The Complete Denture

A Clinical Pathway, *2nd edition*

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The Complete Denture: A Clinical Pathway
Second Edition

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Contents

Dedication

To Mary for constant support and encouragement

To my father Patrick J. MacEntee who introduced me to the art of complete dentures

To Stephen Bartlett and John J. Sharry for the direction to master the art

To my colleagues and students who continue to stimulate me

Preface

I began the preface to the first edition of this text by posing several questions: "Why write a book about a dying art, about a skill with little science, or about a service that is no longer in the main purview of the dental profession? Is not edentulism on the decline because the youth today will keep their teeth for life? Have not oral implants transformed the edentulous mouth into a foundation for fixed prostheses?"

I continue to hear these questions, even accompanied by the ring of ageism: "Isn't tooth loss an old person's affliction?" Everyone in dental academia knows that the curriculum has moved away from prosthodontics to embrace, it is said, knowledge that is much more relevant to the dentist in the new millennium.[1] The seminal question remains on the agenda of most dental faculties: "Why bother with the complete denture?" But, as I explained in the first edition, the art and science of complete dentures provides the foundation for so much of a dental clinician's day: listening to patients; probing for diagnostic clues; distinguishing healthy from diseased tissues and functional from dysfunctional structures; assessing the arrangement of teeth for patients who are concerned about dentofacial disfigurements and for occlusal contacts that are physiologically unstable; making impressions; using dental articulators; manipulating an array of biomaterials; and communicating their observations and recommendations to others.

There has been remarkably little attention given in either dental education or the related sciences to the management of chronic disorders, yet we know that successful aging is influenced strongly by the long-term skills people develop to adapt and cope with chronic adversities.[2,3] As clinicians, we are skilled in the techniques to remove, change, and replace structures in and around the mouth. We can deliver the most exquisite prostheses, far beyond the expectations or demands of most patients. Yet, we are much less skilled at maintaining a comfortable quality of life with minimal effort and expense to patients and ourselves.[4]

Almost everywhere, there has been an excellent trend away from complete tooth loss, and more people than ever before are retaining some natural teeth for life. However, the epidemiologic data available on the prevalence and incidence of tooth loss is sadly wanting.[5] Steele et al[6] reported from a 2009 survey of oral health in the United Kingdom that "[a]lthough the percentage of people who are edentate is small, it still accounts for approximately 2.7 million adults across England, Wales, and Northern Ireland." The 2007 to 2009 Canadian Health Measures Survey found that 6.4% of adults aged 19 to 79 had no natural teeth, which amounts to about 1.5 million adults in Canada, excluding indigenous peoples, who need complete dentures.[7] The equivalent number of edentulous adults in Australia is about 1.2 million.[8] Therefore, no matter how or where we look, we cannot say with any confidence that patients in the near future will not need or want full dental prostheses.

Oral implants have moved the demand away from complete dentures as described in most of this book, although we have included a chapter on implant-retained dentures. Yet, replacement of missing teeth with an implant-retained denture is not far removed from the main topics of this book. The diagnostic skills are very similar for the clinician who is helping a patient decide whether or not to replace an old prosthesis. The materials available for making either mucosal or implant dentures are much the same—as are the impressions, jaw relationships, clinical trials, delivery, and post-delivery care. In short, it would be impossible to make an implant-retained denture without the skills associated with complete dentures. And so, the question remains: "Where do we learn effectively about the consequences and replacement of missing teeth if not when making complete dentures?" A dental curriculum without complete dentures will be a curriculum challenged for clinical relevance to so much of prosthodontics and dentistry. Ultimately, a clinician without the knowledge, skills, and art associated so directly and obviously with complete dentures will be seriously restricted as a general provider of oral health care.

We see already a decline in prosthodontic services as clinicians focus their practice on less demanding services. Denture wearers do not place a heavy demand on dentists, not necessarily because they are at ease with their dentures, but because they have learned to adapt and cope with this disability. They are reluctant to seek further prosthodontic treatment because they have been dissatisfied with the treatment they received previously.[9,10]

This text is one among many on the topic of complete dentures. It differs only in that it describes and illustrates a technique that my colleagues and I have found to be relatively straightforward and based on methods without unnecessary frills. It offers a minimally acceptable protocol or clinical path based on the principles of "appropriatech".[11,12] Of course, this path is influenced largely by our own clinical experiences, but, when available, we reference the sources of more objective evidence to provide the biologic, psychologic, technical, and artistic foundations upon which people who are disabled by tooth loss might find relief. We have avoided detailed descriptions of alternative techniques, not because we feel that they are any less effective, but because, in our experience as clinicians and teachers, our students have attained greater success by focusing carefully on one path without the confusion of many crossroads.

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Acknowledgments

This text evolved initially from the influence of my teachers, Stephen Bartlett, John J. Sharry, and Aiden Stephens, who gave me the solid foundation of their experiences while encouraging me to question everything. It was refined over many years by the advice and experiences shared freely by my colleagues at the University of British Columbia and by the questions raised and sometimes answered by my colleagues in prosthodontics, dental geriatrics, and public health around the globe. I am very fortunate also to have benefited from the friendship of two giants in our discipline—Gunner Carlsson and George Zarb. Gunner has been the most coherent voice of reason in prosthodontics, and in retirement he continues to ask the right questions, which I hope will be evident to readers of this book. George Zarb, in a similar way, has changed the way we all practice dentistry, yet he remains solidly connected to the foundations of our profession. His friendship, erudition, and constant support have been my mainstay in prosthodontics for almost half a century. And, most recently, I have been inspired by Peter Owen in South Africa who, through his concept of "appropriatech," has shown me that economic stress and quality of care are indeed compatible in prosthodontics and the rest of dentistry if we can look past the technical glitz to find the services most appropriate for the communities we serve.

I acknowledge the manufacturers of the materials mentioned throughout the book. I would like to add, nonetheless, that the products identified in the text reflect my own practical experience, and in no way do I or my colleagues wish to imply that they are superior to materials available for the same purpose from other manufacturers.

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CHAPTER > 1

Seeking the Problem

The Interview

> ***"Interviewing is rather like marriage: everybody knows what it is, an awful lot of people do it, and yet behind each front door there is a world of secrets."***
>
> **Ann Oakley[1]**

People seeking the services of a dentist are usually concerned about their teeth and present with specific expectations: a periodic check of the mouth, a new filling or denture, or extraction of a tooth. The clinician identifies the cause of the concern and recommends treatment after considering the many factors that could be influencing the patient's condition. A diagnosis is difficult to make based on physical evidence alone without insight into the psychologic and social context in which a patient lives and has lived. Therefore, before considering a diagnosis or treatment, the clinician should interview the patient to identify and explore all the concerns, related conditions, and expectations that prompted the patient to seek care.

The patient's story

Conducting a useful interview is an art in which the interviewer listens, observes, analyzes, and records the essence of the conversational story and behavior of the patient. Smith and Hoppe[2] explain the importance of actively encouraging the patient to describe the human dimension of the problem. They contend that the patient who is involved in exploring the problem and choice of available treatments is more likely than the passive patient to comply with treatment.

Phase 1—Introductions

The initial phase of the interview is helped by courteously but formally using the patient's family name (eg, Mr or Mrs Wong), rather than a first name. The overtly familiar approach of using a first name, especially when there is a large difference in age between patient and clinician, can disturb some patients and inhibit the possibility of a free-flowing and respectful dialogue. Personal familiarity when addressing older patients is better postponed until treatment is underway and mutual comfort has grown naturally between both parties.

A simple and direct introduction is a good way to begin an interview, followed sensitively by the question, "How can I help you?" Time for "small talk" should also be allowed at this initial encounter to show the patient that time has been reserved for this personal interaction. It is best not to provide too much guidance to the patient but rather to allow the problem or complaint to unfold during the dialogue. Later, when the patient's perspective and feelings have emerged, the clinician can be more direct to solicit details and confirm the interpretation of the problem.

Phase 2–Directing the discussion

The more directive phase of the interview begins when details are needed on specific aspects of the problem. For example, when a patient states adamantly, "All I want is a good denture that fits," the interviewer should direct the conversation to identify what exactly the patient means by "a good denture that fits." Occasionally, this can reveal that treatment is requested by the patient in response to pressure from family or a close friend, in which case the treatment will need to satisfy a larger circle of participants. An appraisal of the patient's general appearance can provide clues about the importance placed on dental appearance and whether or not the teeth are disturbing communication and social activities.[3] The clinician may also notice indications of disease that require closer investigation. Angular cheilitis, for example, suggests inadequate occlusal support, a lack of proper denture hygiene, or a nutritional disorder. Swollen fingers or a tremor of the hands suggests arthritis, Parkinson disease, or other systemic disorders that complicate a patient's tolerance of dentures. Therefore, the dentist must

resist diagnosing an organic disorder until all the human and biologic information is collected, sorted, and aligned to one or more reasonable diagnosis that could explain the patient's complaint.

At the beginning of this directive phase, as the clinician guides the patient into a transition from the general to the specific and from the past to the present, it can help to inform the patient of the need for more details about the effects of the complaint. Sometimes eliciting this transition will quickly bring focus on a particular problem (eg, "My upper denture slips when I talk."), but usually, the patient's story remains vague (eg, "It embarrasses me when I eat.") until specific prompts clarify each detail of the concerns and symptoms. The exact words used by a patient, such as "pain," "rocking," or "ugly," are frequently more informative than general terms, like "fit," for describing specific symptoms. Past and present psychologic health is assessed by probing for evidence of chronic pain or emotional instability, including depression and prolonged use of psychotherapeutic medications (eg, tranquillizers and sleeping pills).

The patient's responses and reactions to questions should be recorded in detail throughout the interview. However, not everyone will willingly and comfortably reveal their feelings and beliefs about their problems, especially if the problems are chronic and previous treatments failed. Some patients become very emotional during the interview, so a tactful statement and a sympathetic posture by the clinician may be needed to defuse emotional outbursts. A clinician can offer a simple statement, such as, "I can understand why you feel so upset; however, tell me more details about the problem." Above all, a patient's emotional distress should be allowed to take its course. Patients will gain control when offered an atmosphere of respect and sympathy, and they will return the respect with trust and greater insight into the problem and its possible solutions.

Phase 3—Explanations

The hypothesis phase of the interview is usually entwined with the interactive phase as more information surfaces and the clinician can make one or more explanatory hypotheses that are strengthened or weakened by the patient's interpretation of the illness. Finally, when the patient's complaints and explanations begin to sound repetitive, it is an indication that the interview has run its course, and further inquiry is unlikely to reveal anything new. This phase should always end with a summary of the story and confirmation from the patient that the clinician has heard and recorded the information correctly. If the patient expresses doubts about accuracy, additional clarification is needed before the clinician attempts to diagnose the source of the problem and offers treatment.

Questionnaires

A structured questionnaire alone is not a reliable instrument for gathering information regarding the health and background of a patient.[4] It can alert the patient to the need to provide particular details, but an open-ended interview is the only comprehensive way to obtain valid information about a patient's concerns and relevant medical and dental experiences.[5]

Smith and Hoppe[2] claim through a quotation from David Eddy that "[un]certainty creeps into medical practice through every pore," and that "interviewing is required for the definitive categorization of most organic diseases and for decisions about disease probability and diagnostic procedures." It is not at all clear how much diagnostic uncertainty is relieved by this patient-centered interview, but it unquestionably differs from the traditional recording of a patient's medical-dental history by focusing directly on the patient's interpretation of the illness. Smith and Hoppe[2] offer the mnemonic POPP (*p*ersonal dimension, *o*rganic-disease dimension, *p*sychiatric diagnosis [if any], and *p*ersonality features) as a guide for systematically constructing a biopsychosocial profile of the patient, with the provision that more information can be added to it as the physical examination and diagnostic tests are conducted and interpreted. A comparison of interview notes obtained on different occasions can reveal recurrent themes or conflicting symptoms and provide further insight into the patient's motivation for seeking help and to the prognosis of various treatments.

Significant events and treatments

Chewing is disturbed as the dentition deteriorates,[6] and even well-fitting dentures are much less effective than natural teeth.[7,8] Therefore, the patient's dental experiences should be investigated in detail after the scope of the complaint has been unraveled and recorded. A historical exploration of denture use includes information about the time and reason for the loss of teeth and satisfaction with the dentures. This reveals the tolerance and expectations of the patient and affords an opportunity to discuss the usual difficulties with dentures and the ability of the patient to cope with tooth loss.[9,10] It also helps to know who previously made dentures for the patient so that the clinician can make reasonable efforts to obtain previous interpretations of the patient's needs and past experiences.

Diet and nutrition

Consideration of the patient's diet has implications for the outcome of denture treatment. Patients with weak natural teeth typically select highly processed food lacking fiber and are at risk of vitamin (eg, C, beta carotene, and folate) deficiencies, which can disturb the oral mucosa.[11,12] A population-based study found that edentulous adults, when compared with those with natural teeth, had significantly lower levels of plasma ascorbate and plasma retinol, which could disturb their skin and eyesight.[13] On the other hand, another population-based study found that many of the differences in nutritional intake could be explained by demographic, cultural, and behavioral differences, including variations in age, historical background, and smoking habits, rather than number or condition of the teeth.[14] Other more limited investigations found that elderly people, whether healthy or frail, could eat nearly all of the food available to them without complaint, even with uncomfortable and worn dentures.[15–17] Investigators in the US[18] and Brazil[19] found that, after adjusting for sociodemographic and behavioral characteristics, people on low incomes who had no natural teeth, when compared with people with natural teeth, consumed about 50 grams less fruit or vegetables per day, and the majority were overweight or obese. Consequently, it can be helpful to inquire about a patient's diet and if necessary offer advice about diet before making new dentures,[20] but it is also realistic to recognize that people who have mouth sores and difficulty chewing do not comply readily with advice on diet.[21]

The Examination

Information on the physical status of the patient is collected deductively and systematically during a structured examination (Box 1-1).

Box 1-1 Systemic oral examination for complete denture wearers[22]

Jaw Function

- Abnormally restricted opening. Less than 30 mm between incisors or more than 45 mm between residual ridges at the midline.
- Opening deviation. More than 10 mm from the midline on opening the mouth to at least 20 mm.
- TMJ or jaw muscle pain.
- Occlusal attrition. More than two-thirds of more than half the dentition.
- Inadequate occlusal contacts. Less than two opposing molars or premolars bilaterally.
- Acceptable.

Maxillary and Mandibular Dentures

- Use. Denture not worn or missing when one can be managed.
- Quality (if worn):
  - Stability. Dislodged with light finger pressure to a premolar.
  - Retention. Dislodged or loose when the lips are licked with the mouth open approximately 15 mm.
  - Structure. Missing parts, fractures, visible porosity, or other structural defects.
  - Hygiene. Calculus or visible plaque on more than 50% of the denture base.
- No problems.

Mucosal Disorders

- Angular cheilitis.
- Stomatitis. Generalized or papillomatous (less than 1 cm^2).
- Denture-induced hyperplasia (epulis) or ulceration.
- Mucosal pathoses:
  - Glossitis
  - White patch
  - Pigmented patch
  - Ulcers
  - Abnormal lip
  - Sinus or fistula
- Other urgent orofacial needs
- None of the above

Extraoral

Teeth dominate the lower third of the face and can be observed during the interview relative to the patient's complaints. Visible movements of a maxillary denture will verify that the denture is loose, whereas a denture that looks natural to the dentist but ugly to the patient is an ominous indication that the dentist may not be able to meet the patient's expectations.[23]

The area over the temporomandibular joint (TMJ) is palpated in and around the ear, to detect pain, crepitation, or joint sounds. A painful response from the muscles of the head and neck bodes poorly for a comfortable denture, although this is an unusual finding in older denture wearers.[24] Clicking sounds within the joint, like most other highly active joints, are not unusual in older patients, and are of little concern without pain. More serious symptoms involving pain, limitation of movement, or extreme deviation when opening the mouth are found in a relatively small (about 15%) proportion of older people.[24,25] In addition, there is no evidence that the quality of complete dentures has any influence on TMJ disorders.[26]

Intraoral

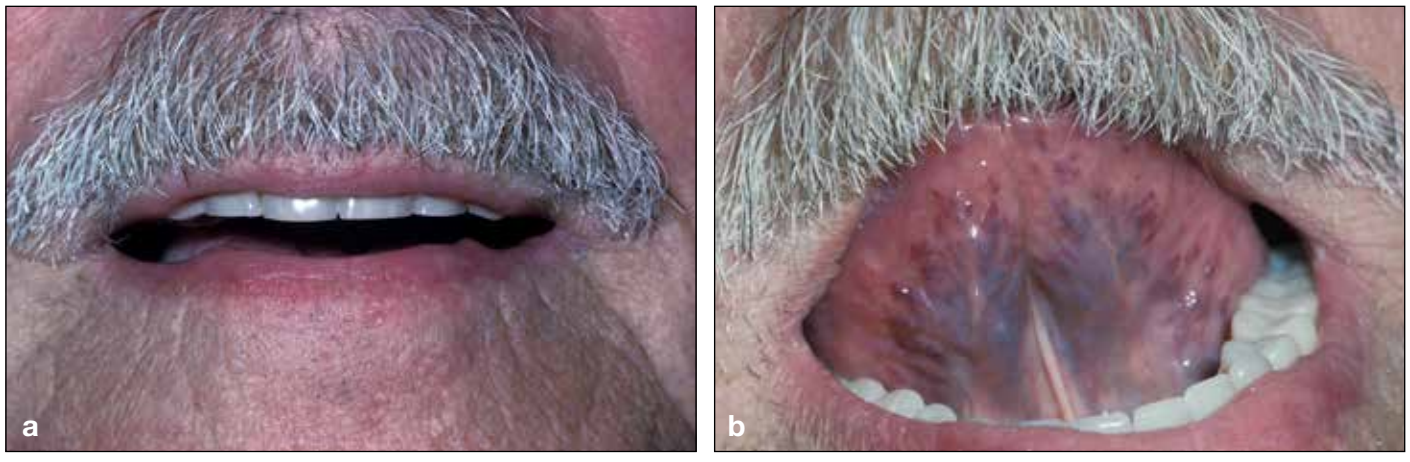
Occlusal contacts

Tooth contacts influence the position of the mandible and the stability of dentures,[27] but probably not as much as was once thought.[28] However, the intraoral examination should identify occlusal contacts that occur: *(1)* when the mandible is relaxed in the retruded intercuspal position (centric relation), *(2)* when the teeth contact in the maximal intercuspal position (centric occlusion), and *(3)* during the eccentric jaw movements. The freeway space (ie, separation of the teeth) usually is measured between the maxillary and mandibular central incisors by sitting the patient upright in a relaxed position and gently parting the lips to see the space between the central incisors. The ability to impart relaxed confidence and gentle assistance to a patient will contribute greatly to the validity of the examination and measurements of occlusal contacts and jaw movements.

Denture quality

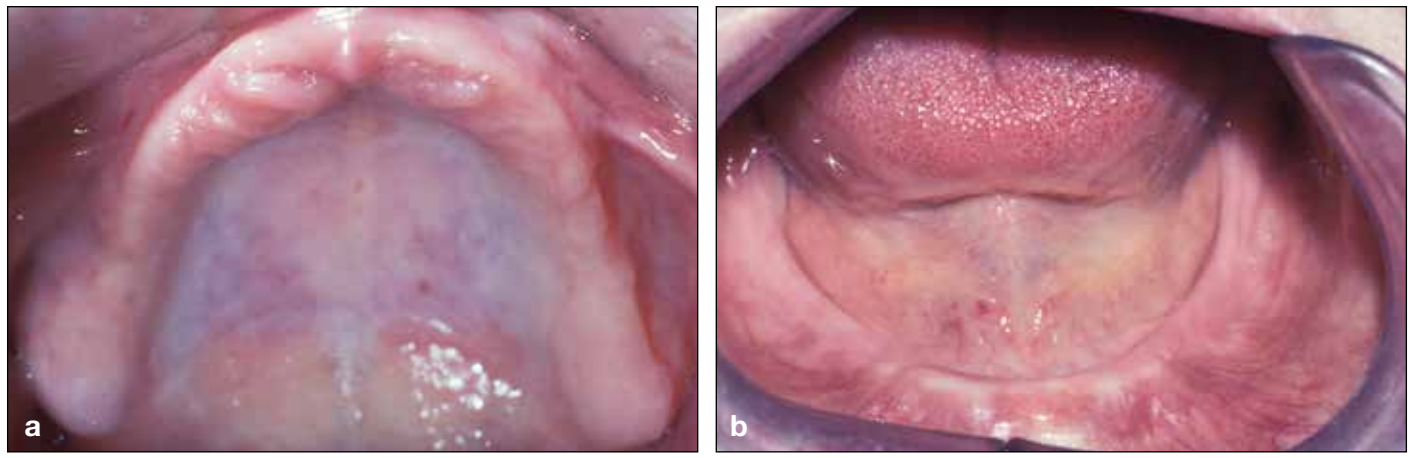
The quality of dentures should be assessed for retention, stability, tooth arrangement, composition and structure, and hygiene.

Retention relates to movement of the denture away from the ridge. When the lips are parted widely (approximately 15 mm), the maxillary denture should stay in position on the roof of the mouth without an artificial adhesive (Fig 1-1a), and the mandibular denture should not move from the alveolar ridge when the patient licks the upper lip (Fig 1-1b). However, some patients interpret even the slightest movement of a denture as a sign of impending collapse, while others undergo amazing oral gymnastics without complaint to hold an extremely defective denture in place.



1-1

Stability of a denture depends on the support provided by the residual ridges and the palate (Fig 1-2). It is enhanced by extending the denture base onto the structures surrounding the residual ridge within the limits of jaw and tongue movements. The usual way of evaluating this support is by assessing resistance to finger pressure on the occlusal and lateral surfaces of the denture. Resistance will depend on the activity, shape, and compressibility of the supporting ridges, muscles, and mucosa. This too is not an exact measurement and should be interpreted cautiously and with reference to the patient's complaints.



1-2

Tooth arrangement on the denture influences not only the patient's appearance but also the stability and retention of the denture bases. The anterior teeth support the lips, cheeks, and tongue in an arrangement that is both pleasing esthetically and tolerated comfortably during normal movements (further details are provided in chapter 6). The central grooves and tips of the cusps of the mandibular premolars and molars are positioned optimally over the crest of the residual ridge, along a line joining the center of the retromolar pad to the incisal tip of the mandibular canines.

The *composition and structure* of a denture base and denture teeth, whether resin or ceramic, should be intact and clean and embody the appearance of natural teeth, gingiva, and mucosa. Damaged or abraded occlusal surfaces on a denture are not unusual after many years of service, but they can appear early if the denture wearer consumes large amounts of abrasive or erosive foods or tends to grind (brux) on the dentures. The supporting mucosa and underlying ridge will be stressed if the patient clenches or grinds aggressively on the dentures, especially at night during sleep. Although the masseter muscle in older denture wearers is more active during sleep than it is in younger adults with natural teeth, the intensity of the activity is relatively low when compared with bruxism in younger people.[29]

Denture hygiene is assessed by looking for stain, plaque, or calculus on the teeth and denture base.[30] Microbial plaque is difficult to see unless it is very thick or stained by a few drops of a plaque disclosing agent or erythrosine or sodium fluorescein. Halitosis (ie, bad breath) is also associated with poor denture hygiene, especially when the base is old and dentures are worn overnight.[31] The bad odor is usually from volatile sulfur compounds,[32] but can come from an otorhinolaryngologic, gastrointestinal, pulmonary, or other systemic disorder. Placing the dentures in a plastic bag for a few minutes provides a useful way to confirm that the dentures are the source of the sweet, unpleasant smell or that referral to a physician is required.

Oral mucosa

Mucous membranes are inflamed by many systemic disorders, and particularly disorders of the blood, hormonal, metabolic, and immune systems. More commonly, inflammation in the mouth of a denture wearer is caused directly by trauma from the denture base. Consequently, examination of the mucosa should also involve areas of the mouth that are difficult to see, such as the ventral (under) surface of the tongue and the alveolar vestibules lateral to each maxillary tuberosity.

Mucosal inflammation in denture wearers can present as denture stomatitis, angular cheilitis, and hyperplasia of the mucosa.

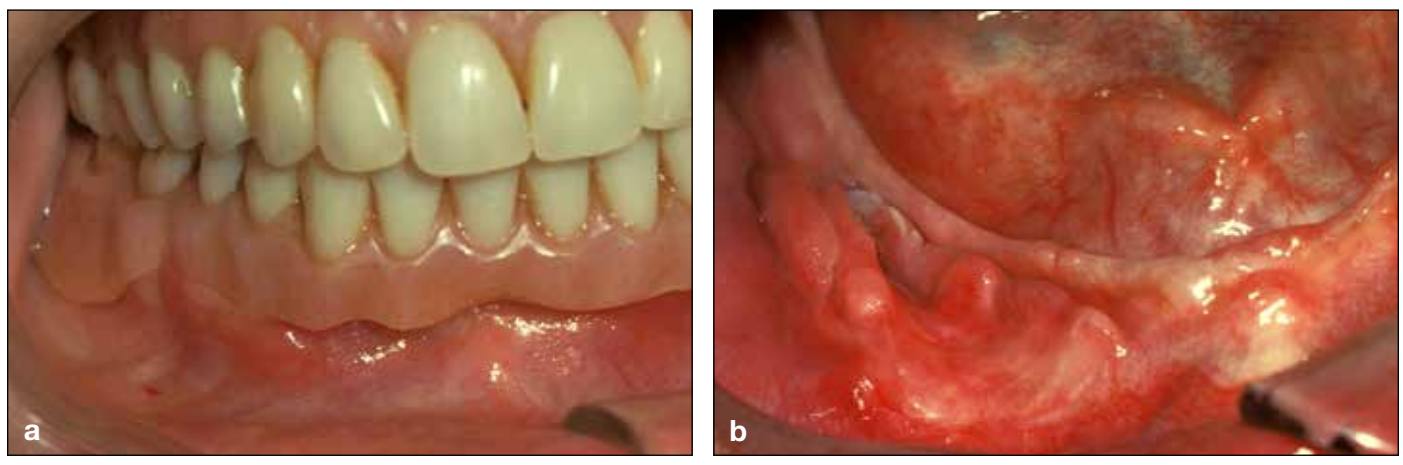
Denture stomatitis is seen in three forms—local, generalized, and papillomatous—in the palatal mucosa underlying a denture.[33] Movement of the papillomas is easily seen by blowing air from an air syringe across the palate (Fig 1-3). The cause and significance of the milder forms of stomatitis are unclear, although aciduric microflora—*Candida albicans* in particular—have been highly implicated, along with an acidic biofilm on a denture.[34,35] Moreover, patients who were at high risk for caries before they lost their natural teeth might later have an elevated risk to denture stomatitis when wearing complete dentures, possibly because both conditions thrive on similar acidogenic microflora and a sweet diet.[36] Candidal overgrowth, or candidosis, can be precipitated by a wide range of conditions, including diabetes, systemic corticosteroids or broad-spectrum antibiotics, poor nutrition, celiac disease, ulcerative colitis, Crohn disease, iron or riboflavin deficiencies, several immunodeficiencies, and local disturbances caused by radiation therapy and nicotine.[37] It tends to grow vigorously in the absence of saliva, which helps to explain why it can grow so easily underneath and in a denture base, as well as in a dry mouth.[38]

1-3

Angular cheilitis (perlèche) is seen at the angles of the mouth (Fig 1-4), usually accompanying an intraoral stomatitis or candidosis.[16] It is associated typically with old and unstable dentures, candida and *Staphylococcus aureus*, and a visible loss of occlusal vertical dimension.

