an effective seal in the sublingual and retromylohyoid regions, which are both influenced by tongue posture and floor-of-mouth dynamics; and *(3)* accurate and functional adaptation

FIG 1-6 Schematic representation of the sealing mechanism in mandibular complete dentures. The diagram illustrates four key sealing zones: anterior labial/buccal sealing *(light blue)*; lingual sealing, supported by spongy tissue in the sublingual fold region *(red)*; posterior lingual sealing, achieved through compensatory closure in the retromylohyoid fossa *(yellow)*; and close-contact sealing, involving the retromolar pad, denture base, tongue sidewall, and buccal mucosa *(green)*.

of the denture flanges to the surrounding soft tissues, including the cheeks, tongue, and labial and lingual vestibules.[16,17,19]

Suction is maintained as long as intraoral pressure remains lower than atmospheric pressure. A break in any portion of the seal—especially in the posterior lingual region or around the retromolar pad—leads to immediate loss of retention. Thus, achieving suction is not merely about extension but is also about precise adaptation.[16,17,19]

Each segment of the periphery contributes differently to the suction effect (Figs 1-6 to 1-11). The anterior lingual area provides stabilization during tongue rest and speech. The retromylohyoid space serves as the primary zone of pressure balance and posterior sealing. The buccal and labial flanges must adapt closely to the cheeks and lips, while still permitting natural muscular movements.[16,17,19]

Equally critical is the role of the tongue and floor of the mouth. During functional movements such as speaking or swallowing, the tongue dynamically supports the denture by pressing upward and outward against the inner flanges, reinforcing the peripheral seal.[16,17,19] This muscular interaction must be carefully anticipated during both the impression and design phases, either by incorporating guided patient movements during border molding or by creating tray designs that accommodate floor-of-mouth elevation.

Suction is not binary. Some patients achieve a near-total seal, with an audible "pop" upon removal. Others experience partial suction that still significantly improves comfort and function. What matters most is that the seal, however strong, is consistent and stable during everyday oral movements (Figs 1-12 and 1-13).

Common causes of suction failure include the following:

- Overextension of the lingual flange impinging on mobile tissues
- Lack of intimate contact in the anterior sublingual zone
- Inaccurate or incomplete recording of the retromolar pad
- Excessively thick flange borders that dislodge during lip or cheek movements