Hyperplasia of the mucosa underlying a denture is caused by chronic irritation from the periphery of an unstable denture (Fig 1-5). It is possible to excise the mucosal folds surgically; however, a more conservative treatment is to allow the hyperplastic tissue to shrink slowly by adjusting the sharp periphery of the denture to remove the cause of irritation and stabilize the base.

1-4

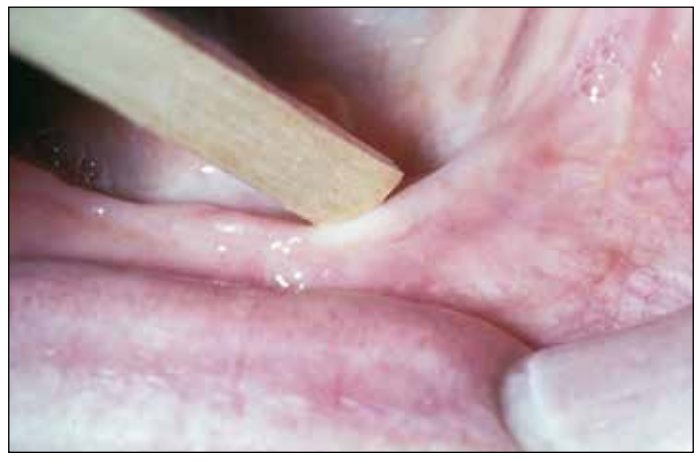


1-5

Residual ridge

Resorption of alveolar bone (Fig 1-6), known as *residual ridge reduction*, occurs at an unpredictable rate when natural teeth are extracted,[39] and the ridge will severely compromise the stability of a complete denture if it is excessively (> 2 mm) mobile or flabby under light pressure, or there is less than 1 mm of mucosa attached firmly to the underlying periosteum[9,22] (Fig 1-7). Light finger pressure on the ridge over and around the mental foramina to solicit discomfort, pain, or paresthesia will give a reasonable indication of the patient's tolerance to functional pressures from the denture bases.

1-6



1-7

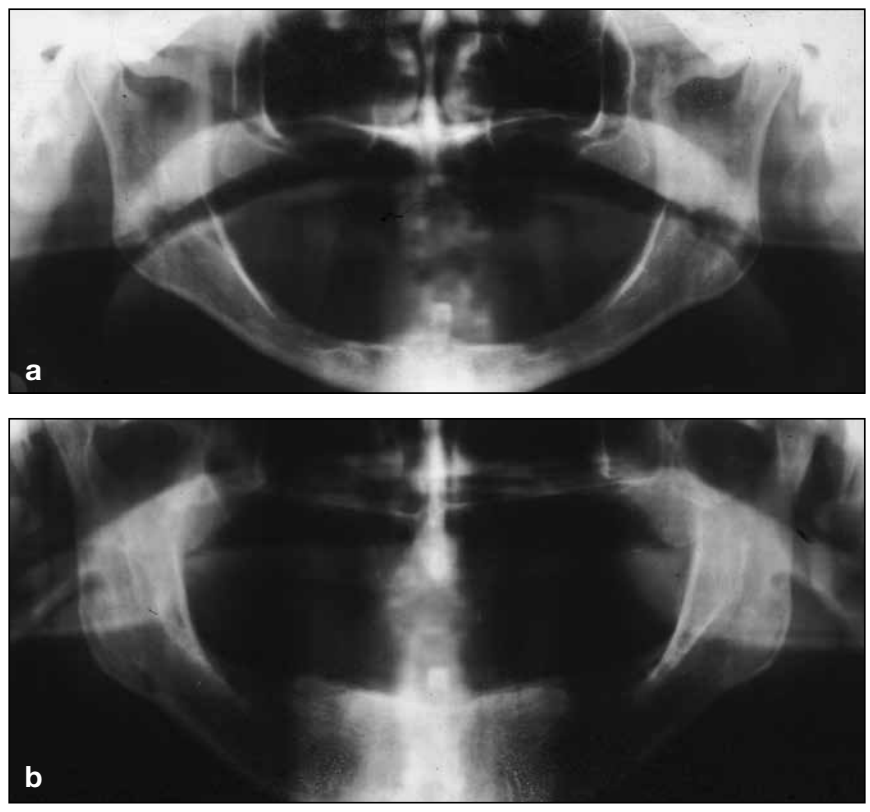
Other abnormalities

When the denture-bearing mucosa has been examined fully, the remaining parts of the mouth are inspected for lumps, ulcers, and sinuses. Like all clinical examinations, this should be conducted systematically so that the less visible areas of the mouth are not overlooked.[19,40]

Other diagnostic tests

A radiographic examination (Fig 1-8) is conducted after the physical examination if there is reason to believe that there might be a problem in the bone. Guidelines on the use of radiographs as part of a routine examination of edentulous jaws tend to caution against unnecessary radiation.[41,42] Although exposure to radiation from the usual doses of oral panoramic radiography is equivalent to a few days of natural background radiation, there is no justification for exposing a patient to radiation when the likelihood of finding disorders that need treatment is low. Innocuous fragments of root tips from extracted teeth are the usual findings on a panoramic radiograph of an edentulous jaw.[43,44] Therefore, panoramic radiographs are prescribed for edentulous jaws only if the patient's history and clinical

examination identifies a specific reason, such as a chronically stuffy nose suggesting a sinus problem, a swelling, a chronically painful lesion, or a mucosal sinus tract or dehiscence.[45] Most of the residual root tips and even impacted teeth are best left undisturbed in the jaw unless there is evidence of a cyst or other active disorder.[46]



1-8

Saliva has a central role in the successful management of compete dentures. It helps to cushion the denture on the mucosa. It lubricates the surface of the denture and overlying mucosa, which helps to retain the maxillary denture on the palate and residual ridges with a peripheral seal.[47] Dentures in a dry mouth become almost unmanageably loose and uncomfortable. Medications, usually anticholinergic or sympathomimetic medications, such as antidepressants, antipsychotics, benzodiazepines, atropinics, β-blockers, and antihistamines, are the most frequent cause of a dry mouth or xerostomia (the subjective sensation of a dry mouth).[48,49]

Other tests, including biopsies of the mucosa and bone, are needed when an unusual lesion is seen, but only after the history and associated conditions or activities of the lesion have been explored and recorded.[50] The characteristics of the lesion, such as size, color, borders, consistency on palpation, and location are examined. Lesions with ragged borders deserve particular attention. Small (< 2 mm) lesions usually have a low risk of cancer; however, a suspicious lesion is managed by removing any obvious irritant associated with the dentures, and, if after 3 weeks the lesion has not healed, it should be biopsied to obtain a histopathologic diagnosis.[51]

The Public Health Agency of Canada estimates that about 1.5 million Canadians 40 years and older (10% of this population) have been diagnosed with osteoporosis by a physician, it is four times more prevalent in women, and about one in every five persons with osteoporosis will have an associated bone fracture.[52] Radiographs of the jaws are not reliable indicators of this disorder, but because of the serious consequences with advancing age and an expected rise in prevalence, dentists can help to detect and refer patients for more thorough investigations of their bone by asking the few pertinent questions that form the basis of the FRAX (World Health Organization) surveillance tool for osteoporosis[53] (see http://www.shef.ac.uk/FRAX/tool.jsp).

Treatment Plan

The plan for treatment emerges from the interview with the patient combined with the clinical observations and additional findings of the clinician. The first step in this process is to confirm that the problems presented by the patient are clearly understood by the clinicians and compatible with the clinical findings. Any conflict between the two must be resolved by further discussion and investigation before a decision on treatment. If, for example, the patient is complaining about dentures that were made recently, and the clinician considers the dentures clinically acceptable and cannot find cause for complaint, then there is no reason to recommend new dentures even if this is the patient's wish. The plan would be better directed toward counseling the patient on the limitations of dentures, suggesting other treatment—perhaps implants (see chapter 12)—to compensate in part for anatomical deficiencies, or recommending psychologic support to help the patient cope with the trauma of tooth loss.[54]

A treatment plan can be simple or complex, involving one or many stages, and each stage should have an aim and a process to assess whether or not the aim has been met before the next stage is initiated. For example, a patient who seeks new dentures and presents with uncontrolled diabetes, unstable dentures covered in a thick biofilm, localized mucositis under both dentures, and occlusal contacts only on anterior teeth will require several stages of treatment. First, the diabetes must be controlled or managed; second, the denture hygiene must be improved; third, the denture should be stabilized, at least temporarily; and finally, depending on the outcome of the preceding stages, the dentures can be either relined or replaced. The outcome of each stage influences the treatment in the following stage, and at the beginning of treatment there is no way to predict the final result. Indeed, for a complicated scenario such as this, and even much simpler scenarios, Laney's advice is particularly apt: "The key to . . . successful treatment is the . . . understanding between the dentist and the patient regarding what is to be done, the time required, and the cost."[55]

Informed Consent

No matter what plan is recommended, the patient must give consent based on full disclosure by the clinician—preferably in writing—of the objectives, benefits, limitations and uncertainties, and known risks associated with the plan. D'Cruz[56] defines this consent as:

> the voluntary and continuing permission of the patient to receive particular treatments and must be given by a patient who has capacity to consent to the intervention in question. It must be based upon adequate knowledge of the purpose, nature, likely effects and risks of that treatment, including the likelihood of its success, and a discussion of any alternative to it. To be valid, consent must be given voluntarily and freely, without pressure or undue influence being exerted on the patient either to accept or refuse treatment.

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CHAPTER > 2

Impressions for Study Casts

A cast for studying the surface of an edentulous ridge is made usually from an impression obtained with an irreversible hydrocolloid (alginate) material.

Most of the hydrocolloid materials are relatively unstable; therefore, the stone should be poured into the impression to make the cast as soon as possible, preferably within 15 minutes, after removing the impression from the mouth.[1] Further development of irreversible hydrocolloids (eg, Hydrogum 5, Zhermack) has improved the material so that the impression of the residual ridge will remain reasonably stable for several hours before the cast is made.[2]

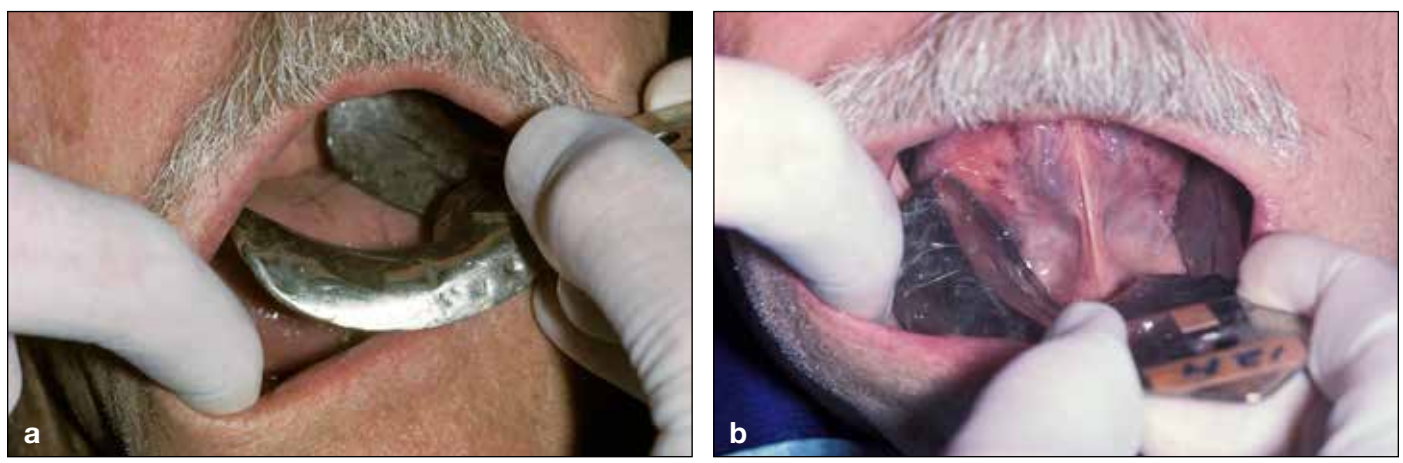
Metal (eg, Rim-Lock, Dentsply Caulk) (Fig 2-1) or plastic (eg, Hi-Tray Light, Zhermack) trays made specifically for the edentulous ridge are designed in a variety of shapes and sizes to carry the material. The mandibular tray should cover the retromolar pads and all of the alveolar ridge, and the maxillary tray should cover the hamular notch bilaterally and the vibrating line of the soft palate and rest comfortably in the buccal vestibules with minimal disturbance to the crest of the vestibular mucosa.

2-1

The Mandibular Impression

When the tray is selected to fit the alveolar ridge, the impression is made according to the manufacturer's instructions as follows:

- The height and orientation of the dental chair is adjusted so the patient's mouth is level with the clinician's elbow to provide access and a good view into the patient's mouth while assessing the fit of the selected tray (Fig 2-2).
- Usually, it is necessary to add a soft beading wax (eg, Utility Wax Rods, Kerr) along the periphery of the tray to help retract the soft tissues and provide additional support for the impression material as it sets (Fig 2-3).
- The box containing the hydrocolloid powder is vigorously shaken before it is opened, and cold water is added to the powder in a rubber mixing bowl according to the manufacturer's instructions. It is usually a 1:1 mix of powder and water using the specific measures supplied by the manufacturer.
- The powder and the water are quickly and thoroughly mixed to a creamy consistency as instructed to obtain optimal consistency and setting time.
- A small quantity of material is placed with a finger into the retromylohyoid spaces and labial vestibules as an assistant places the mixture into the impression tray (Fig 2-4a).
- The corner of the patient's mouth is reflected immediately, and the tray is rotated into the mouth and onto the alveolar ridge.
- The patient is instructed to raise the tongue and then relax it while the clinician lowers the tray with the impression material onto the ridge (Fig 2-4b).
- When the tray is oriented symmetrically on the ridge and the material flows from the tray into the vestibules, the patient is asked again to raise and extrude the tip of the tongue. This elevates the floor of the mouth for the impression to record the shape of the vestibule with the tongue raised.
- The tray is kept securely in place until the material is set fully (usually about 2 to 3 minutes, as instructed by the manufacturer), and when set it can be removed from the ridge by retracting the lips to allow air between the material and the mucosa.
- Finally, the impression is rinsed immediately with water, inspected (Fig 2-4c), covered with a wet tissue, and placed aside with care to avoid direct pressure on the fragile periphery.



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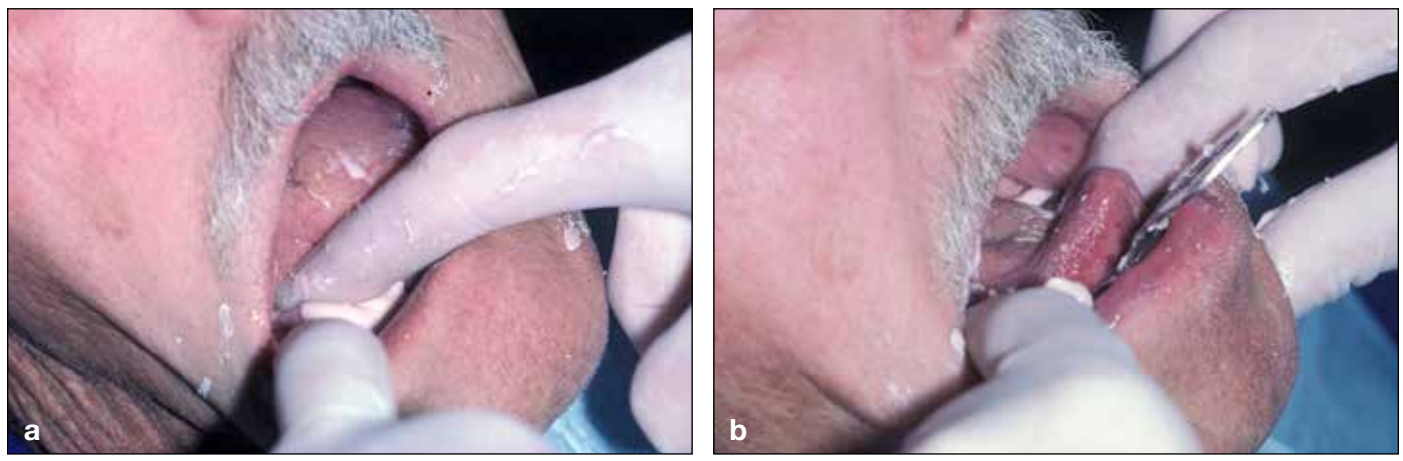
2-3



2-4

The Maxillary Impression

The maxillary impression is made in a manner similar to the mandibular impression:

• The vibrating line is marked on the soft palate from the hamular notch on either side with an indelible marker (Fig 2-5a), and a strip of soft beading wax is placed on the posterior periphery of the tray to help contain the impression material (Fig 2-5b).

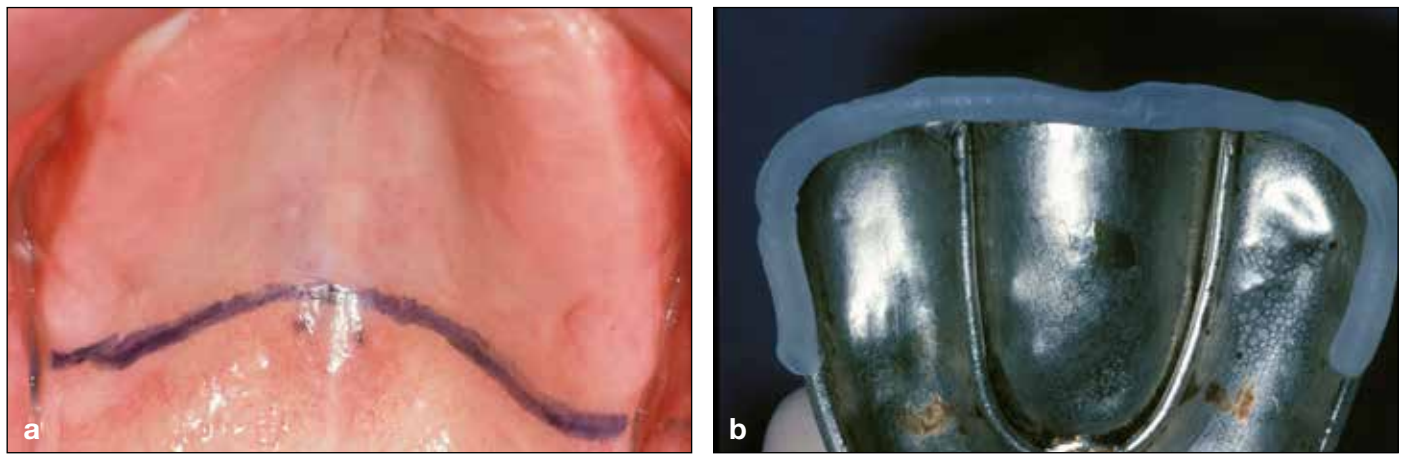
• Impression material is placed into the vestibules lateral to each tuberosity (Fig 2-6a), and the corner of the mouth is reflected as the tray is rotated into the mouth, oriented symmetrically over the ridge, and seated gently onto the palate until material extrudes around the periphery of the tray.

• The flow of the material is regulated as it extrudes by initially seating the posterior border of the tray against the palate and then bringing the anterior part of the tray into place as the material flows anteriorly.

• The upper lip is manipulated to mold the material in the vestibules as the impression sets (Fig 2-6b).

• The impression is removed from the palate by lifting the lip to break the peripheral seal.

• Finally, the impression is rinsed with running water, inspected (Fig 2-6c), covered with a wet tissue, and placed aside with care to avoid direct pressure on the fragile periphery.



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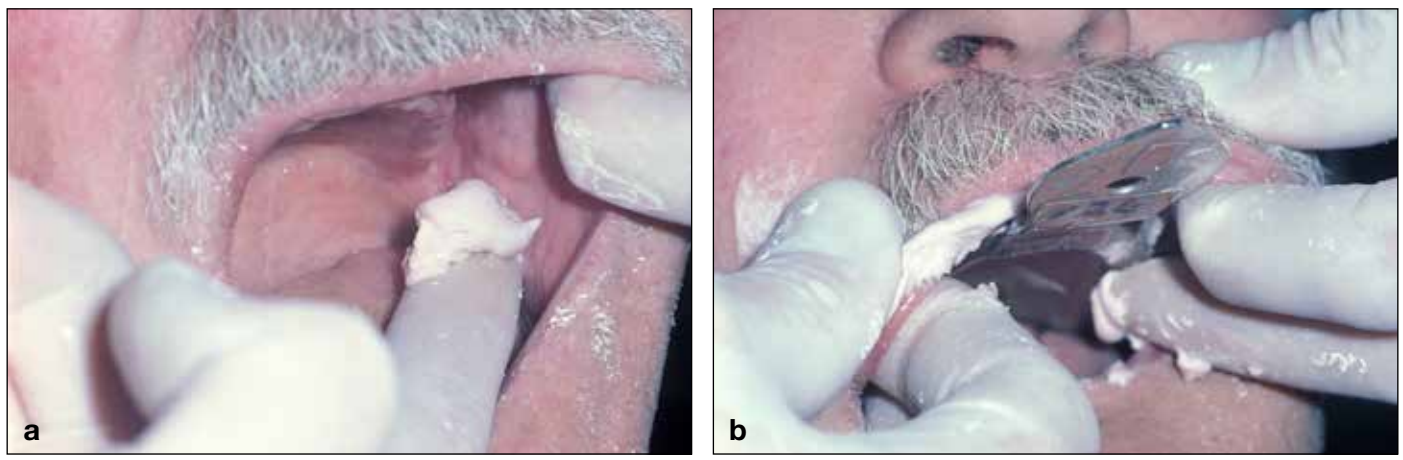
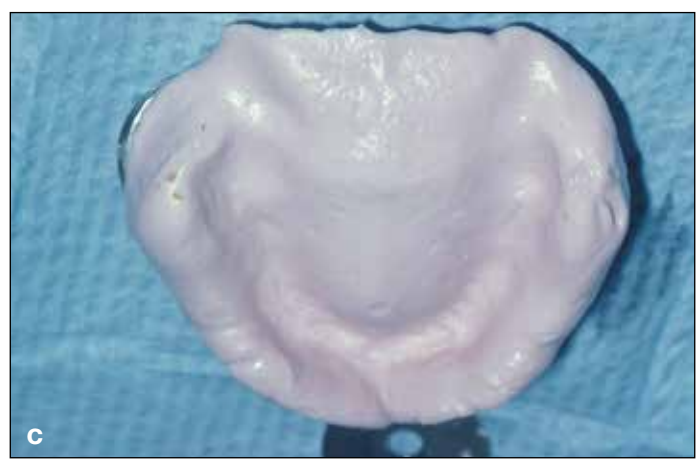
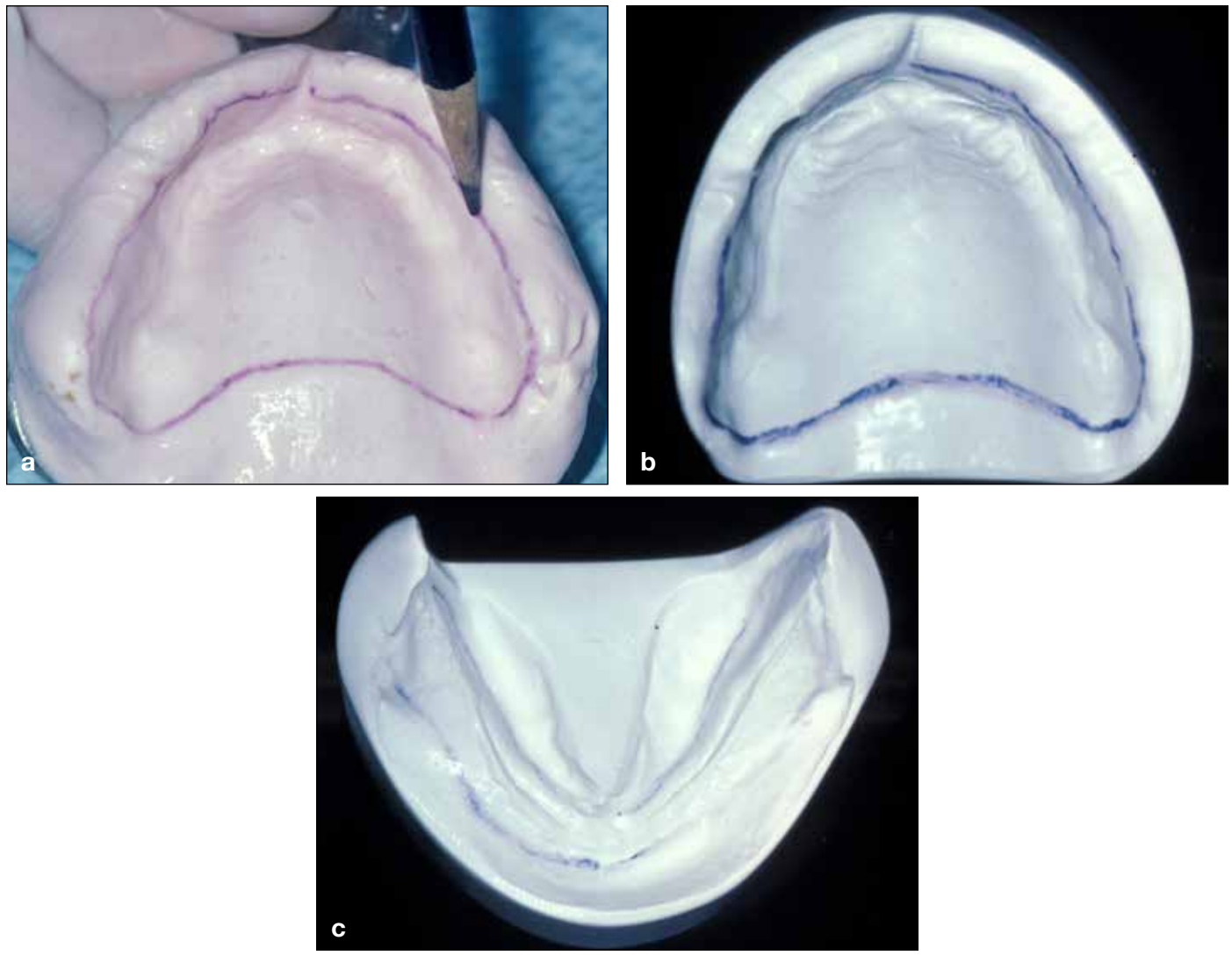




2-6

Outlining the Vestibules

The functional limits of the vestibules and the soft palate are marked on the impression with an indelible marker (Fig 2-7). This mark should transfer to the stone casts and the oral mucosa and provide a guide for the periphery of the acrylic trays in the vestibules.



2-7

Disinfecting Hydrocolloid Impressions

Controversy remains regarding the optimal way to disinfect dental impressions. A number of disinfecting solutions have been suggested, including glutaraldehyde, chlorine compounds, iodophors, and phenolic and alcohol compounds, either as immersion solutions or sprays.[3] There appears to be negligible clinical effect to the accuracy or stability of impression materials from immersing them in a 2% glutaraldehyde solution or 0.5% sodium hypochlorite solution for a short period,[4,5] and bacterial growth is inhibited by most of the commercially available disinfectants after 10 minutes.[6]

Finally, the impressions should be rinsed again with water after they are disinfected. They are stored then in a humid environment, usually a wet towel within a plastic bag, before they are poured in a white type II dental stone (eg, Hydrocal White Gypsum Cement, United States Gypsum) to make the primary casts.

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CHAPTER > 3

Making Master Casts

Denture Stability and Retention

Stability

A complete denture is stabilized and retained in the mouth by a combination of atmospheric pressure; surface tension between the mucosa, saliva, and denture base; the surrounding muscles; and occlusal contacts.[1] However, the interaction of a denture with surrounding structures is subject also to the diurnal movement of the mucosa[2] and the range of muscle movements. Consequently, an optimal impression of the mucosa overlying the residual ridges and surrounding muscles must record the shape of the structures as they are during normal movements of the mouth when speaking, chewing, swallowing, and expressing emotions. This is a challenging clinical task that relies more on the skillful manipulation of impression material than on the choice of material, of which there are many. And, despite a carefully made impression, the base of a new denture, especially for the mandible, usually requires multiple adjustments during the first few weeks of use to accommodate the full range of movements of surrounding muscles and the variable resiliency of the mucosa on the residual ridge. The need for these adjustments (see chapter 9) should be explained to the patient, even at this early stage of making new dentures.

Mucosa and jawbone can be distorted by ill-fitting dentures, although the extent or persistence of the distortion is poorly understood.[3,4] The old denture can be modified with a hard (eg, Kooliner, GC America) or resilient (eg, Coe-Comfort, GC America) relining material until the supporting tissues look healthy, or the patient can be advised not to wear the old denture for several hours before making the impression for the master cast.[5]

Retention

An intimate contact between the base of the denture and the mucosa helps to increase retention of the denture.[1] The strength of the retention depends largely upon the surface tension of the saliva and upon the intimate fit of the base to the mucosa, particularly along the periphery. Indeed a thin layer of saliva adhering to the denture and the mucosa has the same effect on denture retention as the thin layer of liquid between two sheets of glass.

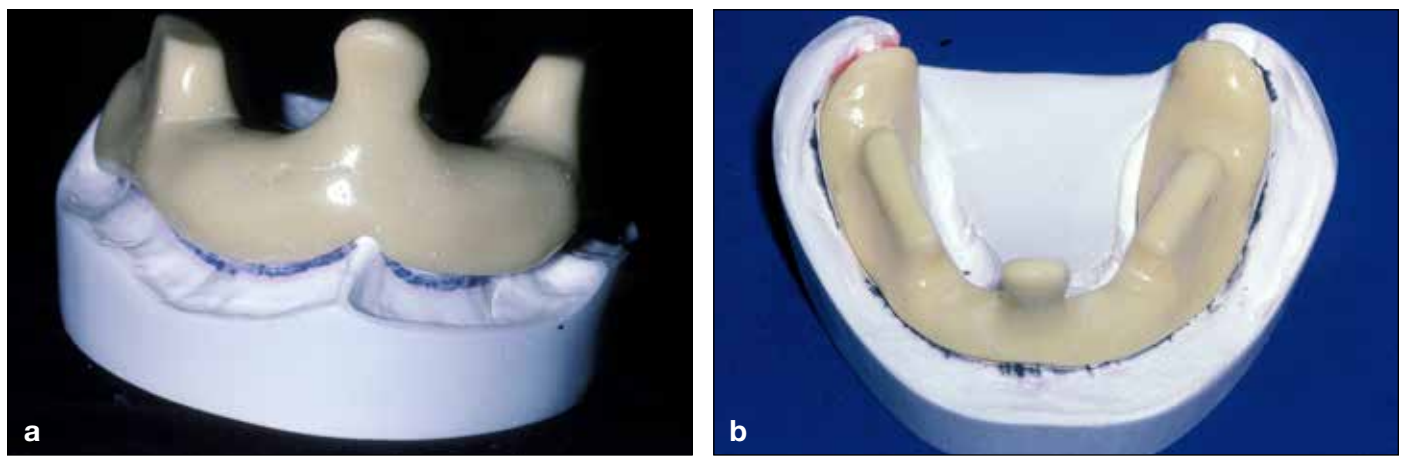
Constructing Acrylic Trays

Acrylic trays made on the study casts provide an accurate foundation for making the final impressions from which the master casts are constructed. They serve to support the materials for a two-stage impression of the edentulous ridge. The boundary of the vestibules and soft palate should be identifiable on the casts from the indelible marks on the impressions transferred to the casts, but it might be necessary to clarify the lines. The surface of the maxillary and mandibular study casts are modified with a thin layer of baseplate wax to cover sharp ridges of stone and to block out undercuts relative to a selected path of insertion for each denture (eg, lateral to the maxillary tuberosities and below the mylohoid ridge). There is no need to cover the whole anatomical surface of the cast with wax, only areas that are rough or sharp (Fig 3-1). Subsequently, the whole surface of each cast is painted with a barrier (eg, Foil Cote, Buffalo Dental) to prevent the acrylic resin from penetrating the porous stone as it hardens on the cast.

The resin for each tray (SR Ivolen, Ivoclar Vivadent) is prepared to the manufacturer's instructions in a layer

3-1

about 2 mm thick and adapted to the surface of the cast. Resin lying beyond the boundary line on the cast is removed with a scalpel. A vertical handle about 1 cm wide and 2 cm high with a depression to enhance the grip is placed on the anterior part of the tray so that it is convenient to hold without disturbing the lips when the tray is in the mouth (Fig 3-2). A finger rest also is placed on the tray bilaterally over the first molar regions to allow the clinician to stabilize the tray on the residual ridge.



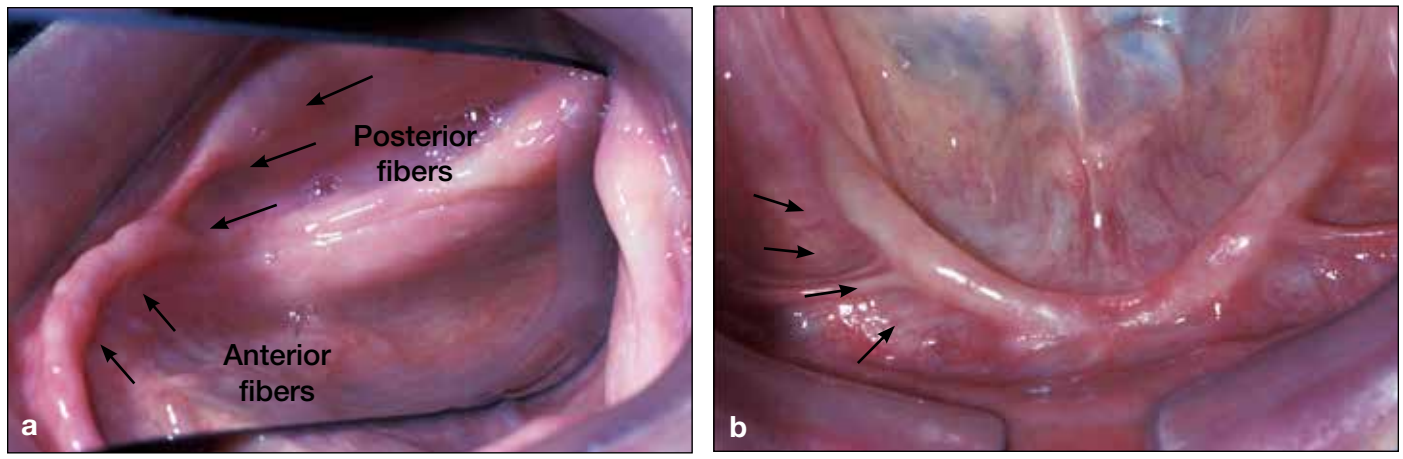
3-2

The tray resin hardens in hot water or more densely in a pressure cooker in about 10 minutes and can be removed from the cast when polymerization of the resin is complete, usually when the water has cooled to room temperature. All sharp edges are removed from the tray, especially its periphery, with an acrylic cutting bur, and the surface is smoothed so that it can be placed safely and comfortably into the patient's mouth.

Impressions

Muscle activity around the trays

The anterior section of the buccinator, mylohyoid, and masseter muscles move perpendicularly across the vestibule to influence the base of the denture more than the fibers of the genioglossus and posterior parts of the buccinator and mylohyoid muscles (Fig 3-3). The muscles will dislodge a denture that does not accommodate the range of muscle movements associated with speech, mastication, and facial expression.



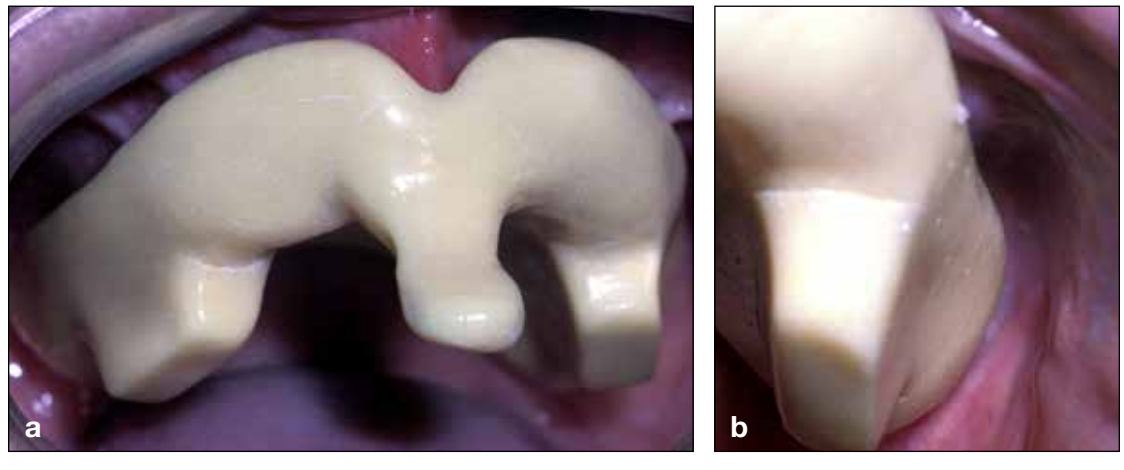
3-3

Modifying the impression trays

The periphery of the impression tray should rest about 2 to 3 mm from the functional vestibule when the tray is on the residual ridge so that the surrounding muscles and frena can move freely. The mandibular tray must accommodate the muscles in the floor of the mouth as the patient raises the tongue to lick the upper lip gently (Fig 3-4). It extends also onto the buccal shelf to the lingual side of the external oblique ridge on the mandible.

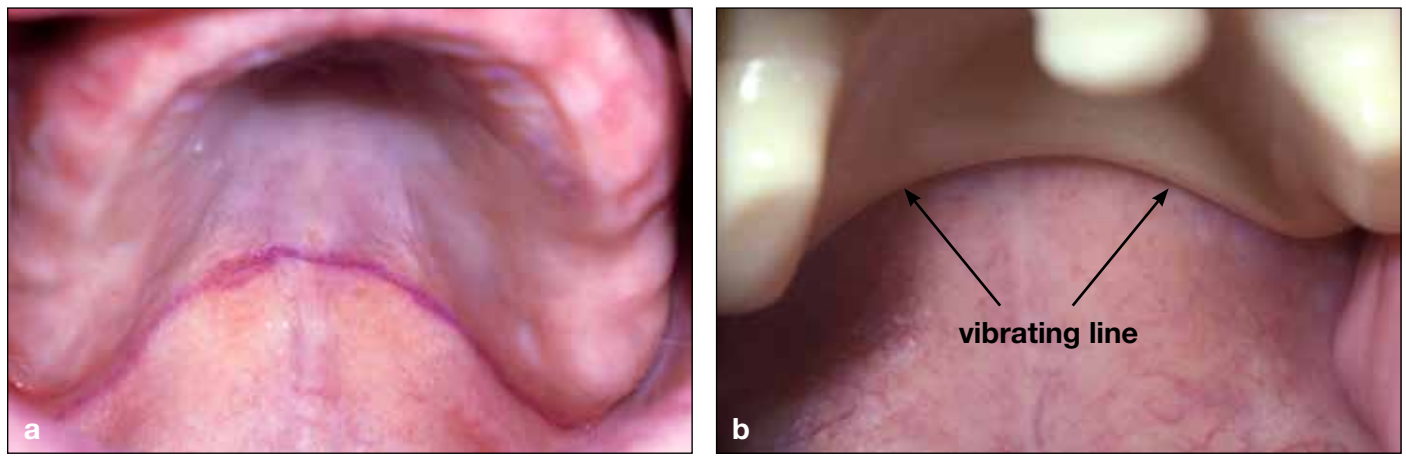
The periphery of the maxillary tray is easier to see when the upper lip is pulled firmly across the periphery of the tray to confirm the 2- to 3-mm clearance between the periphery and the height of the functional vestibule (Fig 3-5).

3-4



3-5

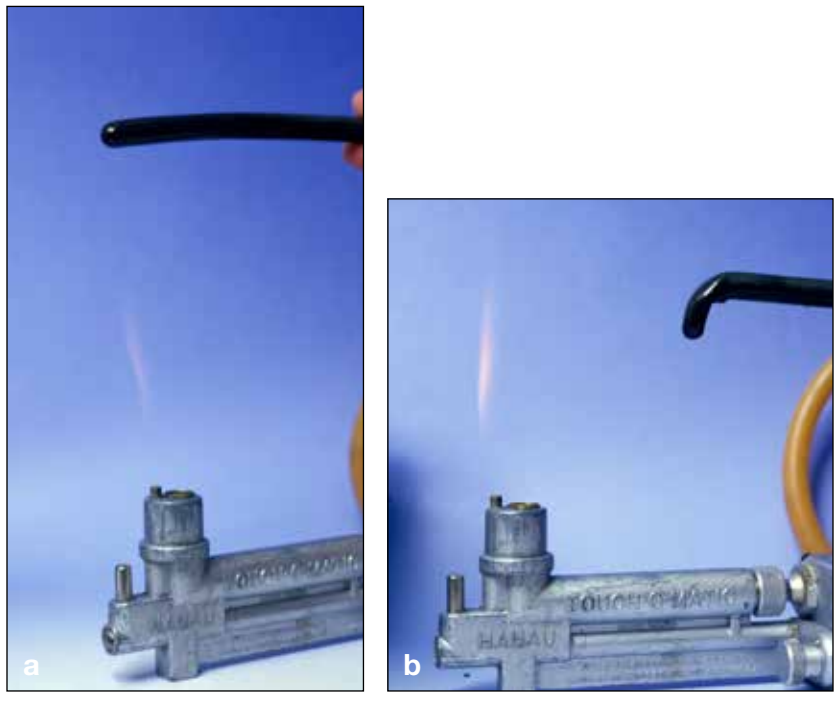
The maxillary tray also covers the hard palate and the relatively immobile portion of the soft palate just anterior to the vibrating line, which demarcates the posterior extension of the denture base, where the soft palate moves during swallowing and speech (Fig 3-6).



3-6

Creating the peripheral seal. Dental impression compound (eg, Green Stick Compound, Kerr) is the most versatile material available for recording the range of muscular activity along the vestibules of impression trays. Viscous putty-like addition silicone materials and polyether materials can be used, but they harden much more slowly than impression compound in the mouth. The hard brittle compound, typically called *green stick compound*, will soften slowly when passed intermittently back and forth over a flame and harden again in about 30 seconds within the mouth. It is available in sticks about 1 cm long that can be held at one end while the other end passes over the flame until it begins to soften and droop (Fig 3-7). A softened stick of compound should be placed on a glass slab or stone cast rather than paper. When soft, it will adhere to the periphery of the dry tray (Fig 3-8a) before it is tempered in a water bath at about 50ºC (Fig 3-8b) and placed in the mouth for molding by the muscles. The shape of the compound in the vestibule can be refined repeatedly by removing the tray to soften and temper it for additional molding in the mouth.

CAUTION: Hot impression compound will liquefy and ignite if held in, rather than passed through, the flame, and it will burn mucosa and skin if not tempered in water at about 50°C.



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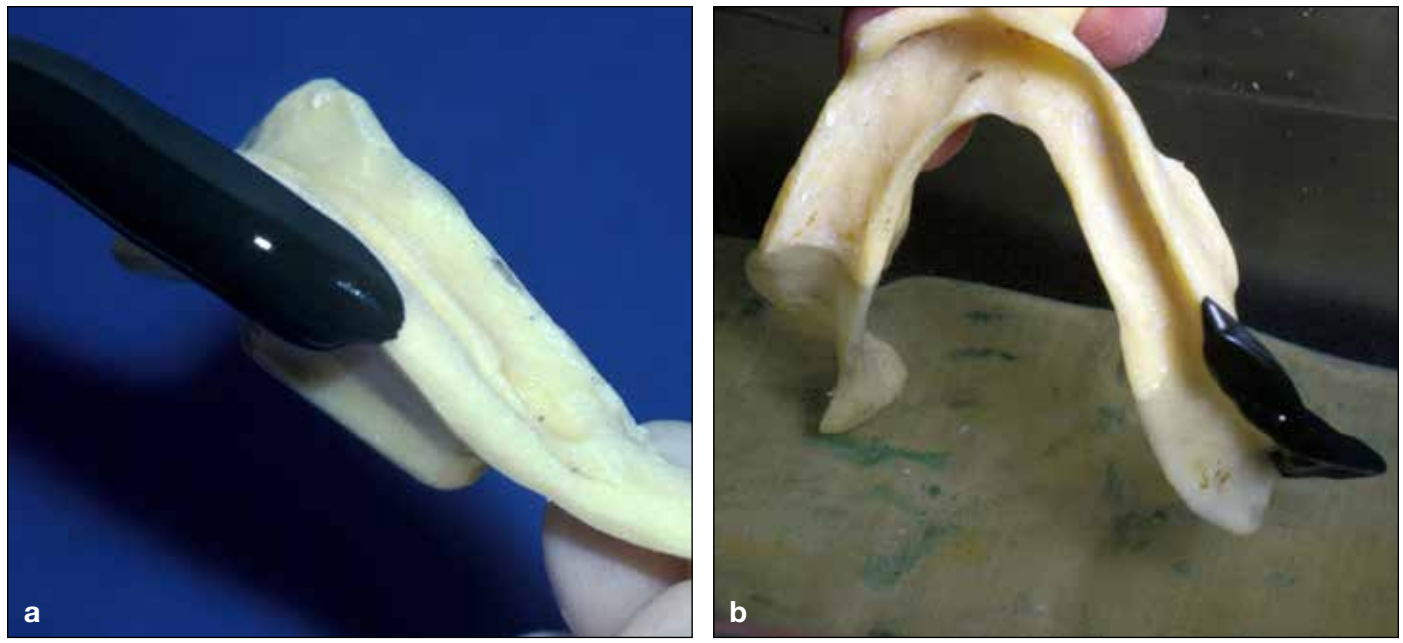


3-8

Activity of muscles around the mandibular tray

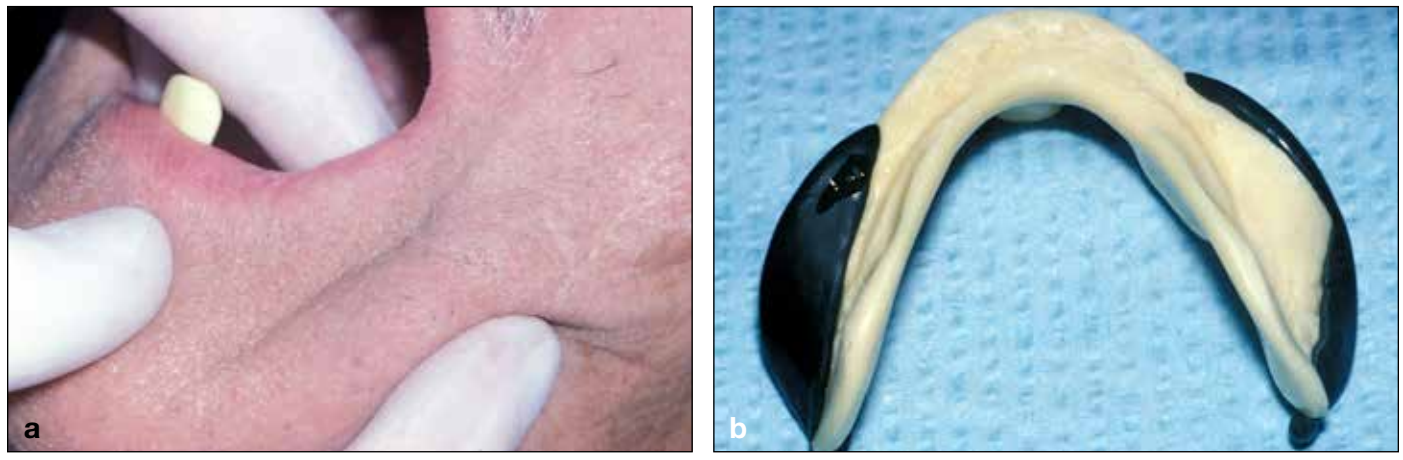
Facial vestibule. The buccal vestibule around the residual ridge of the mandible is influenced by the masseter, buccinator, mentalis, and other more minor muscles of facial expression. The functional shape of this vestibule is recorded by adding impression compound in three or four segments to the periphery of the tray as follows:

• *Retromolar pads, buccal shelf, and external oblique ridge:* The soft compound—covering at least half of each pad and engaging the posterior fibers of the buccinator along the buccal shelf and external oblique ridge of the mandible—is shaped by pressing on the finger stop of the tray and massaging the cheek and lower border of the mandible (Fig 3-9).

• *Buccal frena and modiolus:* Vigorous manipulation of the cheek adjacent to the angle of the mouth will activate the perpendicular anterior fibers of the buccinator and the minor muscles of facial expression that run through the buccal frena (Fig 3-10).

• *Mentalis muscle:* Perpendicular fibers of the mentalis muscle running from the tip of the chin to the residual ridge across the midline are activated by massaging the lower lip and chin *gently* because the mentalis is not a very active muscle in most people (Fig 3-11).

• *Masseter muscle:* The actions of the masseter muscle are recorded laterally to the retromolar pad. This major chewing muscle can be very strong, so the influence of its activity on the contour of the compound should be reconfirmed by softening and tempering the compound of the tray in this region and asking the patient to resist strong downward pressure on the finger stops of the tray. The additional stability of the tray with compound on the buccal shelves and along the anterior buccal vestibules at this stage allows the patient to contract and actively bulge out the masseter muscles comfortably against the clinician's vertical finger pressure on the tray.