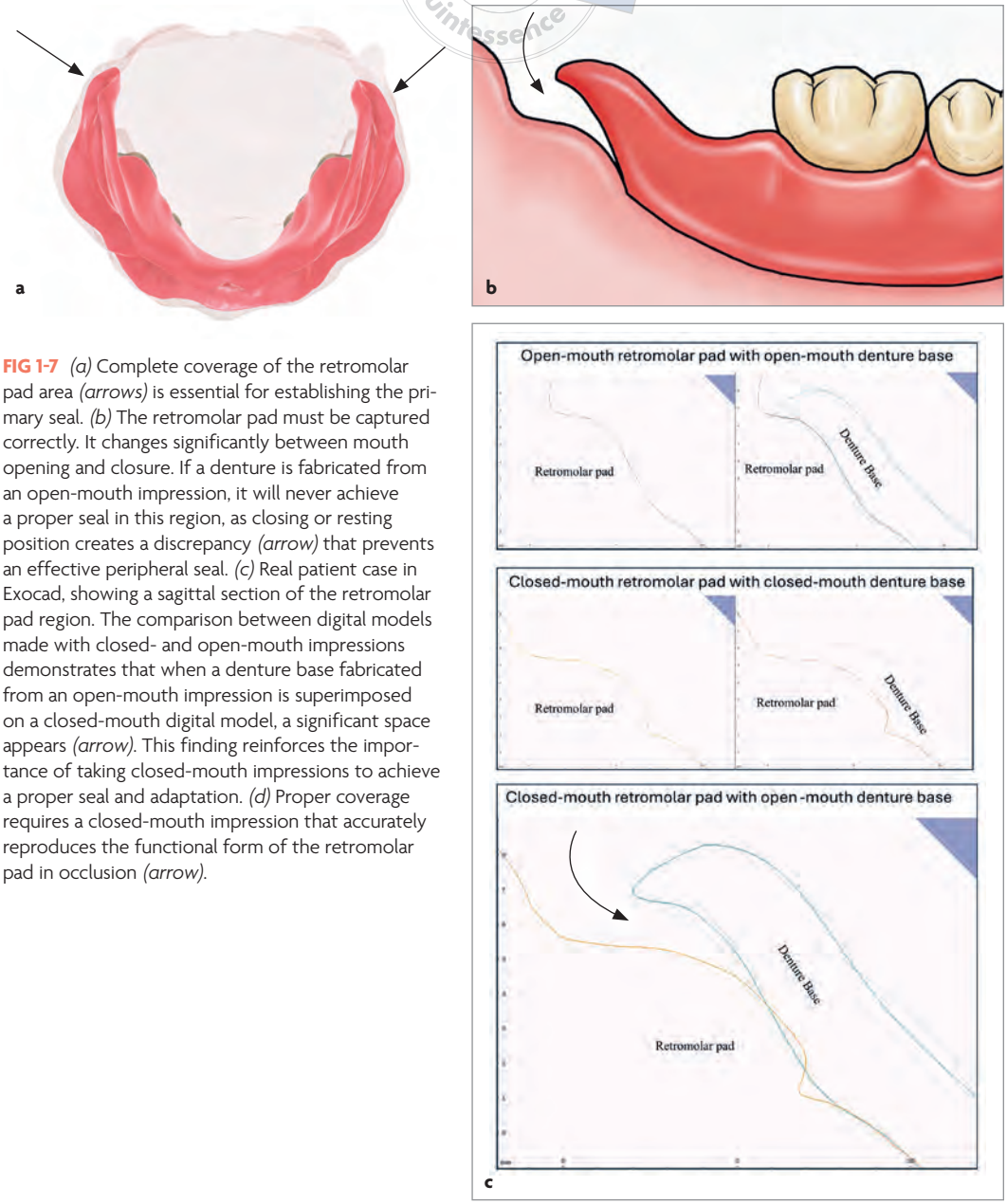

FIG 1-7 *(a)* Complete coverage of the retromolar pad area *(arrows)* is essential for establishing the primary seal. *(b)* The retromolar pad must be captured correctly. It changes significantly between mouth opening and closure. If a denture is fabricated from an open-mouth impression, it will never achieve a proper seal in this region, as closing or resting position creates a discrepancy *(arrow)* that prevents an effective peripheral seal. *(c)* Real patient case in Exocad, showing a sagittal section of the retromolar pad region. The comparison between digital models made with closed- and open-mouth impressions demonstrates that when a denture base fabricated from an open-mouth impression is superimposed on a closed-mouth digital model, a significant space appears *(arrow)*. This finding reinforces the importance of taking closed-mouth impressions to achieve a proper seal and adaptation. *(d)* Proper coverage requires a closed-mouth impression that accurately reproduces the functional form of the retromolar pad in occlusion *(arrow)*.

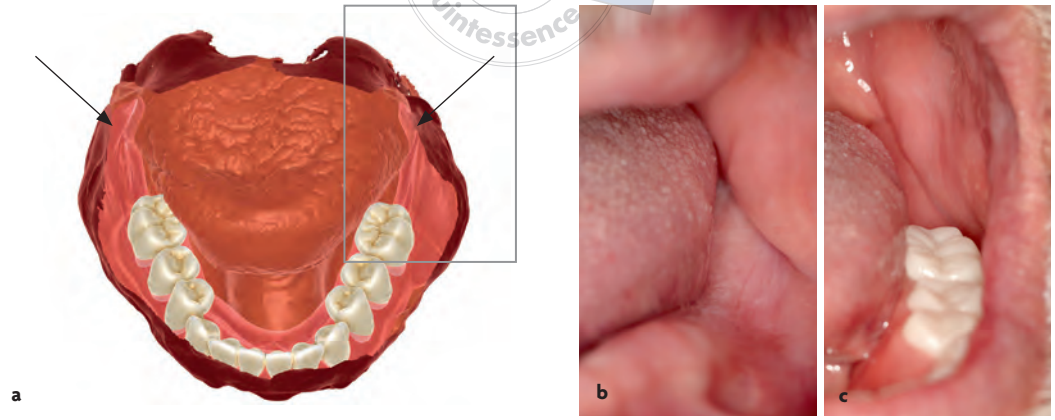

FIG 1-8 *(a)* The buccal mucosa–tongue sidewall contact (BTC) point *(inset box)* is a functional sealing zone situated above the retromolar pad, where the buccal and lingual mucosa converge against the posterior border of the denture base *(arrows)*. It plays a key role in maintaining mandibular denture suction by reinforcing the secondary peripheral seal. *(b)* Intraoral view of the BTC point. *(c)* Posterior border seal at the BTC point, achieved when the denture base is supported by simultaneous contact of the tongue and buccal mucosa.