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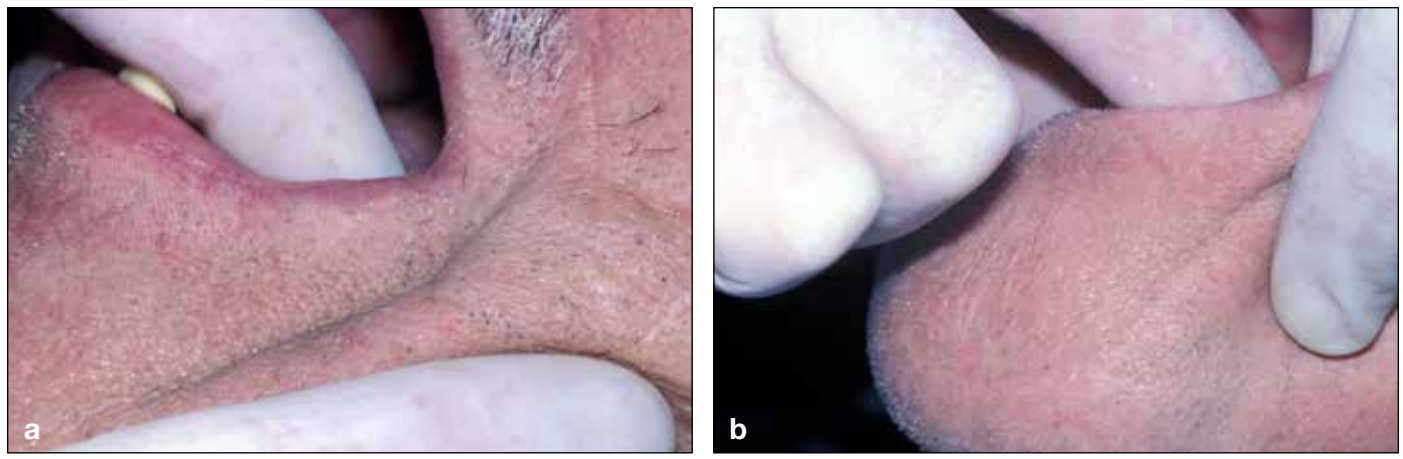

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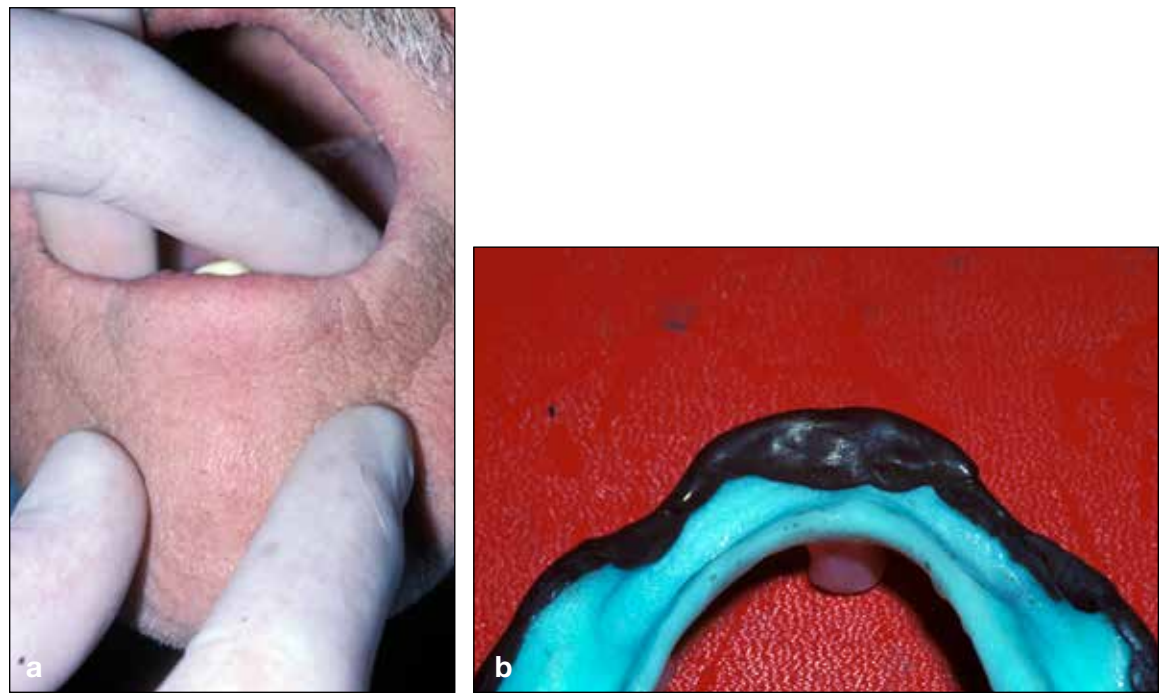


3-11

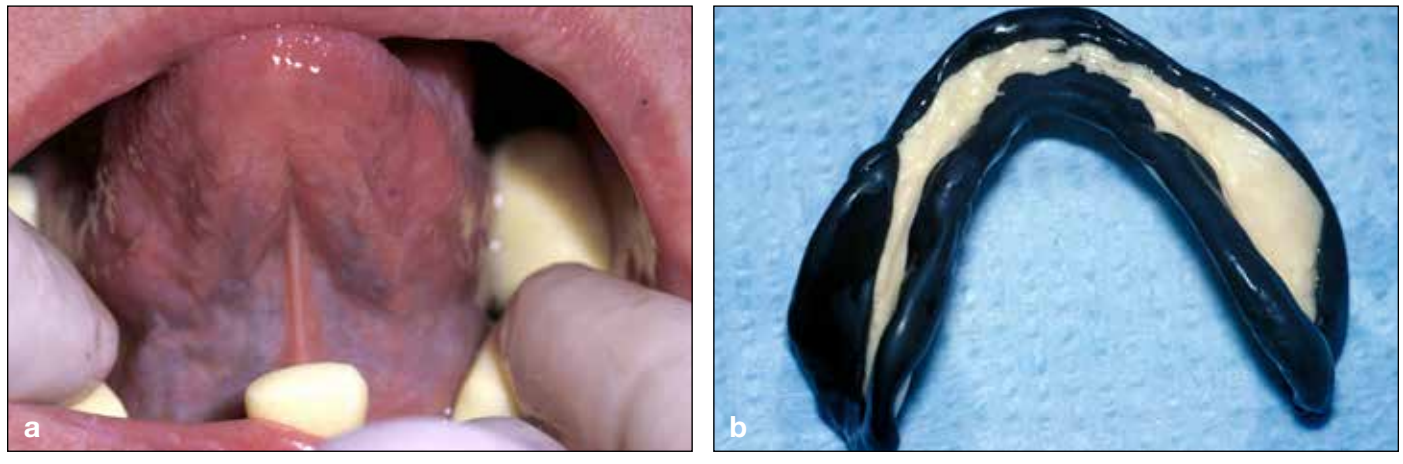
Lingual vestibule. The contours of the lingual vestibule are influenced largely by the superior constrictors of the pharynx and the mylohyoid muscles and across the midline by the genioglossus muscle. Their influence on the impression compound is recorded as follows:

• *Superior constrictor of the pharynx and retromylohyoid space:* This muscle closes the pharynx when the patient swallows. The compound in this region was shaped when applied over the retromolar pad; however, additional compound usually is needed to capture the shape of the floor of the mouth in the retromylohyoid space.

• *Posterior fibers of the mylohyoid muscle:* The fibers of the mylohyoid muscle in the floor of the retromylohyoid space and for several millimeters along the mylohyoid ridge typically run almost horizontally and displace the soft compound very little when the tongue licks the lips. Consequently, the functional vestibule drops posteriorly over the mylohyoid ridge and horizontal fibers of the muscle and into the retromyloid space until influenced by the vertical fibers of the pharyngeal constrictor (Fig 3-12).

• *Anterior fibers of the mylohyoid muscle and genioglossus muscles:* The muscle fibers that run anteriorly along the mylohyoid ridge and from the genioglossus elevate the floor of the mouth and the lingual frenum to contour the compound when licking the lips from side to side and swallowing (Fig 3-13).

3-12



3-13

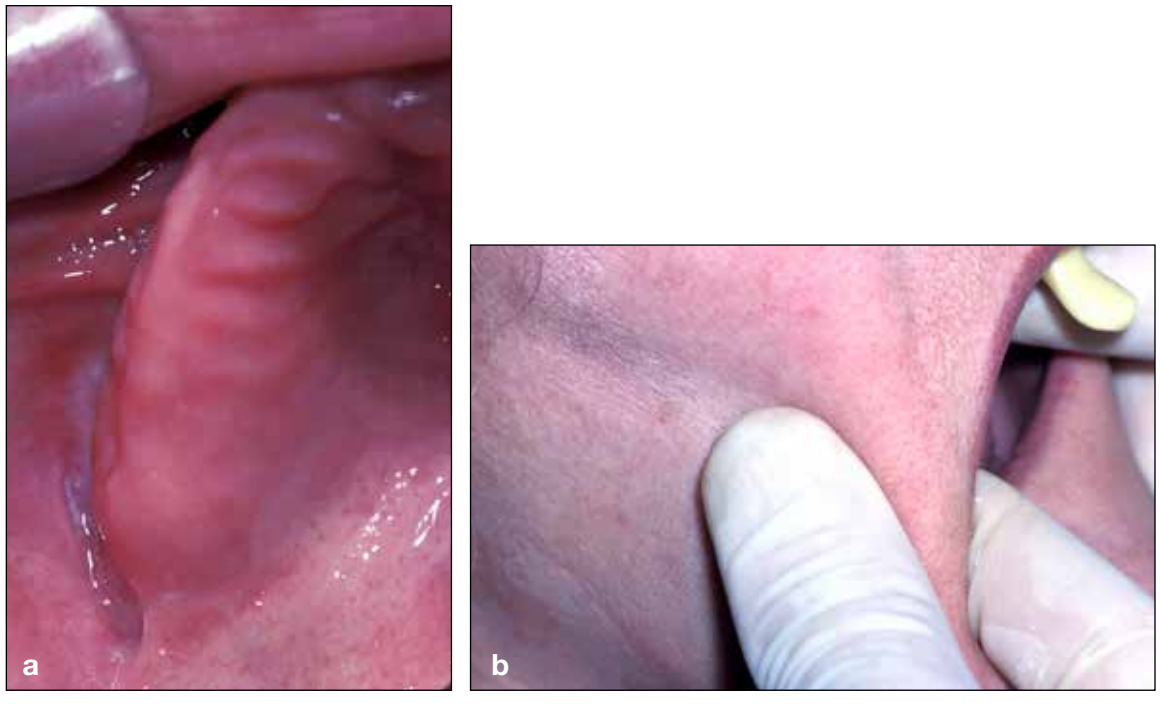
Activity of muscles around the maxillary tray

The muscles of facial expression, including the masseter and buccinator muscles, exert a strong influence on the periphery of the maxillary denture. Consequently, they should be manipulated vigorously when contouring the compound around the impression tray. Again, it is usual to add and contour the compound in segments around the functional vestibule.

• *Tuberosities and hamular notches:* The cheek is pulled firmly to extend the masseter and buccinator muscles lateral to the tuberosity and hamular notch (Fig 3-14).

• *Zygoma and anterior vestibule:* The pull on the buccinator and other muscles of facial expression that cross the zygoma through the buccal frena is repeated, and the upper lip is massaged to contour the compound in the anterior part of the vestibule between the buccal and anterior frena. The compound is softened again in the midline, and the upper lip is pulled firmly, or the patient is asked to pucker the lips, to fully accommodate the contractions of the anterior frenum (Fig 3-15).

• *Post-dam:* Finally, compound is added in the shape of a cupid's bow along the posterior border of the tray anterior to the vibrating line, and the tray is seated firmly against the palate (Fig 3-16).



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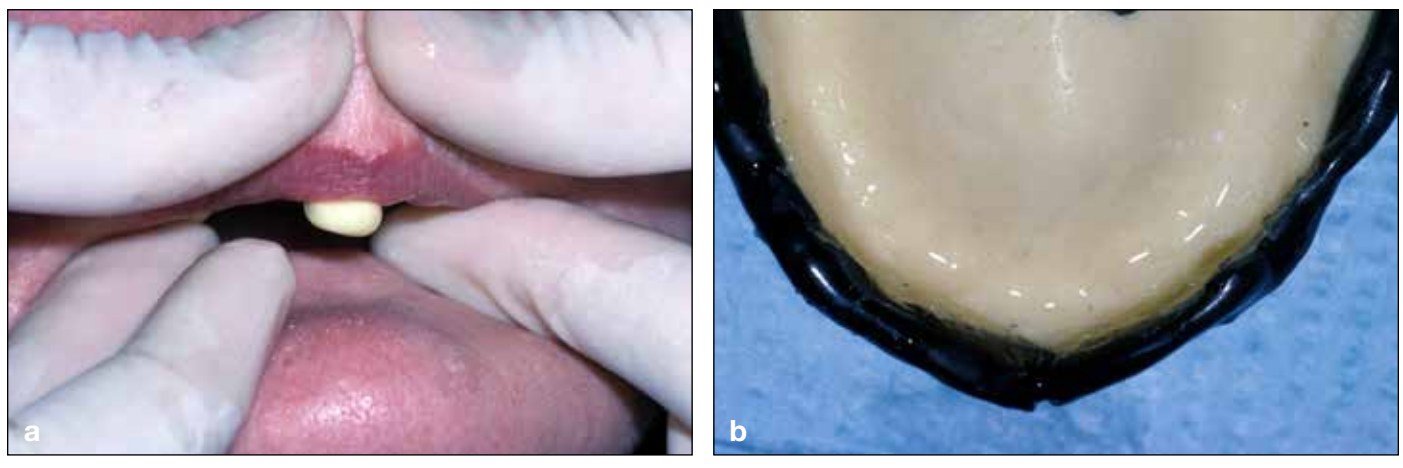

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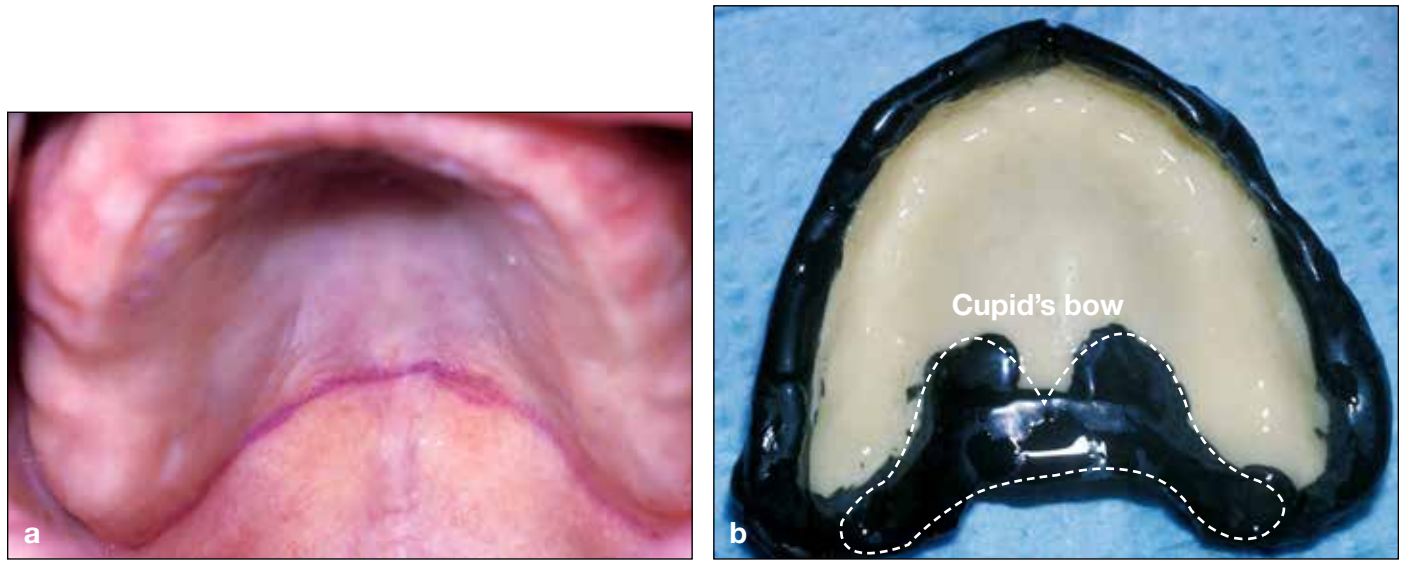


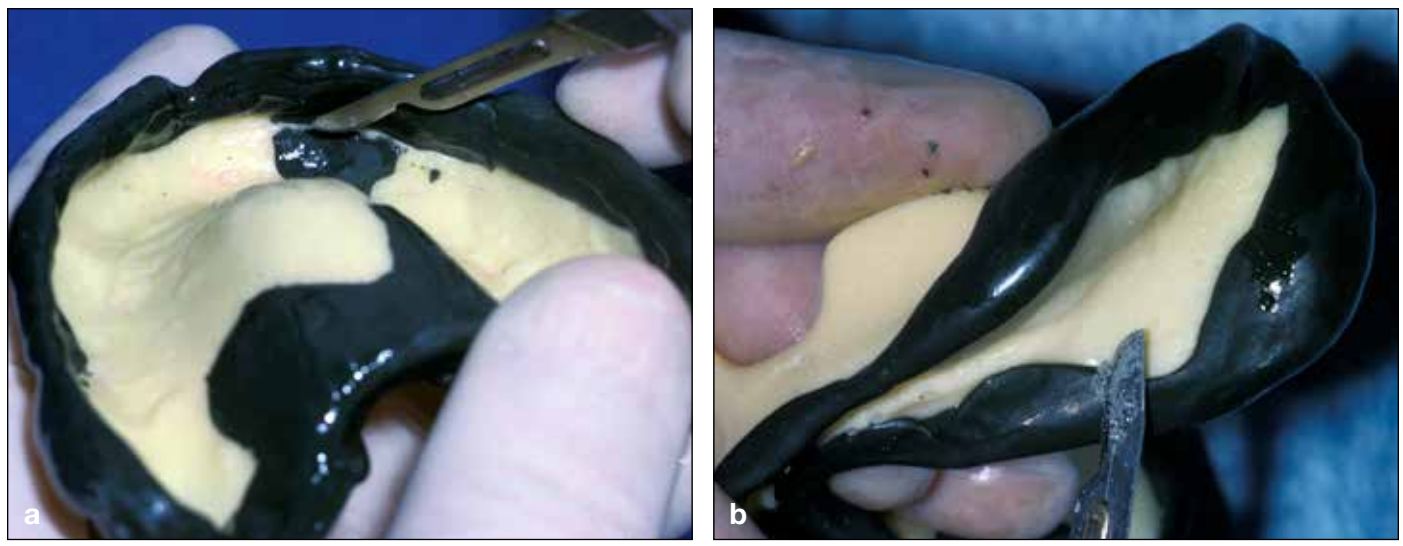
3-16

Checking the seal. When the seal is intact around the tray, it should be possible to pull on the handle of the tray without dislodging it (Fig 3-17).

NOTE: The final stage of the maxillary impression should not be performed if the tray does not stay securely in place with the compound around the periphery of the tray.

3-17

Remove excess compound. Each tray should go in and out of the mouth and rest on the residual ridges without discomfort for the patient. Excess compound is removed from the central area of the tray, and the thickness of the compound is reduced with a scalpel to relieve discomfort where the compound protrudes into large undercuts around the alveolar ridges, eg, lateral to maxillary tuberosities and below the mylohyoid ridge (Fig 3-18). The maxillary tray should remain comfortably on the palate with positive suction during most movements of the mouth and lips, but there is much less retention between the mandibular tray and the mandibular residual ridge because of the complicated movements of muscles around the mandibular tray.



3-18

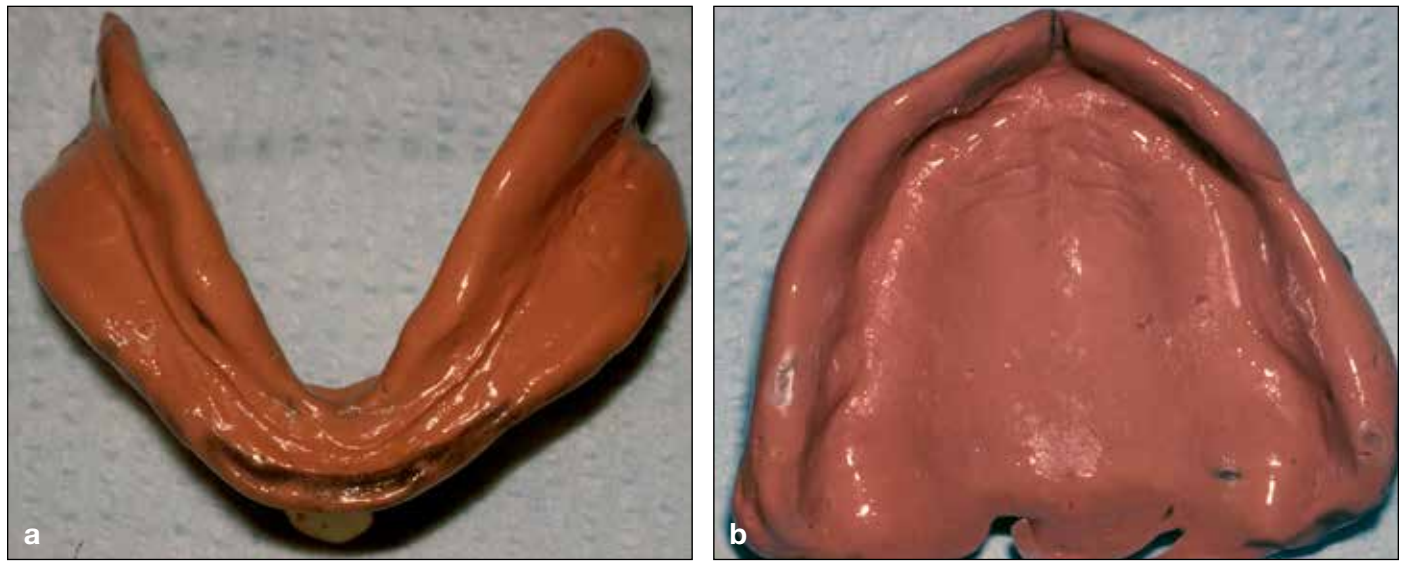
Recording mucosal contours

There are many materials suitable for recording (or impressing) the contours of the mucosa overlying the residual ridges, palate, and functional vestibules. Vinyl polysiloxane (VPS) materials produce accurate impressions of mucosal contours and are available in heavy, medium, and light consistencies.[6] The viscosity of the material determines how it is used; however, a light consistency is suitable for mucosal impressions in both the mandibular and maxillary trays.

Making the impressions. A VPS adhesive is painted thinly on the tray before the impression material is smeared evenly over the tray and compound, including the facial surfaces of the functional vestibules. The tray—typically the mandibular tray first—is placed in the mouth, oriented visually over the ridge, and brought slowly into position on the mucosa. As it approaches the resting position on the residual ridge, the impression material should be

observed closely to see it flow within the vestibules to dislodge air bubbles, cover the mucosa completely, and accommodate to the functional shape of the surrounding muscles. The tray is held securely in position while the patient and clinician cooperate to continuously move the cheeks, lips, and tongue to shape the impression as the material hardens.

The impressions (Fig 3-19) are removed from the mouth and disinfected (as explained in chapter 2) before they are removed from the clinical area to make the stone casts.

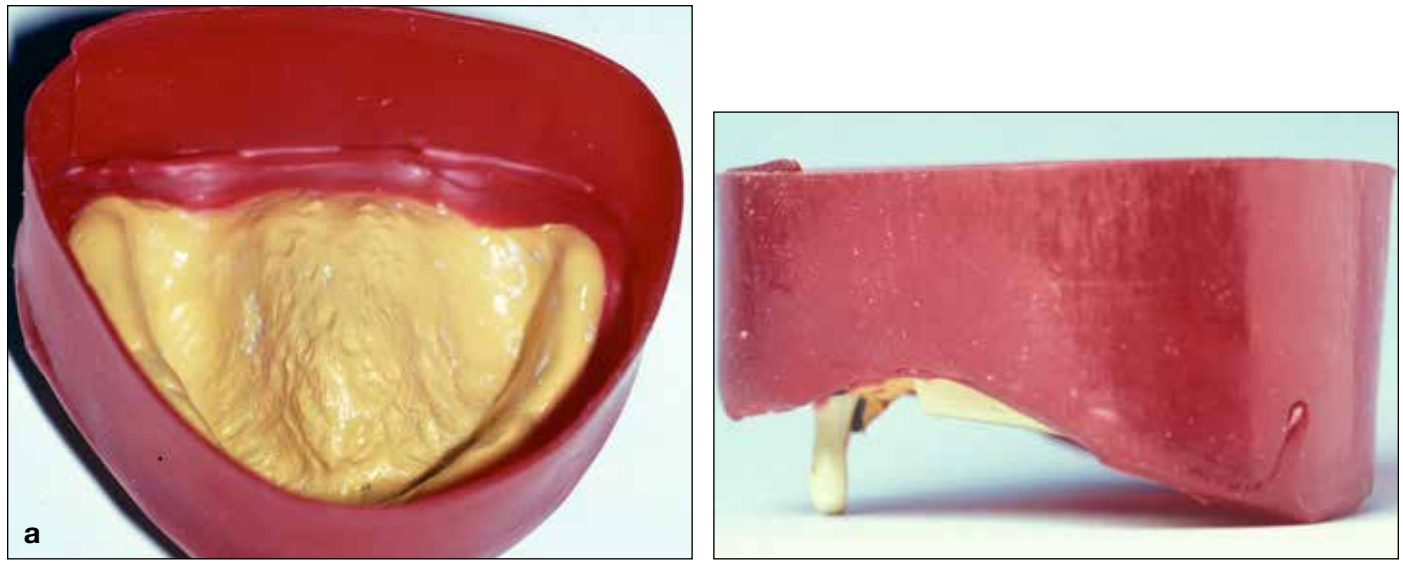


3-19

Pouring stone casts from the impressions

VPS materials are stable for a prolonged period, so unlike the alginate impressions, they do not have to be poured in stone quickly. The entire surface of the impression, including the full contour of the functional vestibules, must be reproduced in stone. The stone can be controlled more easily when a box of wax is built around the final impression to contain it on the impression and to produce a stone cast with a base that is at least 2 cm thick and a perimeter that is at least 2 mm wide. The wax box is made by attaching two or three strips of beading wax with sticky wax to form a shelf at least 2 mm wide around the periphery of the impression, boxing wax (eg, Kerr) to fill the lingual space of the mandibular impression, and a 2-cm-high wall of wax around the beading wax (Fig 3-20). The junction between the wax sections is sealed with a hot knife.

The stone powder is mixed with water under vacuum as advised by the manufacturers and vibrated gently into the box so that the stone flows slowly over the surface of the impression without trapping air. The casts can be separated from the boxed impressions when they are hard, ie, at least 45 minutes later, and after soaking for about 10 minutes in hot water to soften the compound (Fig 3-21).



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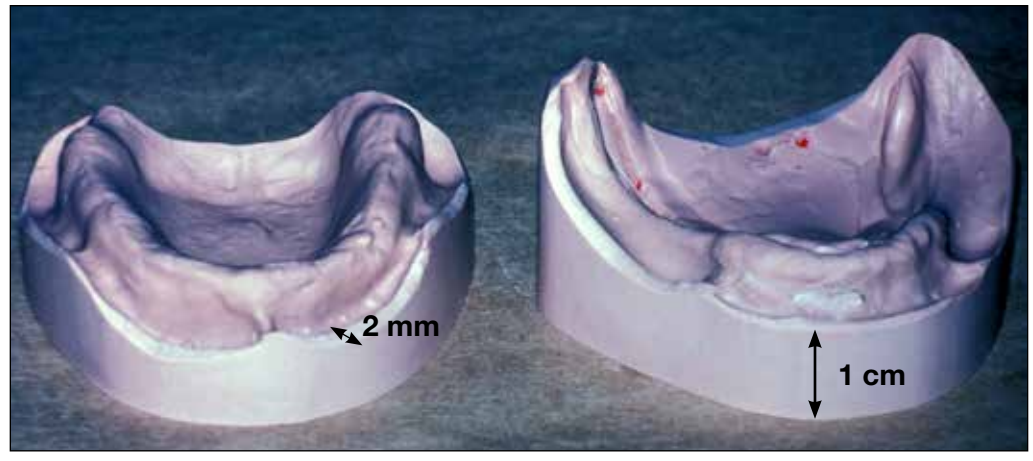

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CHAPTER > 4

Selecting Maxillary Anterior Teeth

There are three essential variables in the selection of artificial teeth: composition, color (shade), and shape (mold).

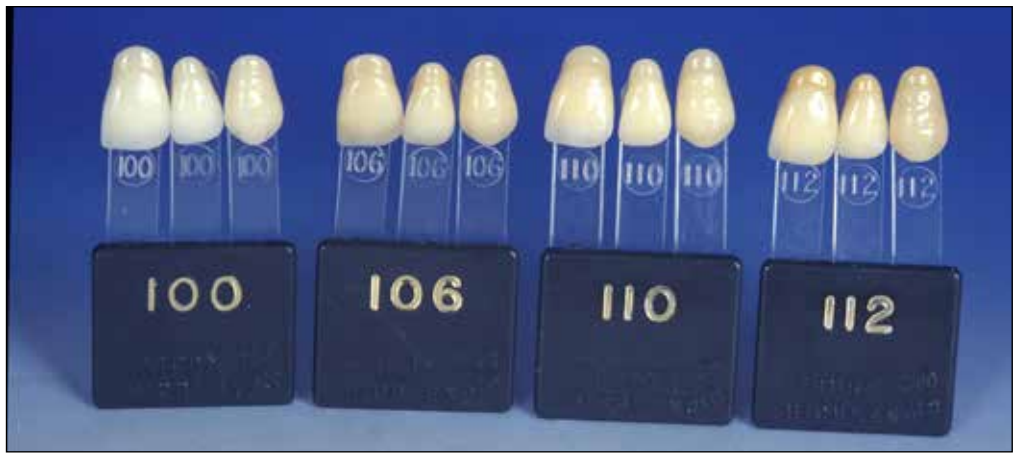
Composition

Artificial teeth can be made from resins, ceramics, or metals. However, most denture teeth are made from polymethyl methacrylate with cross-linked polymers. There are few long-term clinical studies on the multitude of factors, such as age, gender, diet, and physical shape, that could influence the wear of denture teeth,[1] although clinical experience shows that under most conditions they are more than adequately resistant to normal abrasion and attrition, and they retain their color quite realistically for many years under normal conditions. Ceramic (porcelain) teeth are more wear resistant and color fast, but if they lose their glaze they can be very abrasive to opposing natural teeth. Metal teeth are perceived to be esthetically pleasing in some cultures,[2] and they too are more resistant to wear than plastic teeth, but the appearance of metal in anterior teeth is not widely acceptable.

Occasionally patients will ask to have ceramic teeth on a new denture because of a previous experience with acrylic teeth that abraded rapidly. Myerson[3] suggested many years ago that maxillary ceramic teeth opposing mandibular acrylic teeth would provide a durable and esthetically pleasing combination. Whatever potential esthetic benefit might come from the arrangement of acrylic resin teeth in one jaw and ceramic teeth in the other, it is poor practice to use ceramic anterior teeth and acrylic posterior teeth in the same jaw. The almost inevitable wear of the acrylic teeth posteriorly is likely to focus occlusal forces on the anterior teeth, which can unsettle the dentures and possibly damage the mucosa and bone of the anterior residual ridge. Others have recommended cast alloy overlays or metal cutting inserts to improve the wear resistance and shearing efficiency of posterior teeth,[4,5] but there is no convincing evidence that denture teeth with metal occlusal surfaces or a combination of metal, ceramics, and resins are any better than teeth made solely of cross-linked polymers. Consequently, most dentures are now made very effectively with teeth produced from cross-linked polymers.

Color (Shade)

The color or shade of the artificial teeth is selected with the help of a shade guide produced by their manufacturer. A guide (eg, Mold and Shade Guide, Dentsply Prosthetics) usually consists of resin or ceramic samples shaped like teeth that are arranged on a plaque to display a selection of colors (Fig 4-1). Each sample is identified by a code; however, each manufacturer uses a different coding system. Colors range from yellow to orange hues, with provision for the variation in chroma and value found in natural teeth.[6] A typical color guide offers a mixture of yellow, orange, and bluish-grey samples, which may seem limited but is usually adequate to meet the demands of most patients. Unless the patient objects, the sample corresponding most closely to the color of the teeth on an old denture is usually suitable for the new denture. A direct question to the patient about the acceptability of the teeth on the old denture will help to identify an acceptable color for the new denture. If the patient does not have a denture or any natural teeth, the color is based solely on the patient's preference from a variety of samples. However, judge carefully how patients interpret the guide lest they are tempted to select the whitest sample available without seeing the teeth arranged in the mouth. Generally patients and dentists judge the color and arrangement of teeth differently, so a discussion about esthetic expectations and concerns is always helpful when selecting teeth.[7] There are a surprising number of denture wearers who prefer a traditional "denture look" rather than a more natural arrangement and color of teeth.[8,9]



4-1

Shape (Mold)

Numerous ideas and theories have directed how artificial teeth are made and selected.[10,11] A temperamental theory, for example, postulated that teeth should reflect the temperament of the patient, whether sanguine, bilious, or nervous. Others gained a wider appeal with dentists by measuring teeth relative to other anatomical features, whereas the dentogenic theory emphasized the influence of sex, age, and personality in tooth form. At least one large manufacturer of denture teeth uses the idea proposed by Williams[12] that teeth are square, round, and ovoid representations of the patient's inverted face.[13] This attempt to match the teeth to the form of the face offers a simple and direct if somewhat unscientific approach to selecting artificial teeth.[14] However, it should not be taken as more than a point of departure for a process of selection that ultimately depends on the patient's satisfaction with the final arrangement of the teeth on the denture *in the mouth*.

Manufacturers produce square, tapering, and ovoid teeth, plus a number of molds that are square-tapering, tapering-ovoid, and square-ovoid, as well as a few molds of square-tapering-ovoid teeth to accommodate all eventualities of harmony between tooth and face. These selections are presented by the manufacturers in mold guides containing the dimensional characteristics of the teeth (Fig 4-2).

4-2

Practical Clues

Several clues from the patient's past and present can assist with the selection of the artificial teeth. For example:

- A denture inserted immediately after the natural teeth were extracted (an immediate denture) should provide a close resemblance of the size, shape, color, and arrangement of the natural teeth.
- Photographs of the patient's face before the anterior teeth were extracted show the arrangement and prominence of the teeth.
- Natural teeth in the patient's children, siblings, or parents provide a good reference.

The patient might have strong opinions on the preferred color and shape of the teeth that conflict with the esthetic sense of the dentist.[7] However, the *patient's opinion, when fully informed, always prevails*.

This preliminary selection of shape and color approved by the patient is identified by the manufacturer's code so that the teeth can be obtained for arrangement in the mouth at the next appointment.

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CHAPTER > 5

Recording the Relationship of the Jaws and Arranging the Maxillary Anterior Teeth

The master casts should relate to one another on an articulator as the human mandible relates to the maxilla. This allows the artificial teeth to be arranged in a laboratory before they are inspected in the patient's mouth. A record base with wax occlusal rims is made on each master cast, whereby the relationship of the jaws to one another is recorded and the patient can assess the esthetic and functional arrangement of the teeth in wax before the dentures are processed in acrylic resin.

Some clinicians prefer at this stage to process heat-cured acrylic bases without teeth on each master cast and then proceed to record the jaw relationship and arrange teeth in wax on the permanent or final denture bases. This approach produces bases that are relatively stable and retentive, when compared with record bases made from wax or other weak materials. It also offers the possibility of several appointments to assess and adjust the fit and comfort of the permanent bases before the dentures are delivered to the patient. Nonetheless, most dental technicians prefer to make the record bases with a thermoplastic material and later to process the bases in acrylic resin with the artificial teeth in one major laboratory procedure just before the patient receives the new dentures. This chapter describes how record bases are made with temporary materials to record the jaw relationships and arrange the artificial teeth.

Record Bases

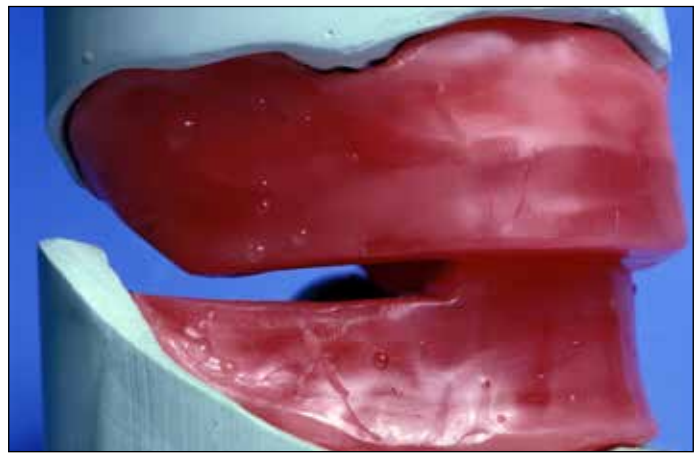
Various materials, including hard wax, shellac, polyvinyl acetate-ethylene copolymer (PAEC), and chemically or light-cured resin are used for making temporary record bases (Fig 5-1). Wax (eg, Truwax Baseplate Wax, Dentsply) will adapt without damaging the master cast but can distort easily in the mouth. Other materials offer a practical compromise between the softness of wax and the rigidity of resin. For example, shellac (Trubase Baseplate Composition, Dentsply) is a fortified wax that softens easily with a flame and can be adapted to the cast with finger pressure. Yet, all too often record bases made with shellac are loose and unstable because they have not been adapted intimately to the cast, especially to the post-dam and functional vestibules. Other materials are used very effectively for record bases, including a PAEC (Sta-Vac Sheet Resin Material, Buffalo Dental) that conforms under suction to the cast and soft resins (eg, Triad, Dentsply) that harden under ultraviolet light. However, the stability and retention of all these materials depend on the care with which they are fitted to the casts.

5-1

Occlusal Rims

The occlusal rim on each cast is made with a hard wax on the record base (Fig 5-2) to simulate the position of the teeth and to support the relationship of the jaws to each other. The wax is shaped arbitrarily to simulate the curvature of the dental arch: about 2 cm high for the maxilla and slightly less for the mandible (Fig 5-3). Later the wax will hold the denture teeth for a functional and esthetic assessment in the mouth before the denture is processed in acrylic resin.

5-2



5-3

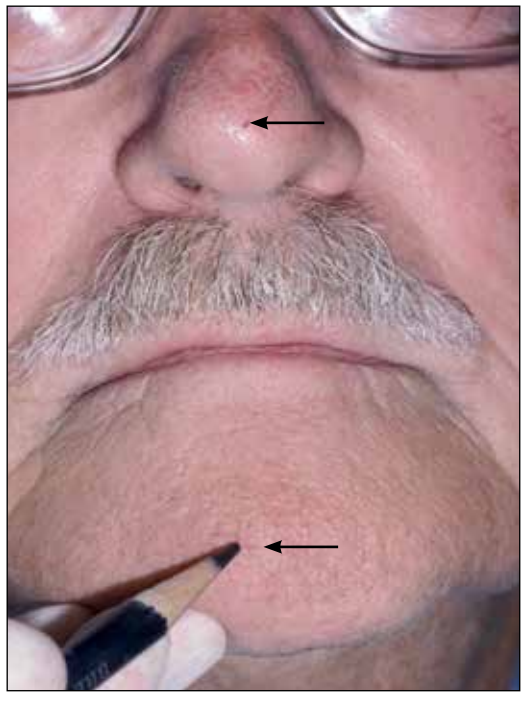
Recording the Vertical Jaw Relations

The vertical dimension of occlusion (VDO) is the distance between the maxilla and the mandible when the teeth occlude. A patient with existing dentures or with some natural teeth offers a VDO that can be used as a reference or starting point for determining an appropriate VDO for the new denture. The clinical methods available for determining a comfortable VDO are imprecise.[1] Many clinicians rely largely on an esthetic assessment or measurement of facial proportions based on the assumption that the ideal distance from the chin to the nose equals one-third of the distance from the chin to the hairline. Fortunately, most patients do not want to change their appearance unless the occlusal support is obviously inadequate, so usually they accept the VDO of their old dentures.

The vertical dimension at rest (VDR), or interocclusal "freeway" space at rest, refers to the position of the jaws when the patient sits upright with the mandible in a relaxed resting position. Traditionally, dentists considered a 2-mm separation of the maxillary and mandibular posterior teeth at rest as the ideal freeway space; however, the space between the teeth can vary considerably between patients, ranging comfortably from none to more than 1 cm of separation at rest without problems. A VDR of 2 mm between the maxillary and mandibular wax occlusal rims can serve as a starting point for locating a comfortable VDO for an edentulous patient who does not have a denture or for a patient who reports that the current VDO is uncomfortable. In any event, the appropriateness of the vertical support provided by dentures to the lower one-third of the face is based heavily on the esthetic judgment of the clinician and confirmed by the patient.

Clinical procedures for recording the VDO and VDR

- The patient should sit upright in a relaxed pose with the head supported by the headrest of the chair.
- A small reference mark is placed on the patient's nose and chin (Fig 5-4).
- The distance between the marks on the chin and nose is measured with the old dentures lightly occluding on the posterior teeth to record the VDO (Fig 5-5), and with the teeth and lips at rest to record the VDR (Fig 5-6).
- The retention and stability of the maxillary record base on the palate is assessed (a denture adhesive [eg, Wernet's Denture Powder, Block Drug] might be necessary for retention if the peripheral seal is inadequate).
- The mandibular record base is stabilized on the residual ridge by pressing with the index fingers downward and forward bilaterally onto the residual ridge, while the thumbs rest *lightly* on the chin to monitor and control (but not force) the movements of the mandible (Fig 5-7).
- The patient might feel discomfort when the rims occlude until the height of the rims are adjusted to approach the preferred VDO.
- To obtain the optimal VDO, an estimate is made of the amount of wax that must be removed from either rim to provide even contact about midway between the alveolar ridges. Adjustments of the height and contour of the rims are made until the VDO looks correct and the patient feels comfortable with the vertical support offered by the rims in contact with each other (Figs 5-8 and 5-9).



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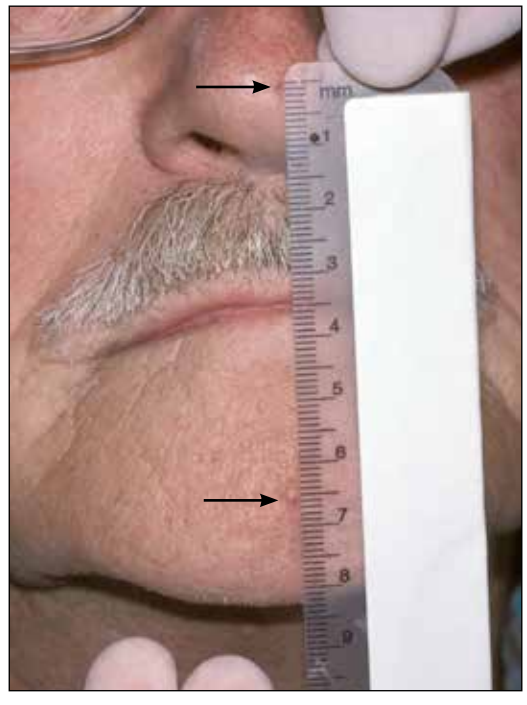

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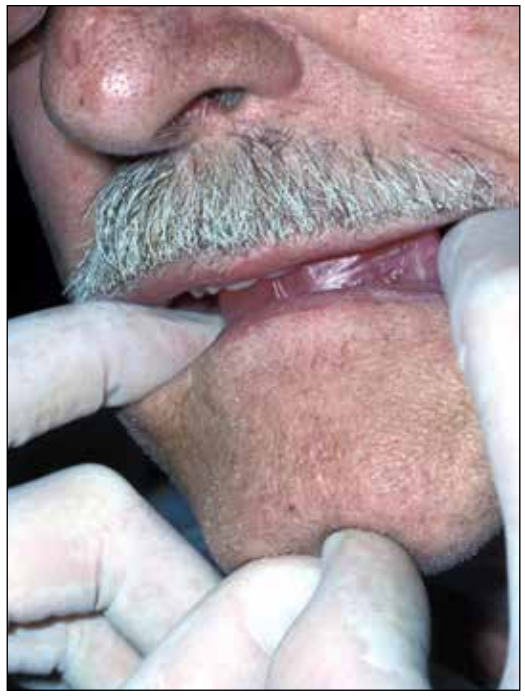

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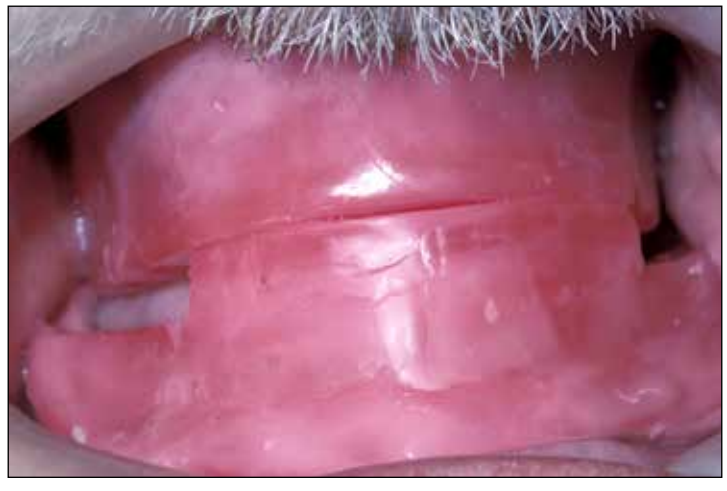


5-9

Arranging the Maxillary Anterior Teeth

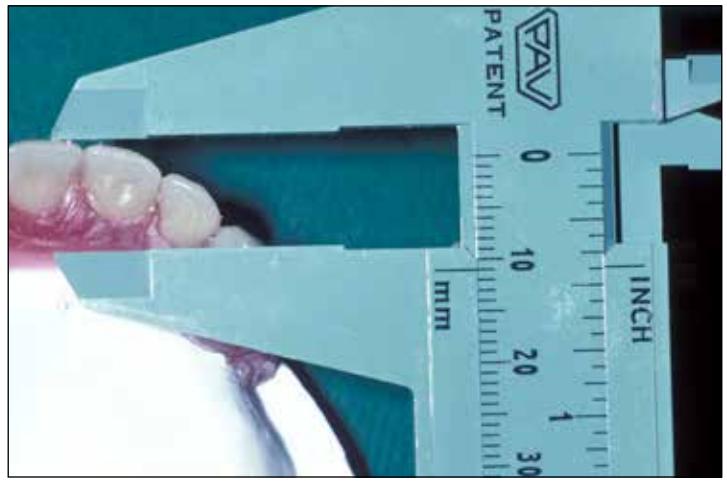
At this stage the lower one-third of the face should be supported comfortably by the occlusal rims, although there will be a clearer view of the esthetic impact of the VDO when maxillary anterior teeth support the upper lip. Hence, the next clinical step is to involve the patient directly in the arrangement of the maxillary anterior teeth. There should be no doubt about the patient's opinions and expectations relating to the appearance of the teeth, a matter that will have been explored extensively during the initial interview and when selecting the teeth. Requests for a change of appearance often focus on the relationship of the teeth to the upper lip because teeth, rather than the denture base, give most of the underlying intraoral support to the natural contour of the upper lip. There are physiologic limits to the position of the teeth, so attempts to remove the wrinkles of old age by protruding the teeth unnaturally or thickening the denture flange are unlikely to succeed.

Artificial teeth are arranged in wax to simulate the orientation of the natural teeth, or the appearance of the old denture if that is the patient's wish. Direct involvement of the patient in the arrangement of the teeth is likely to produce the most desirable result, at least from the patient's perspective. The patient can contribute by assessing the position and esthetic impact of each individual tooth in the mouth as it is placed in the wax. Ultimately, the size and color of the teeth can be assessed most critically only when all of the teeth are arranged together and the impact of the complete arrangement can be seen in the mouth.

Although there are numerous variations that occur in the orientation of teeth, a few general principles help to create a natural appearance.

Central incisors

The facial surface of the central incisor is located about 1 cm anterior to the incisive papilla (Fig 5-10). The mesial surface is aligned to the midline of the lip and face (Figs 5-11a and 5-11b), with the facial surface aligned to the profile of the face and the incisal edge showing a few millimeters below the lip (Fig 5-11c).



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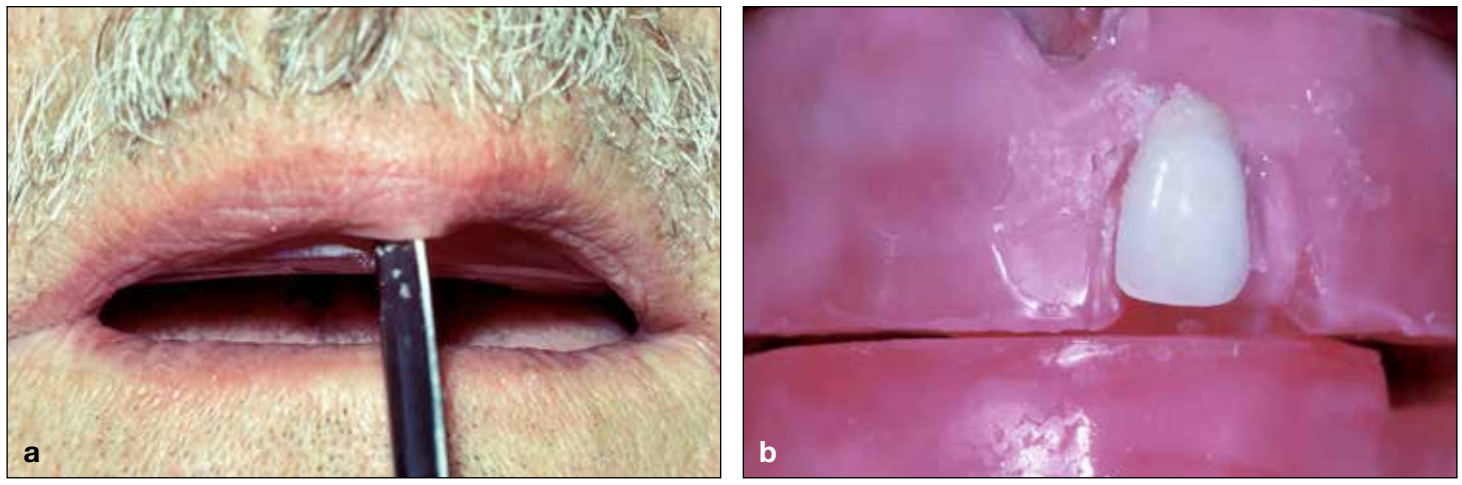


5-11

Lateral incisors

The position of this smaller incisor offers the greatest opportunity for characterization as it protrudes or recedes relative to the central incisor and appears shorter than the central incisor (Fig 5-12).

5-12

Canines

The width and shape of the dental arch is established by the position of the canines. The neck of each canine supports the lip at the corners of the mouth, with the incisal tip slightly anterior to the neck (Fig 5-13a) and showing just below the lip at rest (Fig 5-13b).

5-13

Horizontal Dimension of Occlusion

Centric relation (CR) is the term used to describe a position of the mandible at a particular VDO determined by muscles and other structures in and around the temporomandibular joints (TMJs). Another description suggests that it is the "maxilla-mandibular relationship in which the condyles articulate with the thinnest avascular portion of their respective discs with the complex in the anterior-superior position against the shapes of the articular eminences."[2] There is no consensus on where best to position the jaws for maximal intercuspal position on dentures[3] or how to record this position.[3–5] Many clinicians favor CR as the position for maximal intercuspation of maxillary and mandibular complete dentures because they can guide most patients to move the mandible under passive muscle tension through an arc of closure until the wax rims contact in CR at the predetermined VDO.[6] Moreover, they can reproduce this movement and contact clinically with reasonable reliability, although it is not a position that patients can reliably reproduce on demand without guidance from the clinician.[7,8]

The CR position of the mandible can be recorded on the wax occlusal rims at the selected VDO with a soft material that hardens quickly when the occlusal rims contact and that remains stable out of the mouth. Brittle waxes and elastomeric materials serve this purpose well. Wax is popular because it is accurate, clean, and relatively inexpensive, and unlike most elastomeric materials, it changes from soft to a brittle consistency very quickly at mouth temperature.

- About 3 mm of the baseplate wax is removed bilaterally from the mandibular wax rim distal to the first premolar region, leaving contact only between the anterior area of the rims to support the VDO, and one or two V-shaped notches cut in the wax over the molar region (Fig 5-14).
- One or two similar notches are cut in the maxillary rim without reducing the height of the rim, and the surface of the wax is smeared lightly with a lubricant (eg, Vaseline, Unilever) (Fig 5-15).
- To guide the patient to the CR position, the maxillary record bases are secured in the mouth (with denture adhesive if necessary), and the mandibular plate is stabilized on the residual ridge by pressing downward and forward with the index fingers against the side of the wax rim (see Fig 5-7). Simultaneously, the patient is asked to relax the jaw muscles as much as possible while the clinician's thumbs press gently on the chin to prompt (but not push) the patient's mandible toward CR as the wax rims contact anteriorly (Fig 5-16).
- This movement induced by relaxation and pressure is repeated until the patient moves the mandible comfortably and repeatedly into CR with little or no guidance from the clinician.
- The mandibular record base is removed from the mouth.

• About one-fifth of a sheet of brittle reinforced wax (eg, Green Aluwax, Aluwax Dental) is slowly softened in a flame and folded into two layers approximately 5 mm wide (Figs 5-17a and 5-17b).

• The strip of wax is removed from the sheet with a warm knife and cut into two sections (Fig 5-17c).

• A prism is produced with each section of wax on the posterior part of the mandibular rim bilaterally, with the height of the wax prism about 2 mm higher than the anterior part of the wax rim (Fig 5-17d).

• The wax is kept soft on the record base by passing the prism of wax quickly and repeatedly over a gentle flame before replacing the record base on the residual ridge and again prompting the patient back to CR with the anterior part of the rims in contact (Fig 5-18).

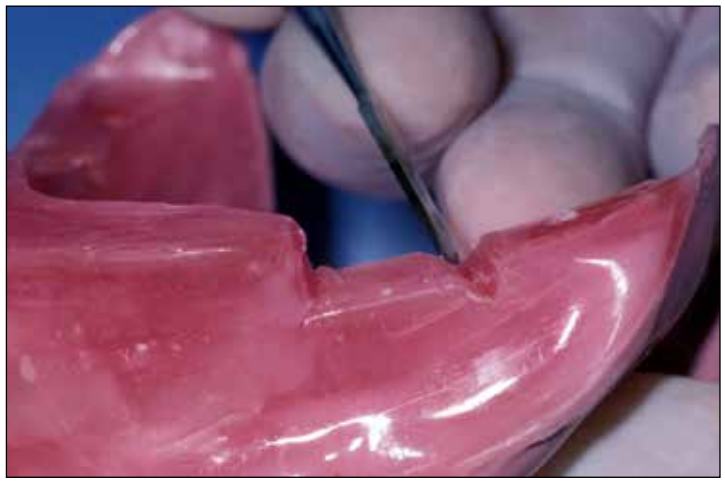
• The soft wax will squeeze into the notches of the maxillary rim to record the position of the mandible to the maxilla.

• The softened wax should not disturb the movement of the mandible; however, the procedure should be repeated if there is doubt about the accuracy of the hardened record.

• The wax hardens quickly at mouth temperature, so with the maxillary rim lubricated, the record will remain attached to the mandibular rim when the rims are separated (Fig 5-19).

• Finally, the wax record is cooled further with cold water, and its accuracy is confirmed by returning it to the mouth and repeating the mandibular movement to CR.

The occlusal record provides a static means of relating the master casts to each other in a dental articulator in the same relationship as the patient's jaws in CR.