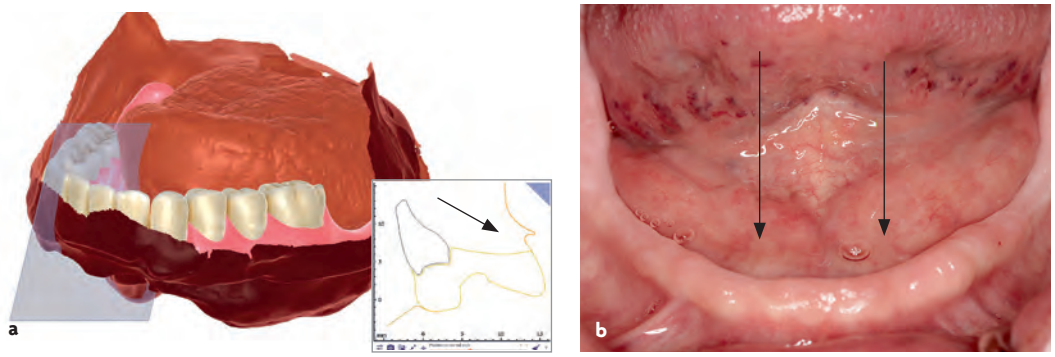

FIG 1-9 *(a)* Cross-sectional view of the sublingual fold region *(arrow)*, a critical area for achieving an effective peripheral seal and enhancing mandibular denture retention. *(b)* When abundant sublingual spongy tissue is present *(arrows)*, achieving an effective seal in this region becomes more predictable.

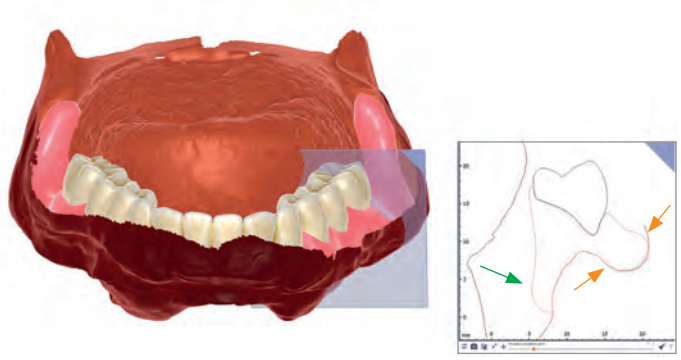

FIG 1-10 The *green arrow* indicates the posterior lingual extension of the denture base, extended 2 to 3 mm beyond the mylohyoid ridge to achieve compensatory closure in the retromylohyoid fossa. The *orange arrows* highlight the buccal vestibular extension, which is critical for establishing a broad, functional seal through contact with the buccal and alveolar mucosa during mandibular movements.

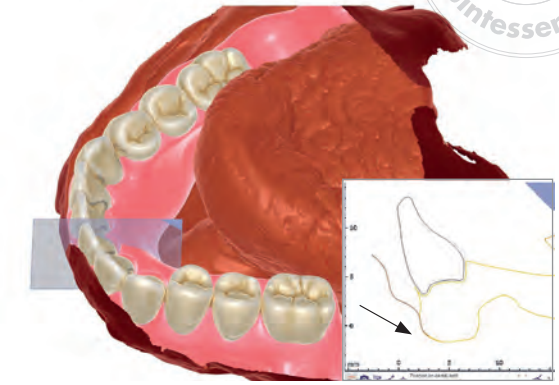

FIG 1-11 Sagittal cross section showing the anterior labial seal *(arrow)*, which is created by the close adaptation of the denture flange to the lower lip. Proper flange positioning ensures a stable peripheral seal.

FIG 1-12 This well-designed suction-effective denture maintains its position during functional movements, not only in occlusion.

The Three Essences and Four Steps in Complete Denture Fabrication

Achieving mandibular suction is not accidental—it is the result of understanding anatomy, respecting physiology, and applying clinical protocols that integrate both. Several authors have attempted to simplify the denture fabrication process into essential elements that guide both clinical and laboratory procedures. Among them, Saito provided one of the clearest frameworks, stating that the construction of a complete denture can be summarized into three fundamental essences[20]:

1. The shape of the denture base
2. The recording of the occlusal relationship
3. The final arrangement of artificial teeth

FIG 1-13 Retention test with a dynamometer shows excellent mandibular denture retention, comparable to implant overdentures.

He further emphasized that these essences are achieved through four key clinical steps. I agree with this structured approach, although I adapt the sequence slightly in my own practice:

1. Preliminary impression and occlusal record
2. Closed-mouth functional impressions and centric relation record
3. Esthetic and functional take-home try-in
4. Final delivery

Each step must be precisely coordinated, with laboratory procedures carefully tailored to the individual needs of each case. The following chapters will explore each of these components in detail, providing a comprehensive and clinically oriented roadmap for achieving consistent and predictable outcomes in complete denture therapy.

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