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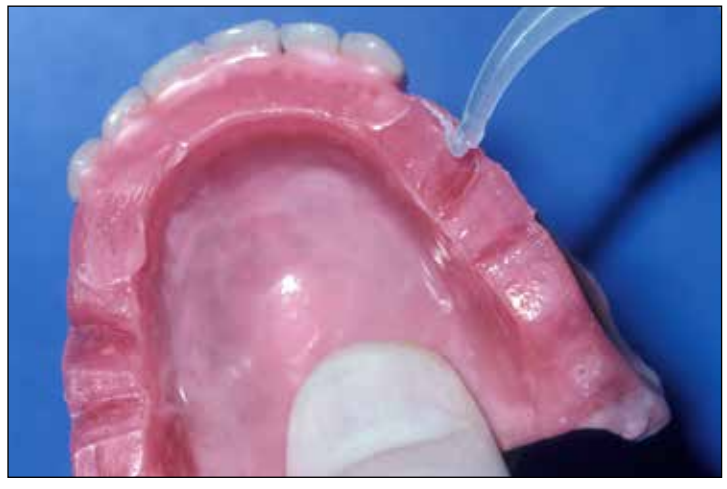

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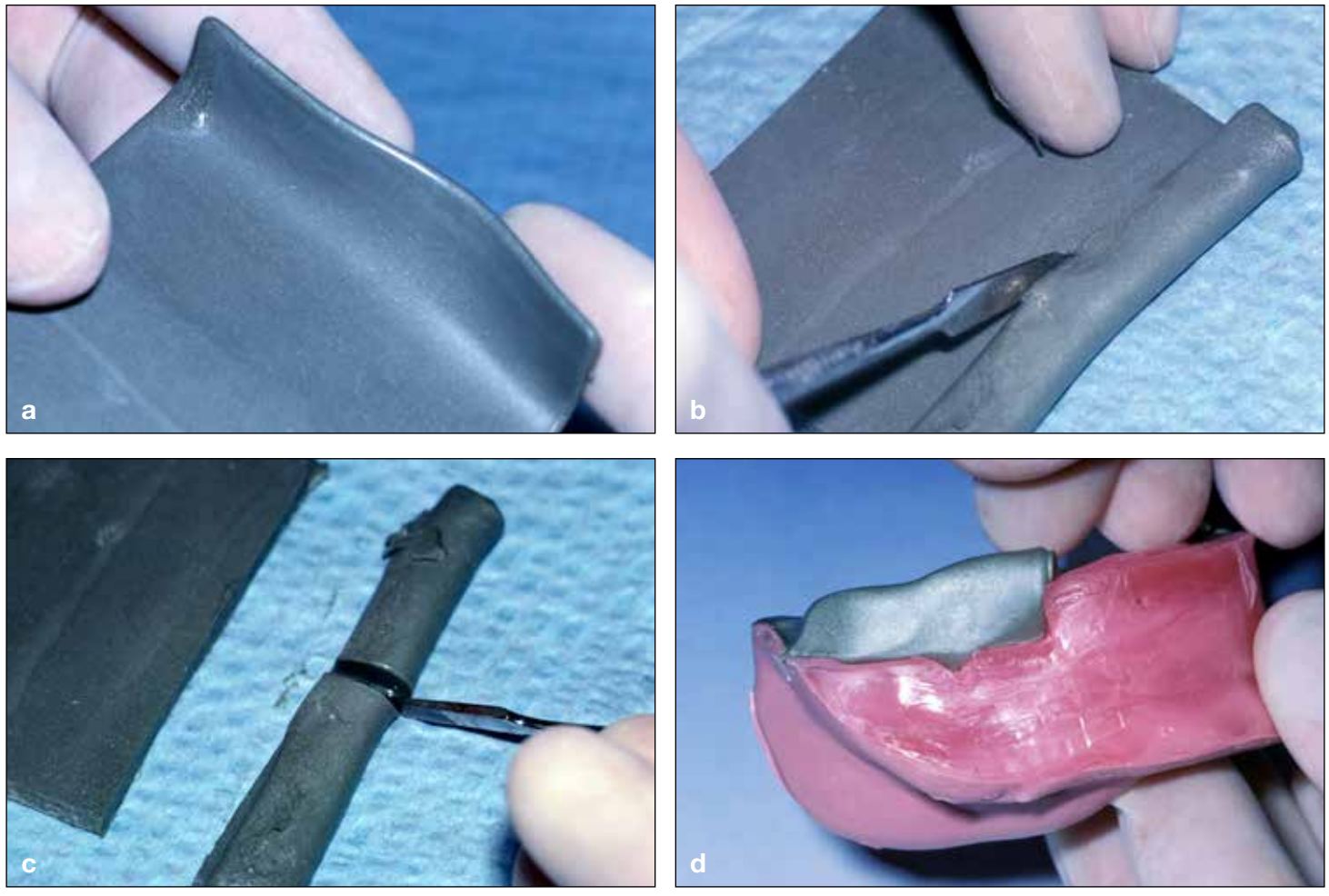

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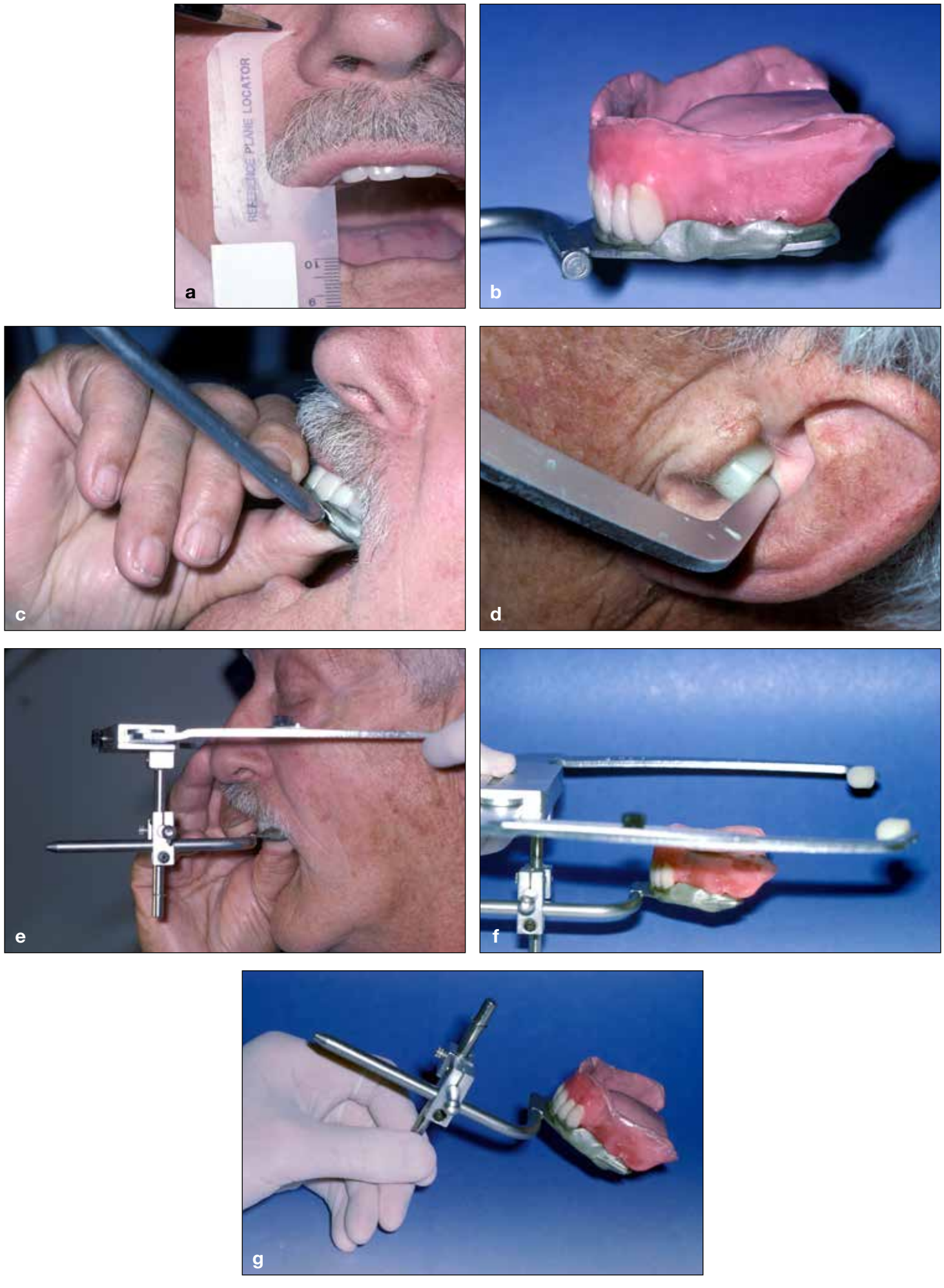
5-19

The Facebow Record

The choice of clinical technique for orienting the casts on the dental articulator depends upon the clinician's belief about the likelihood or relative importance of simulating the movements of the patient's jaw on a dental articulator. The casts can be located arbitrarily by hand with a relatively simple articulator,[9] or they can be oriented with a facebow, which attempts to relate the master casts to the condyles of the articulator as the jaws relate to the patient's jaw joints.[10]

The culture of clinical practice influences the relative importance given to the use of the facebow. In North America, for example, there is a strong belief in the clinical value of the facebow as an essential component of relating the casts in the dental articulator to the movements of the patient's joints. Moreover, it is believed that occlusal irregularities from arbitrarily placing the casts in an articulator can be very significant clinically and time consuming to correct. However, this concern might be of greater relevance to prostheses on natural teeth or implants rather than to mucosa-supported complete dentures.[11] On other continents, there are equally strong beliefs with some empirical evidence that the facebow is unnecessary for quality, comfort, or any other measurable outcome of new dentures.[12–14] The controversy revolves largely around the clinical relevance of the discrepancy between the movements of the patient's mandible and the corresponding movements of the articulator when casts are mounted with or without a facebow.

Controversy aside, the facebow offers at least a reasonably convenient way of orienting the maxillary cast to an articulator similar to the orientation of the maxilla to the TMJs, as illustrated in Fig 5-20 with a facebow that uses the external auditory meatus as the reference point for the arbitrary hinge axis of the mandible (Denar Slidematic Facebow, Whip Mix) and a semi-adjustable articulator (Denar Mark II Articulator, Whip Mix).



5-20

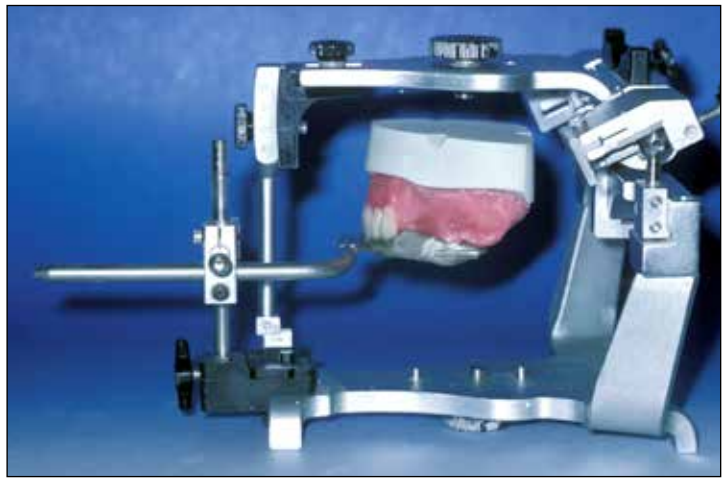
The facebow record concludes the clinical procedure for identifying the jaw relationships so that the casts can be attached to an articulator:

• The incisal pin of the articulator is set at zero, and the vertical bar of the facebow record is attached to the articulator. The maxillary cast is placed in the record base after reducing the base of the maxillary cast if necessary to allow the upper arm of the articulator with attached mounting ring to close without interference (Fig 5-21).

• A triangular notch is cut in three locations around the base of both master casts (Fig 5-22), and the maxillary cast, dampened with water, is attached to the mounting ring with plaster.

• When the plaster is hard, the bite fork is removed from the upper rim, the articulator is inverted, the mandibular cast with the record base and wax record are attached securely to the upper rim, and the mandibular cast is joined with plaster to the articulator. (Fig 5-23).

Once the orientation and attachment of the casts to the articulator are complete, the remaining teeth can be arranged by a dental technician.



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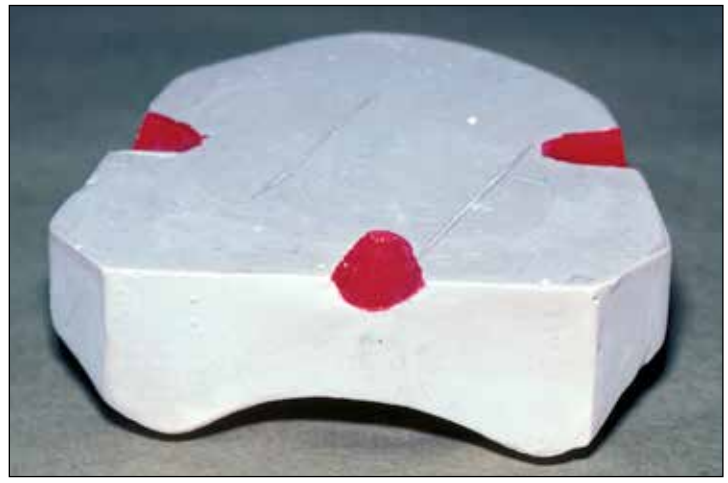

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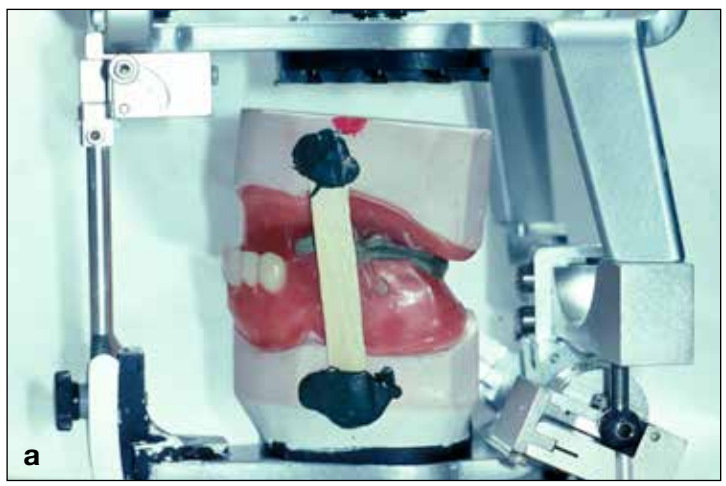

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CHAPTER > 6

Arranging the Mandibular Anterior Teeth and All of the Posterior Teeth

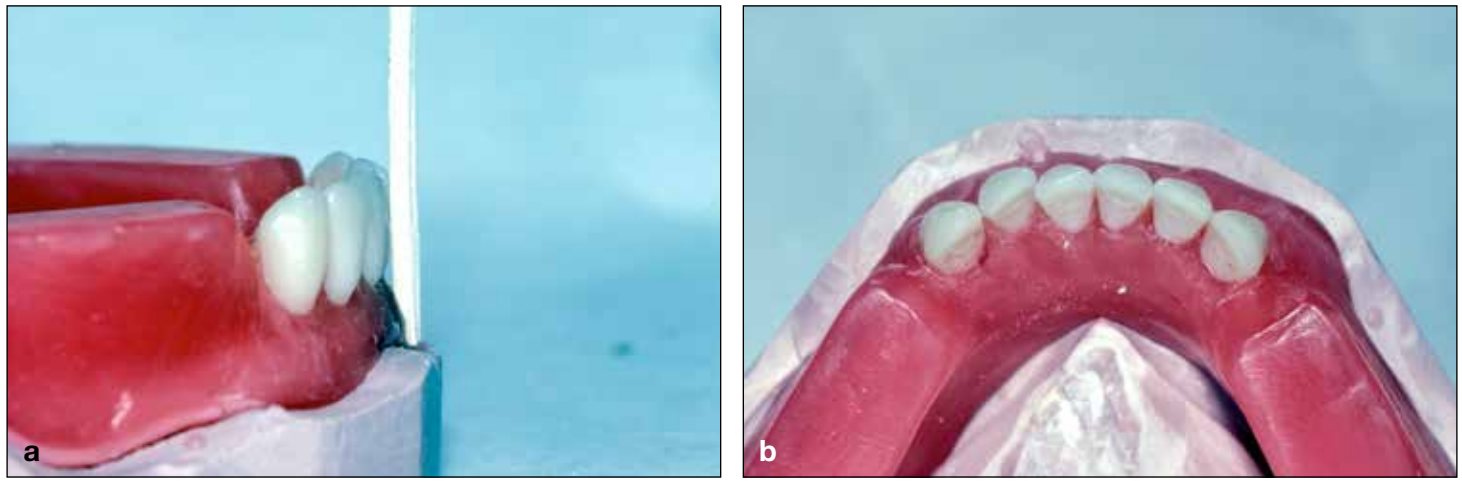
The clinician, with the guidance and approval of the patient, has arranged the anterior teeth on the maxillary record base, and at this stage the remaining denture teeth can be selected and arranged, usually by a dental technician in a dental laboratory. In general, there is widespread agreement that dentures function most effectively if the artificial teeth are located in the position occupied previously by the healthy natural dentition, but minor modifications are made occasionally in an effort to enhance the stability of the mandibular denture.[1]

Mandibular Anterior Teeth

The six mandibular anterior teeth are selected to match the size, shape, and color of the maxillary teeth. The tooth guides available from the manufacturers of denture teeth give direction to appropriate combinations of molds for maxillary and mandibular anterior teeth. Consequently, we usually select the mandibular anterior teeth from a mold and color that complement the maxillary anterior teeth that the patient has already seen in the mouth. It is important to instruct the dental technician not to alter the maxillary anterior teeth that have been arranged in the mouth with the patient's approval. The clinician should prescribe for the dental technician the horizontal and vertical positions of the mandibular incisors and all of the posterior teeth.

Horizontal position

The skeletal relationship of the mandible to the maxilla dictates the horizontal relationship of the mandibular anterior teeth with few exceptions. However, the labial surface of the mandibular incisors should not protrude beyond the labial vestibule (Fig 6-1). The maxillary incisors will protrude very slightly in a Class I skeletal relationship and more substantially in a Class II relationship, whereas the mandibular incisors will usually contact edge-to-edge with the maxillary incisors in a Class III relationship. This horizontal placement applies even in a severe Class II jaw relationship with a large overjet of the maxilla, unless the patient insists on an unstable protrusion of the mandibular incisors to achieve a particular esthetic effect. Protruding the mandibular incisors beyond the labial vestibule will probably destabilize the denture when eating and speaking. A natural alignment of the mandibular incisors parallel and posterior to the vestibule creates the illusion of natural teeth with roots imbedded in alveolar bone.

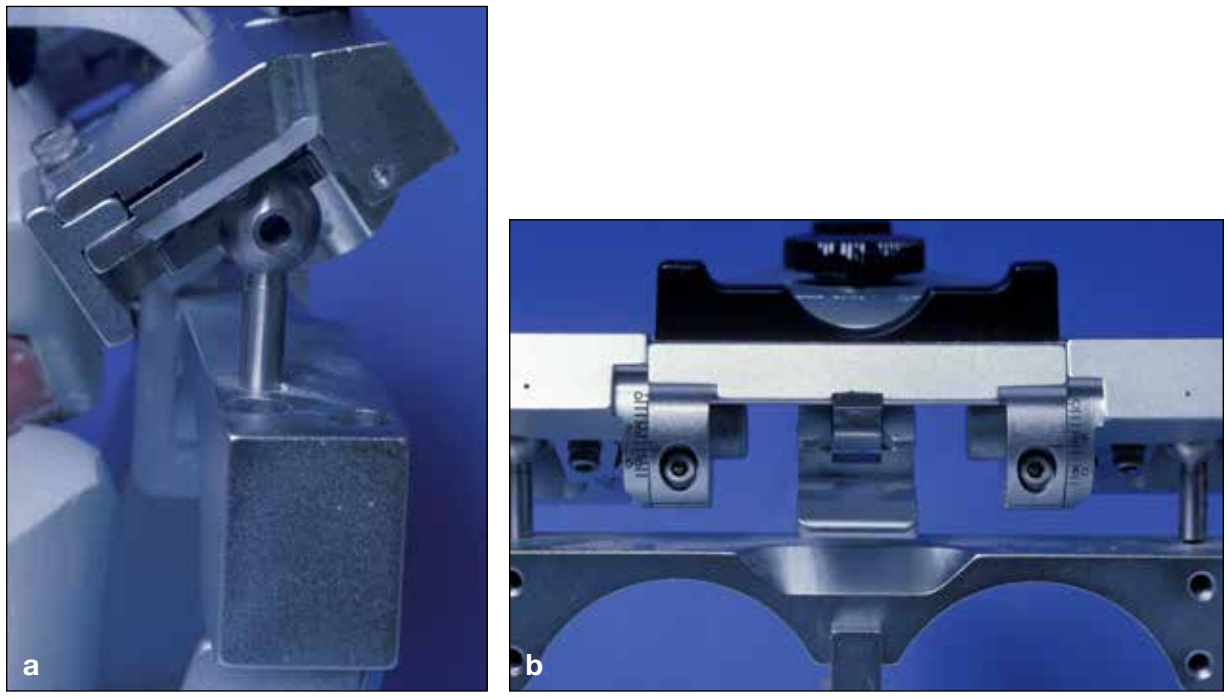


6-1

Vertical position

Movements of the mandible are influenced by the shape and movements of the temporomandibular joints and by the way the mandibular anterior teeth contact the maxillary anterior teeth during the movements. The articulator can be adjusted arbitrarily at this stage until more information is obtained at the next appointment about how the mandible moves eccentrically.

- The condylar guidance is inclined arbitrarily to 25 or 30 degrees bilaterally,[2,3] and if the articulator allows more refined adjustments, the progressive side shift is set at 7 degrees (Fig 6-2).[4]
- The incisal table on the articulator is adjusted to about 15 degrees of protrusive guidance and about 5 degrees of lateral guidance (Fig 6-3).



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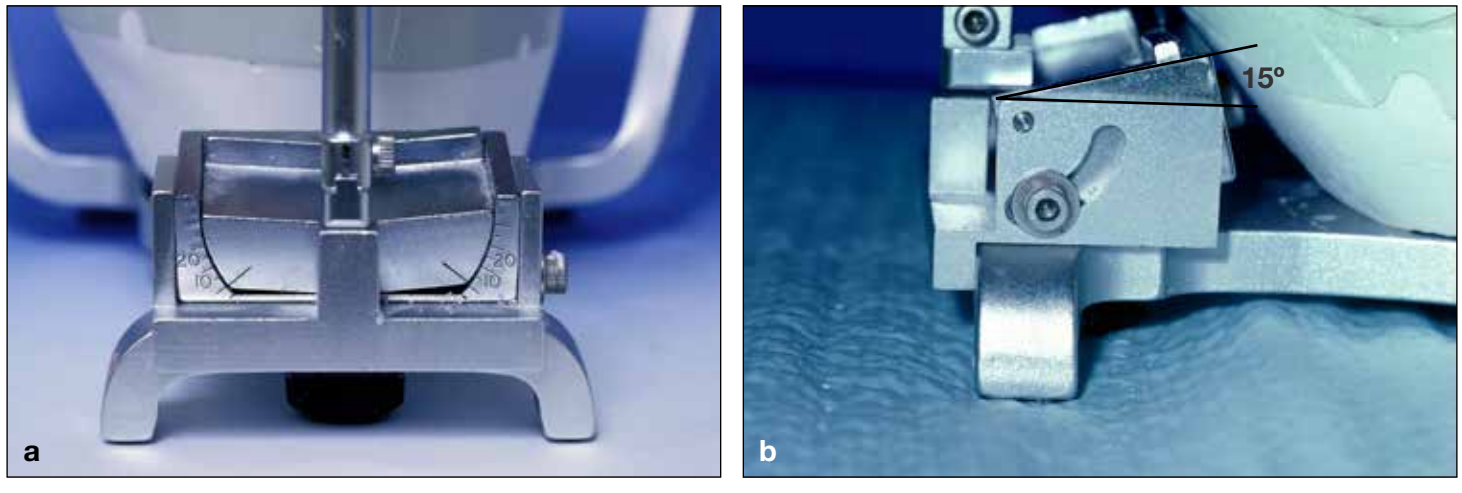
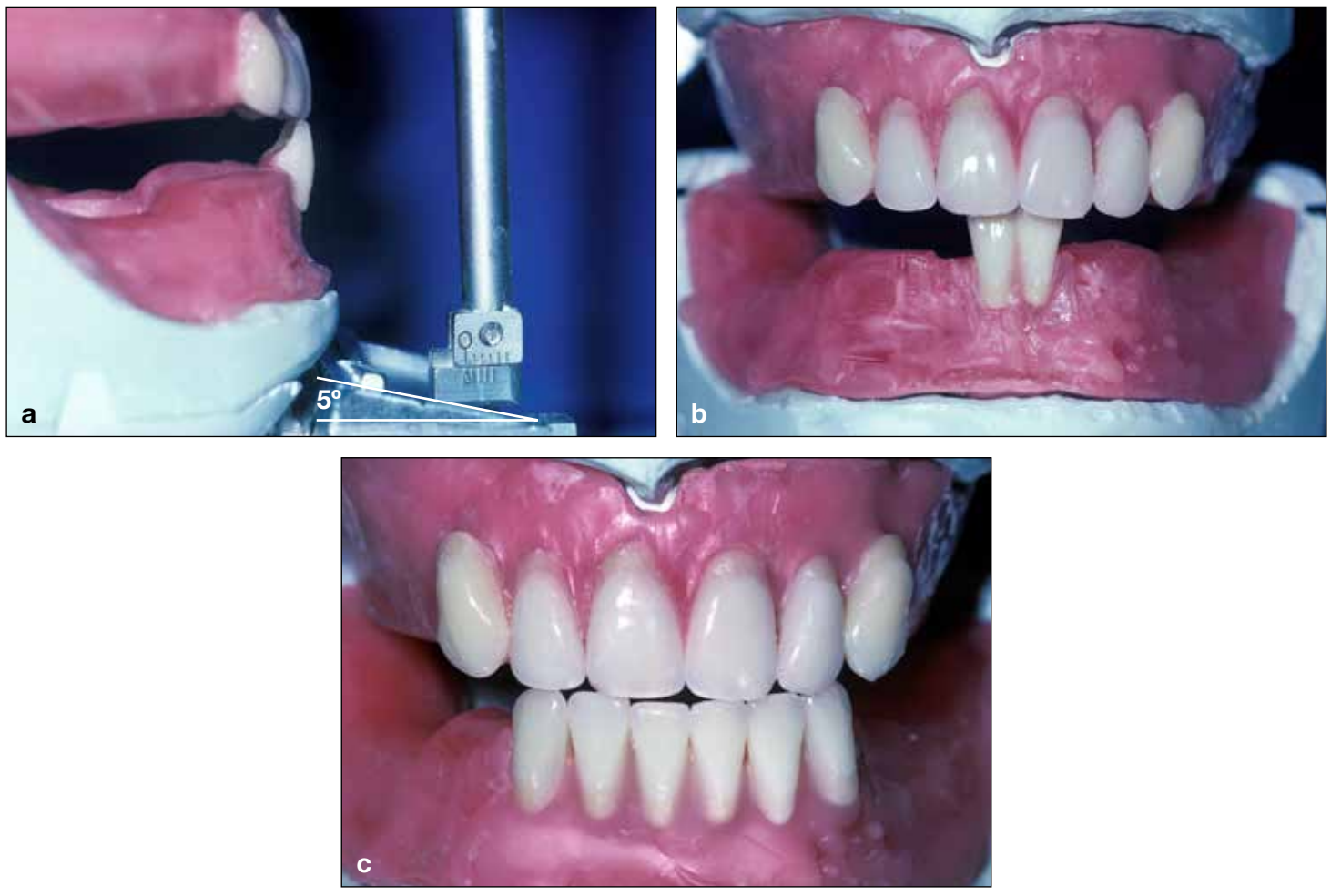


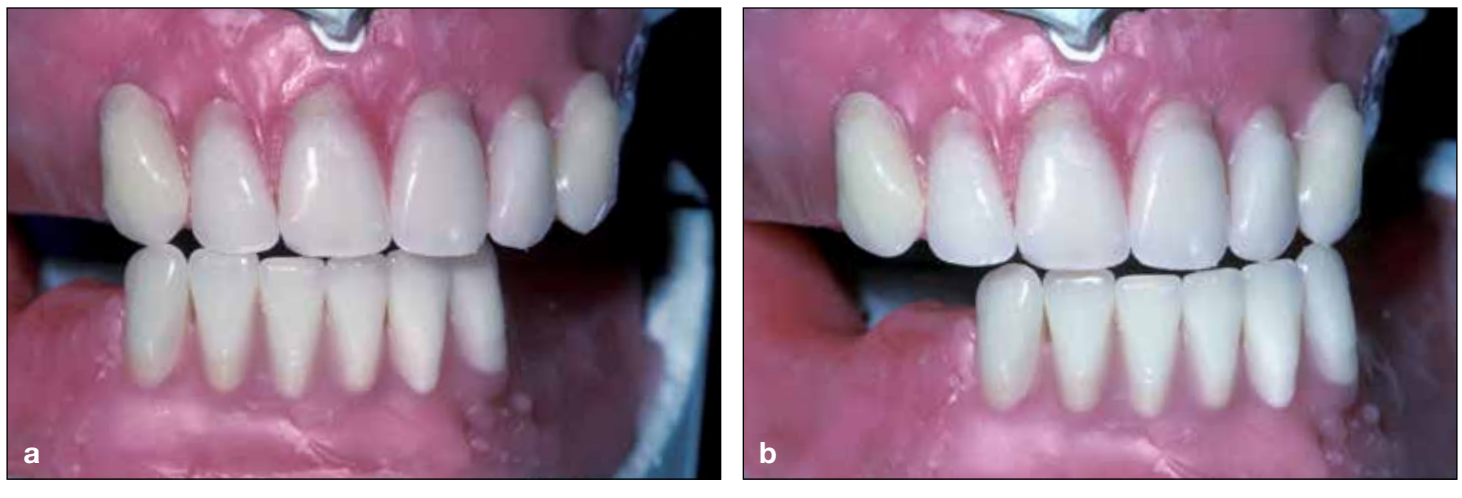
6-3

With the articulator adjusted arbitrarily and the mandibular incisors aligned horizontally within the confines of the lingual and labial vestibules:

- The wax is softened with a very hot knife, and the mandibular teeth are brought into contact with the incisal edge of the maxillary incisors as the mandibular cast protrudes along the tilt of the articulator's incisal table for the incisal pin (Fig 6-4).
- Similarly, the relationship of the mandibular canine is modified on each side to permit lateral movements of the articulator while the teeth remain in contact (Fig 6-5) without lifting the incisal pin away from the incisal table.



6-4



6-5

The maxillary and mandibular incisors do not usually contact each other when the condyles are retruded against the posterior fossa of the articulator, except in a Class III skeletal relationship. Contacts between the maxillary and mandibular incisors are made only when the mandible moves eccentrically. In a Class III relationship, the mandibular incisors are simply raised to the incisal edges of the maxillary teeth without influence from the condyles.

Posterior Teeth

Composition

Like the anterior teeth, posterior teeth are available in plastic and ceramic materials. Some dentists prefer ceramic teeth posteriorly because they are quite resistant to occlusal wear and abrasion. However, others believe that ceramic teeth are more destructive to residual ridges and that a combination of acrylic mandibular teeth against ceramic maxillary teeth is less abrasive overall.[5] Unfortunately, there is no convincing evidence favoring one material or a combination of both; yet the weight of opinion favors acrylic teeth today, probably because the cross-linked resins used to produce the teeth are adequately resistant to wear for most patients.

Color

The color of posterior teeth complements the color of the anterior teeth. This match is verified later in the patient's mouth and can be changed easily if necessary.

Shape

Artificial teeth are made in various heights and lengths to accommodate the vertical height of the resorbed residual ridge and the length of the mandible from the distal aspect of the mandibular canines to the middle of the retromolar pads (Fig 6-6).

The occlusal shape of posterior teeth varies by occlusal form, usually described in terms of the angle (eg, 0, 20, or 33 degrees) that cusps rise above the occlusal plane. There is no evidence that any occlusal form is superior in any way other than the more natural-looking appearance of teeth with cusps in contrast to teeth without cusps.[6] Teeth with cusps certainly look more natural in younger patients, and teeth with abraded cusps probably look more natural in older denture wearers.

The dentition provided by complete dentures should contact bilaterally and broadly in the centric relation (CR) position for optimal stability of the dentures, but beyond that there is much less certainty about the need for intimate interdigitation of tooth cusps either in CR or eccentrically. Therefore, like the choice of material used to make teeth, the shape of the posterior teeth on dentures is a matter largely of esthetic preference with little or no relevance to the stability or chewing efficiency of the dentures.[7,8] Continuous pressure from an ill-fitting or structurally defective denture can irritate the supporting mucosa and possibly the underlying bone, but there is no evidence that this irritation causes irreversible loss of bone or irreparable damage to the jaw joints.[9,10]

Intraoral markers for the mandibular posterior teeth

The following approach to selecting and arranging posterior teeth aims to: *(1)* provide teeth that look natural for the patient; *(2)* stabilize the denture in CR; and *(3)* minimize destabilizing contacts between teeth during protrusive and lateral movements of the mandibular denture.

The incisal edge of the canines and incisors form the anterior position of the occlusal plane. The maxillary anterior teeth have been arranged primarily to address the esthetic expectations of the patient. The mandibular incisors and canines have been placed horizontally within the limits of the labial vestibule and vertically to contact the maxillary teeth within the arbitrarily established eccentric movements of the articulator.

The retromolar pad at the posterior border of the mandibular ridge lies at or near the occlusal surface of the molars in the natural dentition. Therefore, lines joining the middle of the retromolar pads to the tips of the canines will lie very close to the natural occlusal plane and can be used to arrange the occlusal surfaces of the premolars and molars (Fig 6-6).

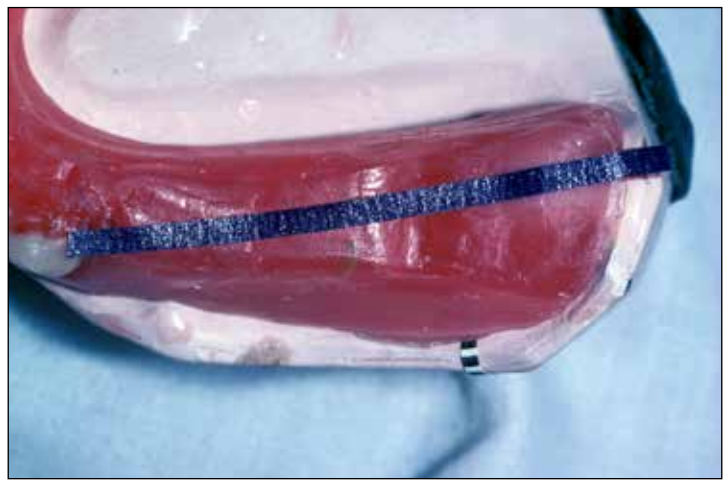
The occlusal surface of the wax rim on the mandibular cast is adapted to this plane, and a line locating the crest of the residual ridge underlying the position of the central groove of the teeth is made in the wax from the tip of the canines to the vertical mark through the retromolar pads (Fig 6-7). The wax is softened with a very hot knife so that the posterior teeth can be arranged in a natural alignment, with the tips of the cusps on the occlusal plane and the central grooves aligned with the crest of the residual ridge (Fig 6-8). The number of premolars and molars is determined by the length of the ridge bilaterally from the distal surface of the mandibular canines to the middle of the retromolar pads (see Figs 6-6c and 6-8a). This space can be filled quite often by three rather than four posterior teeth without loss of chewing ability.[11,12]


a


0 35 40 45 50 55 60 65 70
b


Middle of
retromolor pad
c

6-6



6-7


Middle of
retromolor pad
a

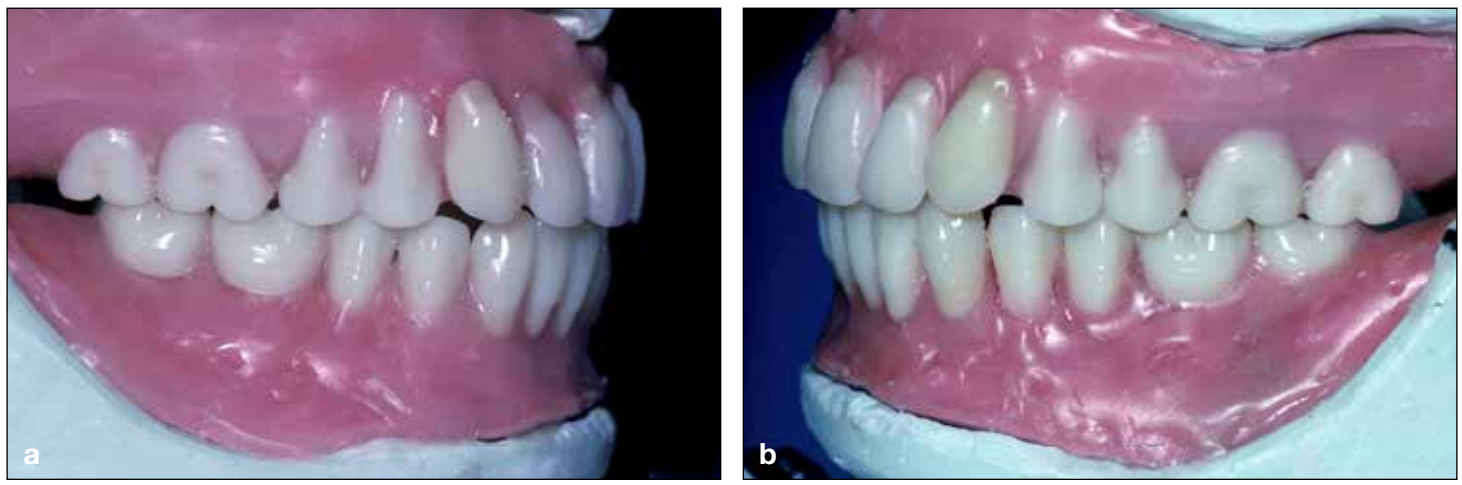

b

6-8

Position of the maxillary posterior teeth

The maxillary premolars and molars are arranged on the maxillary occlusal rim to occlude maximally with the mandibular teeth (Fig 6-9). They can be arranged with a conventional occlusal overjet or a crossbite to suit the skeletal relationship of the resorbed residual ridges. However, either way, the maxillary and mandibular facial cusps must have at least 1 mm of overjet in CR to minimize cheek biting.

The stability of the mandibular denture might be enhanced by adjusting the cusps to remove contact between buccal cusps and direct the occlusal forces onto the lingual cusps and central fossae of the teeth.[13] This minor reduction in the length of the maxillary facial cusps, if acceptable esthetically to the patient, directs the occlusal forces between the lingual (palatal) cusps of the maxillary teeth and the central fossae of the relatively flat mandibular teeth in CR, similar to a mortar and pestle. Advocates of this "lingualized occlusion" claim that it provides light stabilizing cusp-fossa contacts between some posterior teeth when the mandibular denture moves eccentrically.



6-9

Waxed Gingival Contours

The last step in arranging the teeth in wax is to contour the supporting wax to simulate the contours and surface characteristics of the gingiva and missing alveolar ridges (Fig 6-10).[14]

6-10

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CHAPTER > 7

Clinical Evaluation of the Teeth in Wax

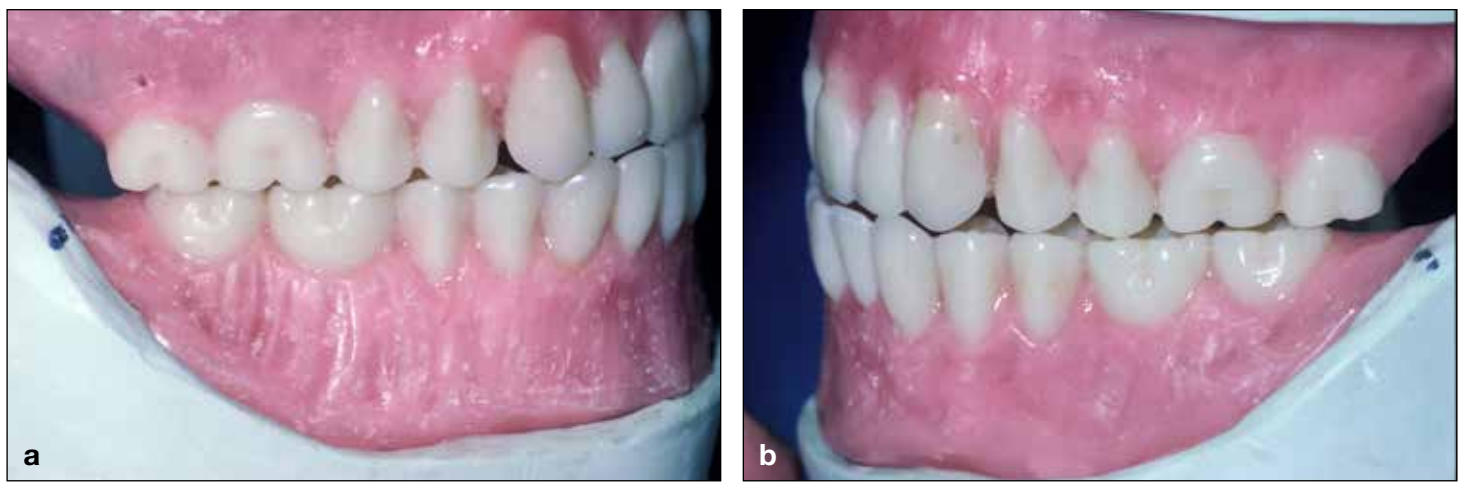
The preliminary arrangement of the teeth to this point is based on several clinical assumptions that require further assessment and measurements. It was assumed that the appearance of the maxillary incisors would satisfy the patient when the other teeth were arranged for closer inspection. The occlusal rims with maxillary anterior teeth were used for an esthetic assessment and preliminary recording of the vertical dimension of occlusion (VDO). Mandibular incisors were arranged on the assumption that the patient's temporomandibular joints (TMJs) would guide the mandible down a 20- to 30-degreee slope on protrusion. However, the instability of the mandibular baseplate along with the difficulty of recording the jaw relationship in the retruded rest position raises the likelihood that the relationship of the casts on the articulator differs from the relationship between the patient's mandible, maxilla, and TMJs. Consequently, the next clinical session will test all of these assumptions and aim to correct the esthetic and other functional errors in tooth position before processing the denture bases in acrylic resin.

Evaluating the Teeth on the Articulator

The arrangement of the teeth is assessed to confirm that:

- Mandibular incisors do not protrude beyond the labial vestibule (Fig 7-1).
- Incisal edges of opposing anterior teeth contact when the mandibular cast protrudes (Fig 7-2).
- The height of the occlusal plane on each side of the jaw coincides with the line joining the incisal tip of the mandibular canine to the retromolar pad (Fig 7-3).
- The central grooves of the mandibular premolars and molars align with the crest of the residual ridge (Fig 7-4).
- There are occlusal contacts bilaterally on the premolars and first molars when the mandibular cast is retruded on the articulator (Fig 7-5).

7-1



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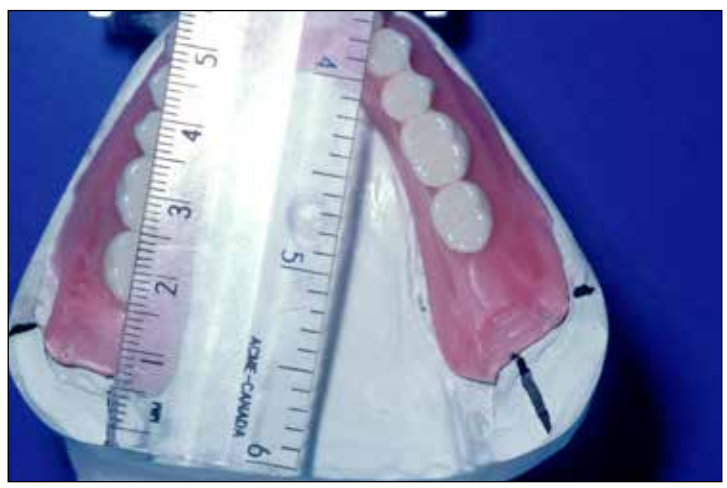

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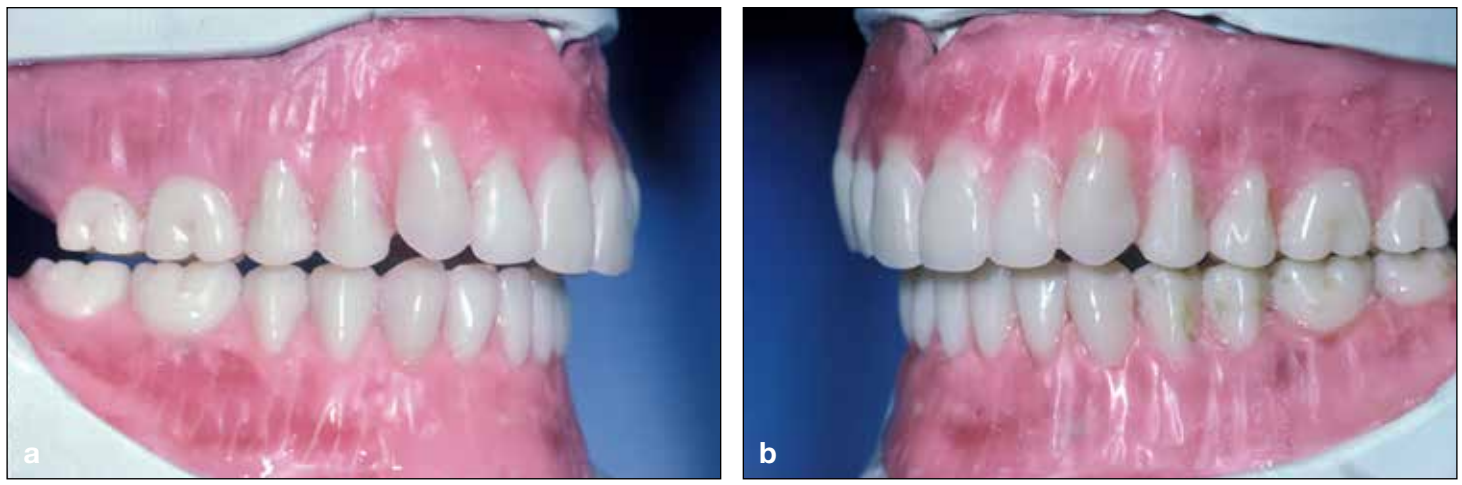


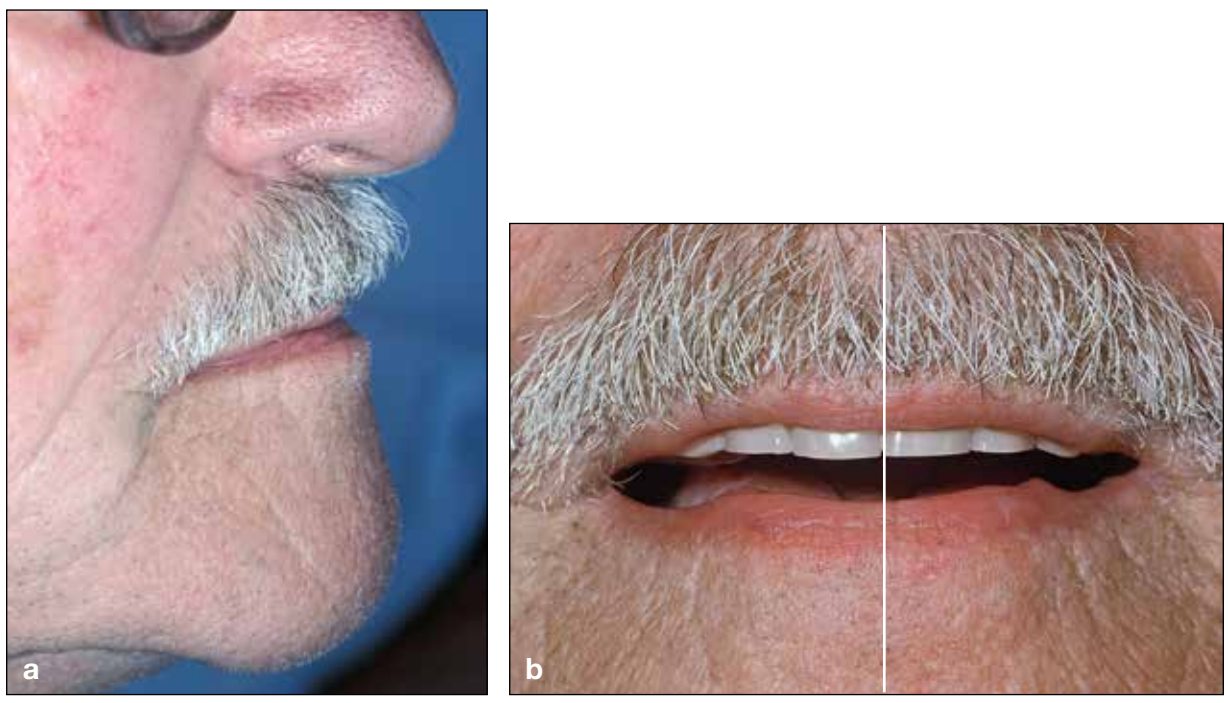
7-5

Assessing the Teeth in the Patient's Mouth

The patient should be told clearly that the clinical objectives of assessing the denture in the mouth at this stage are primarily to approve the arrangement of the teeth on the baseplates and warned that the baseplates will probably feel unstable and loose in the mouth.

When the teeth are in the mouth, the clinician and patient together assess the esthetic acceptability of the VDO (Fig 7-6a) along with the alignment of the incisors to the midline of the face and to each other (Fig 7-6b). The clinician also observes the occlusal contacts when the mandible is in the retruded relaxed position with the patient confirming the position of the initial occlusal contact as the teeth touch (Fig 7-7).

The occlusal contacts in the mouth must be compared with the contacts between the teeth on the articulator, and, if different, a new interocclusal record must be obtained to remount the mandibular cast on the articulator. *The dentures must not be processed in acrylic resin until the dental contacts in the mouth and on the articulator are the same.*



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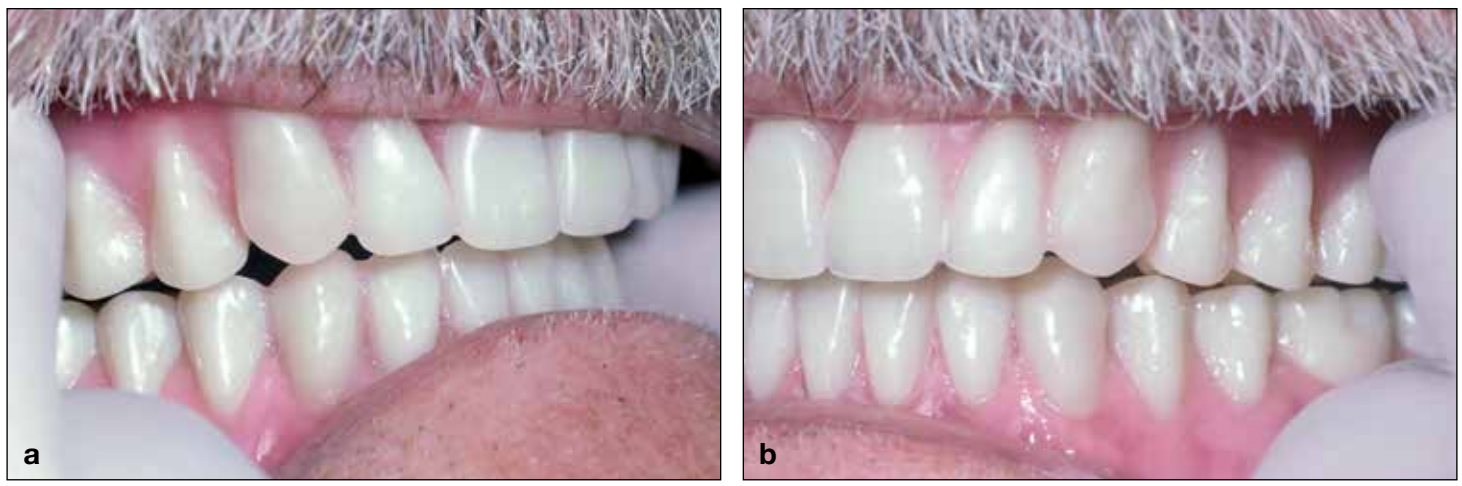
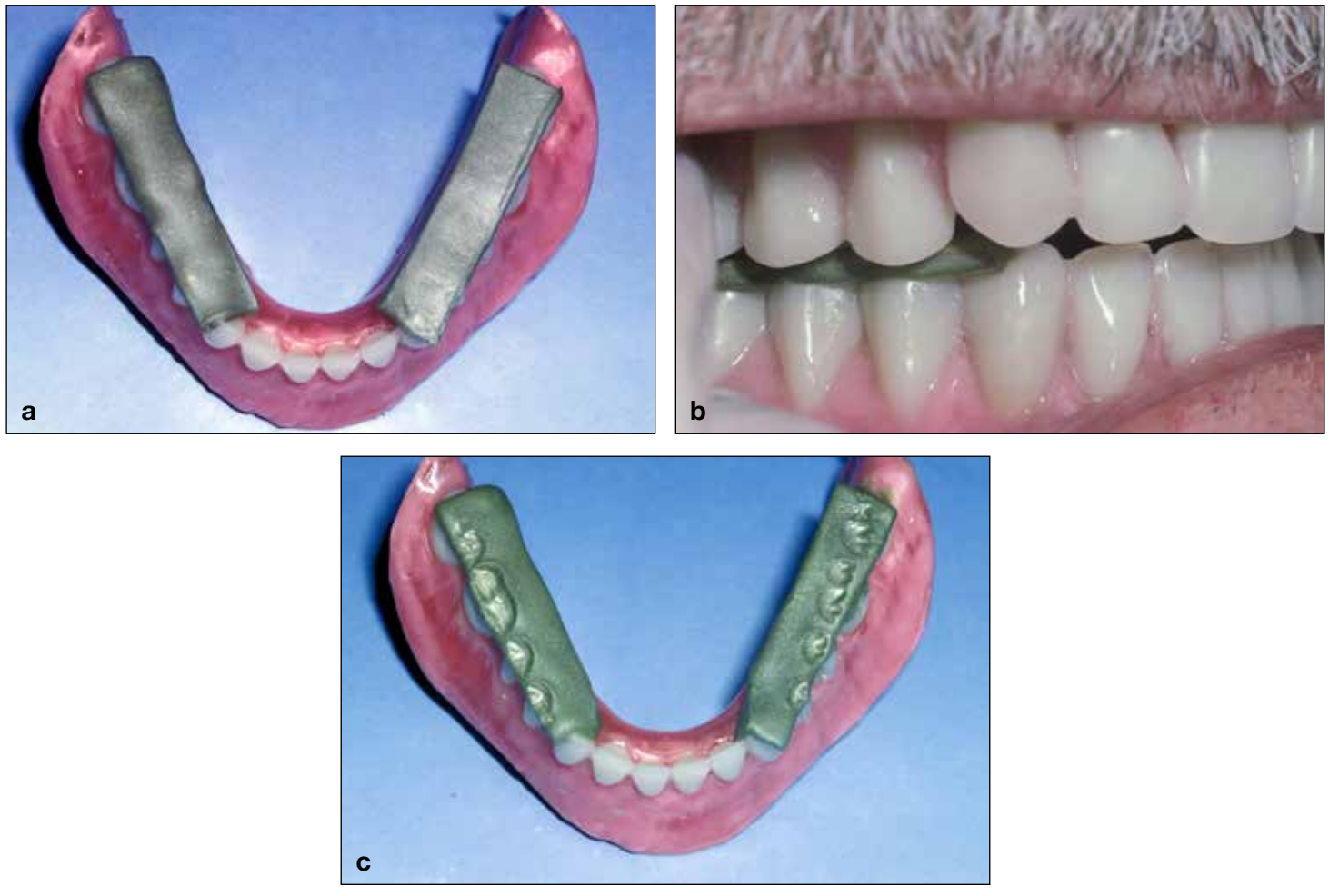


7-7

Recording a New Jaw Relationship Record

The new record is obtained when the clinician can stabilize the baseplates in the mouth to guide the patient's mandible to the first occlusal contact in the retruded (CR) position. This is not a position that the patient can reliably assume without direction from the clinician.[1,2] It is recorded quite efficiently with a reinforced wax record similar to the previous jaw relationship record (see chapter 5) by: *(1)* removing the mandibular baseplate and teeth from the mouth, drying the occlusal surfaces of the teeth, and placing a single strip of softened wax (Green Aluwax, Aluwax Dental) on the posterior teeth (Fig 7-8a); *(2)* replacing the mandibular baseplate on the ridge and guiding the patient to the first occlusal contact with the mandible relaxed and retruded (Fig 7-8b); and *(3)* inspecting the record to confirm that the contact point showing through the record coincides with the initial cuspal point of contact identified previously in the mouth (Fig 7-8c).

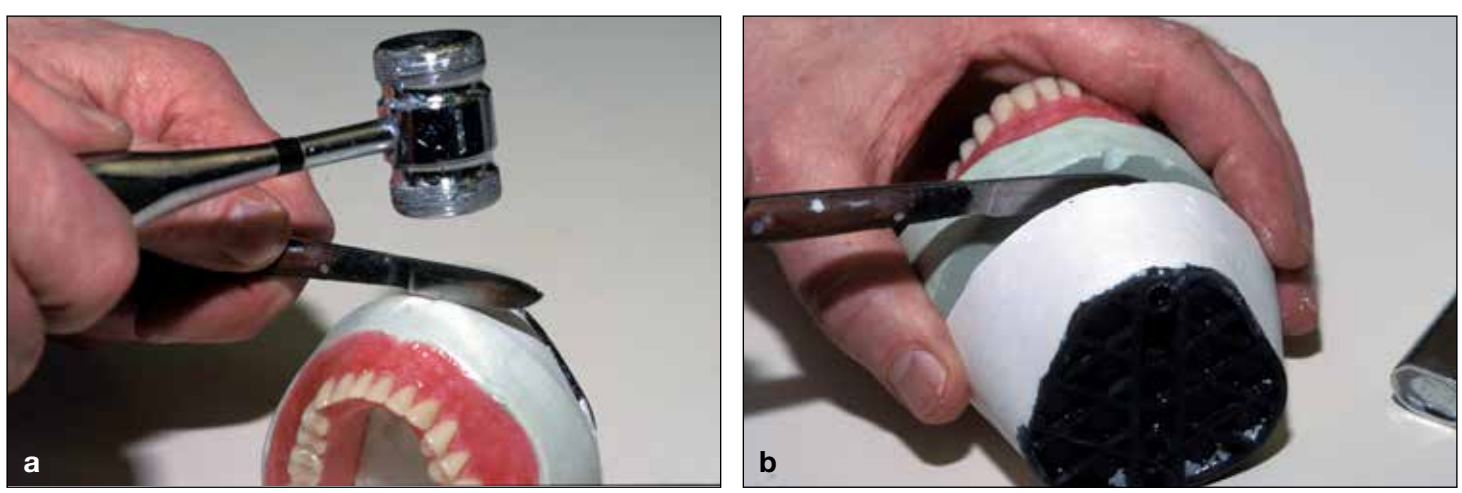


7-8

Remounting the Mandibular Cast

The mandibular cast is remounted using the following sequence of procedures:

- The mandibular cast is removed from the articulator and separated from the mounting plate with a tap on the back of a knife placed at the junction of the cast and the mounting plaster (Fig 7-9).
- The height of the incisal pin is increased by the thickness of the wax record (Fig 7-10).
- The articulator is turned upside down, the mandibular mounting ring is reattached, the mandibular cast and teeth with the wax record are placed on the maxillary teeth, and the mandibular cast is reattached to the articulator with a fast-setting mixture of slurry water and plaster (Fig 7-11).



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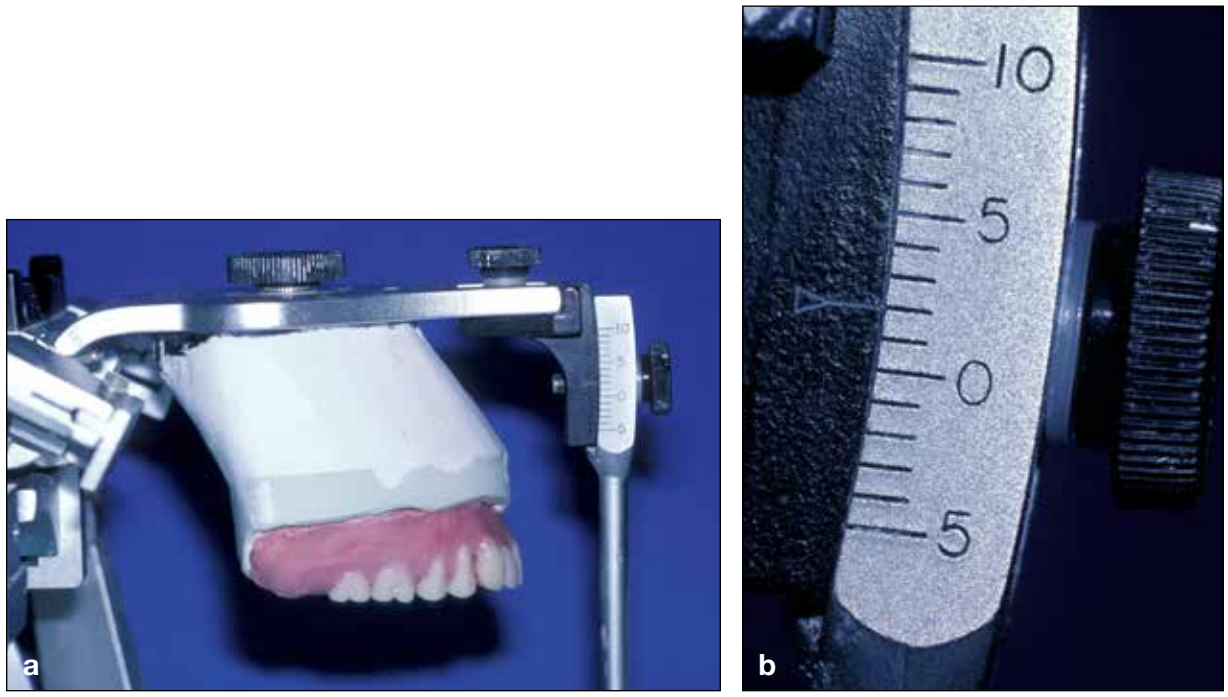

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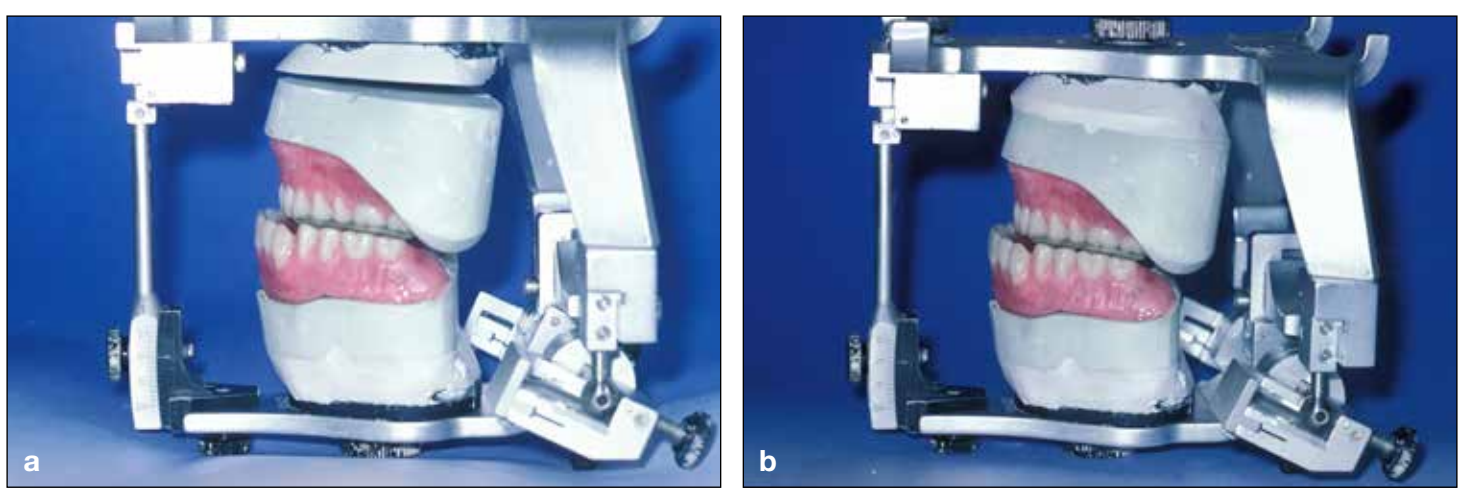
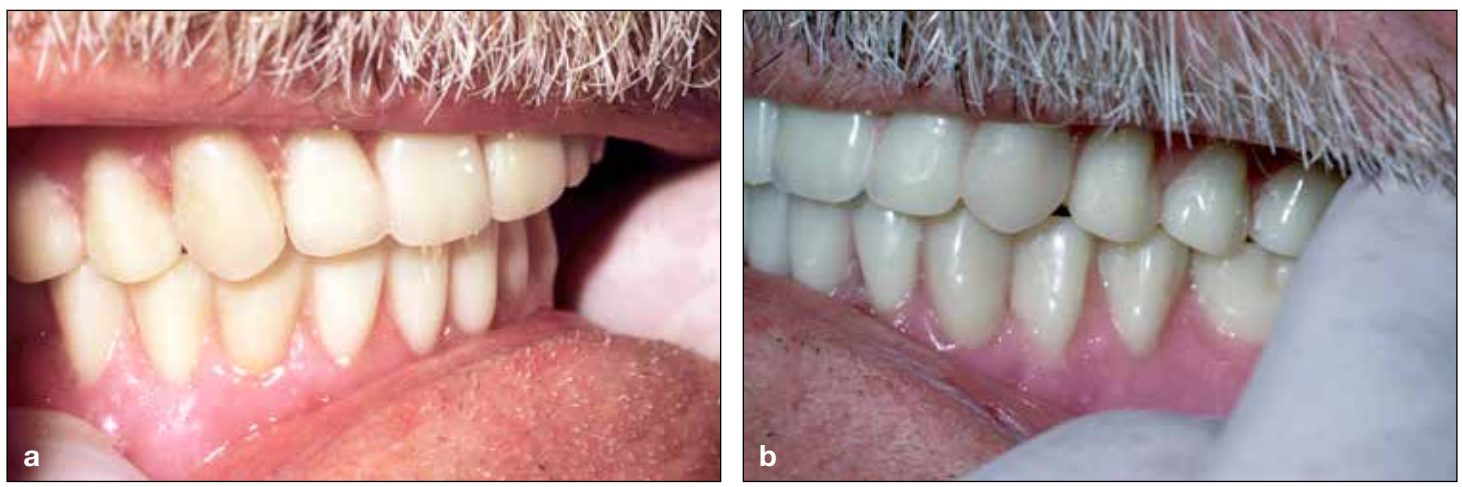


7-11

Adjusting Occlusal Contacts

Before the teeth are adjusted on the articulator, the baseplates of the denture are replaced in the mouth to locate the first occlusal contact and confirm that it coincides with the first contact between the teeth on the articulator. The cast must be remounted if there is any doubt about the mounting of the casts on the articulator. When the correct mounting on the articulator is confirmed, the teeth are rearranged in the wax to obtain even contact bilaterally on the articulator, and then the occlusal arrangement of the teeth is checked for accuracy in the mouth (Fig 7-12).



7-12

Condylar guidance on the articulator

It should be possible now to observe directly in the mouth the influence of the patient's TMJs on the separation of the maxillary and mandibular molars when the patient makes light contact between the incisors. However, the patient will need guidance and practice before protruding the mandible on demand to this incisal position as the clinician stabilizes the mandibular baseplate on the residual ridge. Typically, there is very little separation of the molars if the articulator's condyles were tilted 25 to 30 degrees bilaterally and the teeth were arranged with a slight occlusal curve to maintain contacts between the distal molars when the incisor teeth were edge to edge (Fig 7-13). However, if the molars separate noticeably when the patient moves the incisors edge to edge while the clinician stabilizes the baseplate securely on the mandibular ridge, the condylar guides of the articulator can be adjusted to reproduce the same molar separation on the articulator. This visual estimate of molar separation is not exact but is sufficient for adjusting the molars on the articulator to remain in contact when the patient moves the jaws eccentrically. Continuous contact between molars is achieved by "ramping" the distal molars at an angle that allows them to remain in contact from the retruded rest position until the incisors meet edge to edge.[3] Typically, mandibular complete dentures move around in the mouth when chewing food and make only fleeting occlusal contact with the maxillary denture, which supports the saying "enter bolus, exit balance."[4]

7-13

Posterior balancing ramps

When the condyles on the articulator have been adjusted to simulate the influence of the patient's condyles, the balancing ramps can be constructed bilaterally as follows:

- The occlusal surface of the maxillary posterior molar is ramped to approximately 20 degrees from the occlusal surface of the opposing teeth in the retruded position of the mandibular cast (Fig 7-14).
- The mandibular molars are brought into contact with the ramped maxillary molars (Fig 7-15a) to maintain contact protrusively until the incisors are edge to edge (Fig 7-15b).
- If the length of the dental arch can accommodate only one molar, the balancing ramps are produced directly on the baseplate (Fig 7-16) and subsequently on the acrylic base of the mandibular denture.

7-14

7-15

7-16

Final Approval of the Trial Dentures

The patient must approve of the appearance of the teeth, preferably with the collaboration and support of a friend, and all concerns should be shared and addressed while the teeth are in wax and convenient to change.

References

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CHAPTER > 8

Processing Acrylic Resin

Acrylic resin or polymethyl methacrylate (PMMA) is the usual material for dentures. The resinous mix of monomer and polymer can be processed to a hard acrylic by several similar methods.[1,2] Processing the resin under pressure in a stone mold of the denture remains the most popular method in dentistry. Typically, the soft doughy resin is packed into the mold within a metal flask and contained under pressure at about 69°C for several hours to harden. Alternatively, the resin can be injected under pressure into an aluminum or polycarbonate flask and processed in hot water or air or in a 600-W microwave oven. There is a slight shrinkage or contraction of the resin away from the stone mold as it hardens, but there is no good evidence that one method is any better than the others or that the dimensional change poses clinical significance to the fit or comfort of the processed dentures.[1,2] This chapter describes the method for processing denture resin in a compression flask and associated procedures to prepare the dentures for the patient.

Preparing the Wax Denture for Processing

Refinement of occlusal contacts

Remounting casts on another articulator

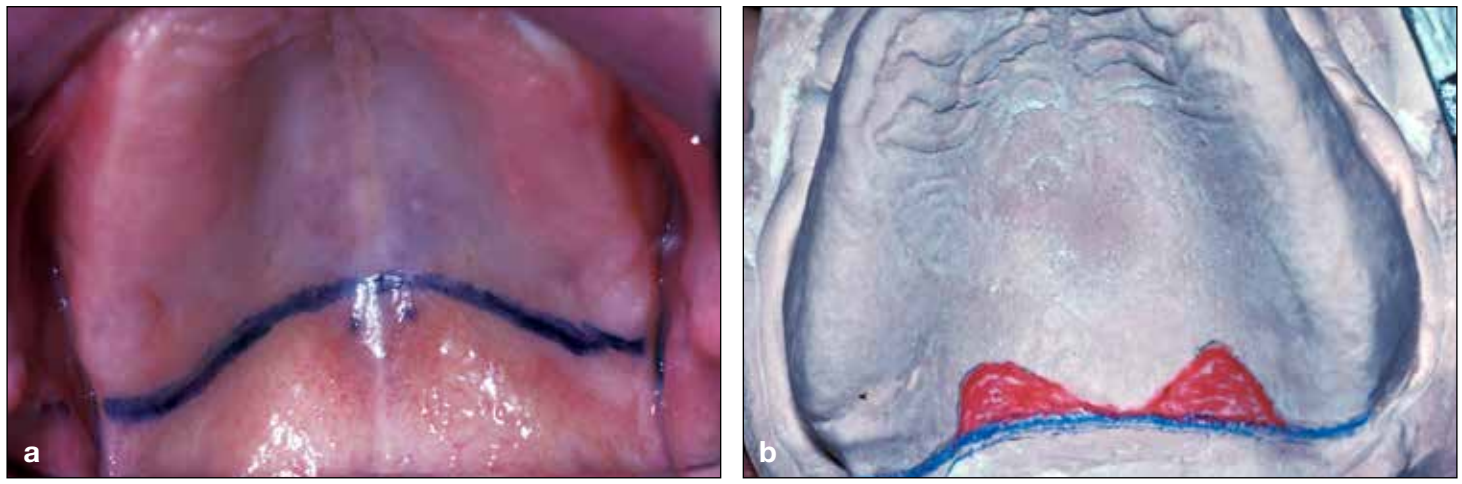
The waxed dentures will need careful assessment by the dental technician because the teeth are likely to have moved during transport to the dental laboratory. Occlusal contacts probably moved slightly as the supporting wax expanded or contracted with changes in ambient temperatures. The technician should refine the contacts again on the wax baseplates before processing the dentures in acrylic resin. Consequently, the technician should receive the articulator on which the teeth were arranged or information about condylar inclinations if the casts can be moved reliably between articulators. Mounted casts can be interchanged between some but not all semi-adjustable articulators[3,4]; therefore, many clinicians and technicians prefer to work with the same articulator. Alternatively, the clinician can record the position of the casts on the primary articulator for transfer to another articulator with a brittle wax (Aluwax, Aluwax Dental) or another stable recording medium.

Increasing the condylar guidance

The technician is asked to increase the condylar inclination of the articulator by approximately 5 degrees bilaterally from the original clinical estimate and to increase the tilt of the posterior molars so that the protrusive balancing contacts are maintained posteriorly during this steeper condylar guidance (see Figs 7-14 and 7-15 in chapter 7). The increased condylar guidance provides opportunity later to adjust the posterior balancing ramps when the processed dentures are in the patient's mouth, where it is easier to reduce than to increase the inclination of the occlusal contacts after the resin has been processed.

Enhancing the palatal seal

The peripheral seal of the maxillary denture is particularly vulnerable to leaks across the soft palate because the PMMA on polymerizing tends to pull away from the palatal area of the cast.[1,2] The effect of this distortion is minimized by creating in the cast a trough—deepening from front to back and 1 mm at its deepest—along a line corresponding to the palatal vibrating line from one hamular notch to the other. The trough extends forward like a cupid's bow on either side of the midline, where the submucosal areolar tissue of the palate is resilient (Fig 8-1). The additional resin that the trough adds to the denture will enhance the seal by depressing the mucosa firmly. However, if it is too thick it can dislodge the denture by breaking the seal elsewhere around the periphery.

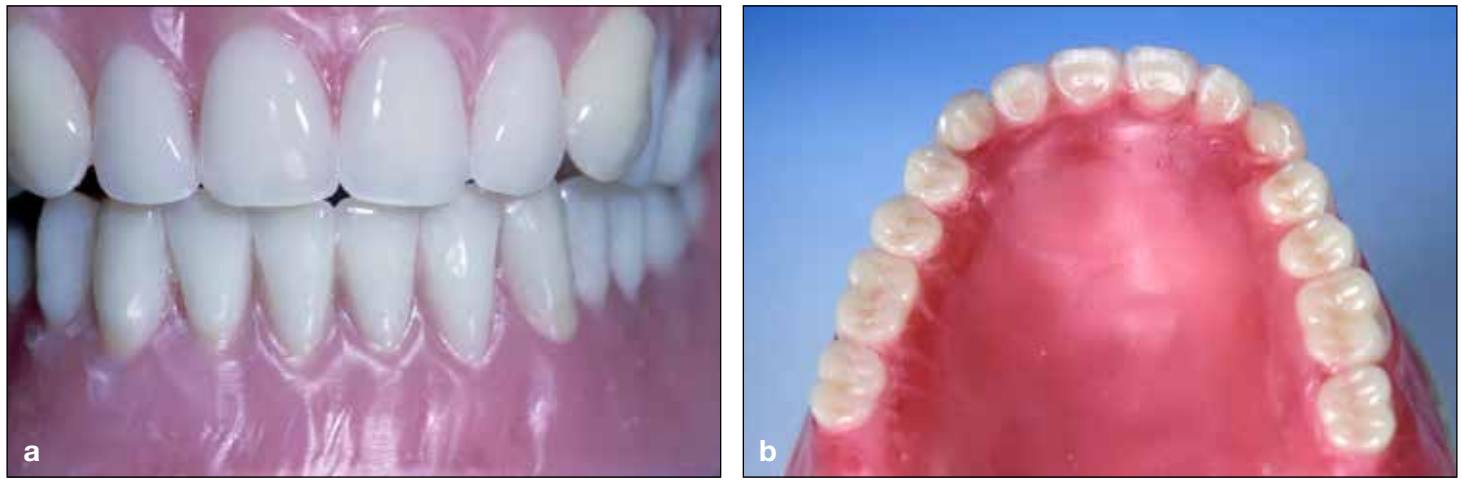


8-1

Wax contours

The wax around the facial surfaces of the teeth is carved to the appearance of natural gingiva and alveolar mucosa, whereas the interdental embrasures on the lingual and palatal surfaces are eliminated to prevent accumulation of food around the teeth (Fig 8-2).[5]

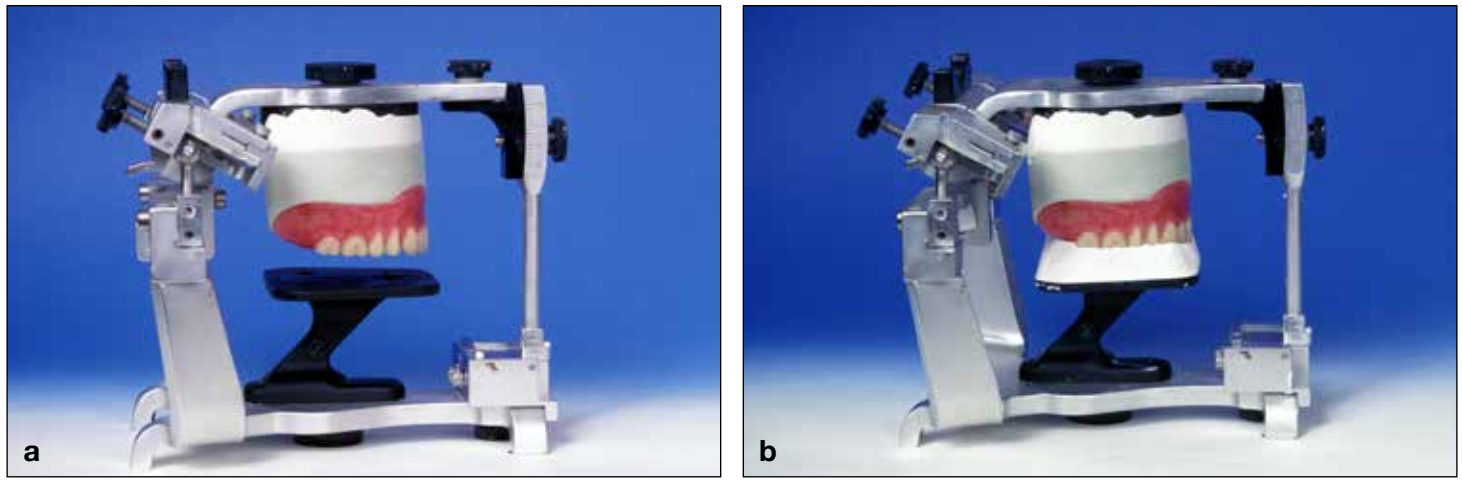
Finally, the periphery of the record base is sealed to the master cast with wax, and the occlusal contacts are reexamined on the articulator for irregularities that might have occurred during the addition and carving of the wax.



8-2

Preserving the orientation of the maxillary cast to the articulator

There is a strong possibility that the master casts will be irreparably broken when removed from the stone molds after the PMMA is processed. It is also likely that the teeth will move slightly under pressure in the processing flask.[6] In anticipation of the occlusal disturbance when the teeth move, the orientation of the maxillary cast on the articulator is preserved before flasking by indenting the maxillary teeth on a platform of stone attached to the lower part of the articulator (Fig 8-3). The dental technician will use this platform later to remount the processed denture on the articulator for the clinician (see chapter 9).



8-3

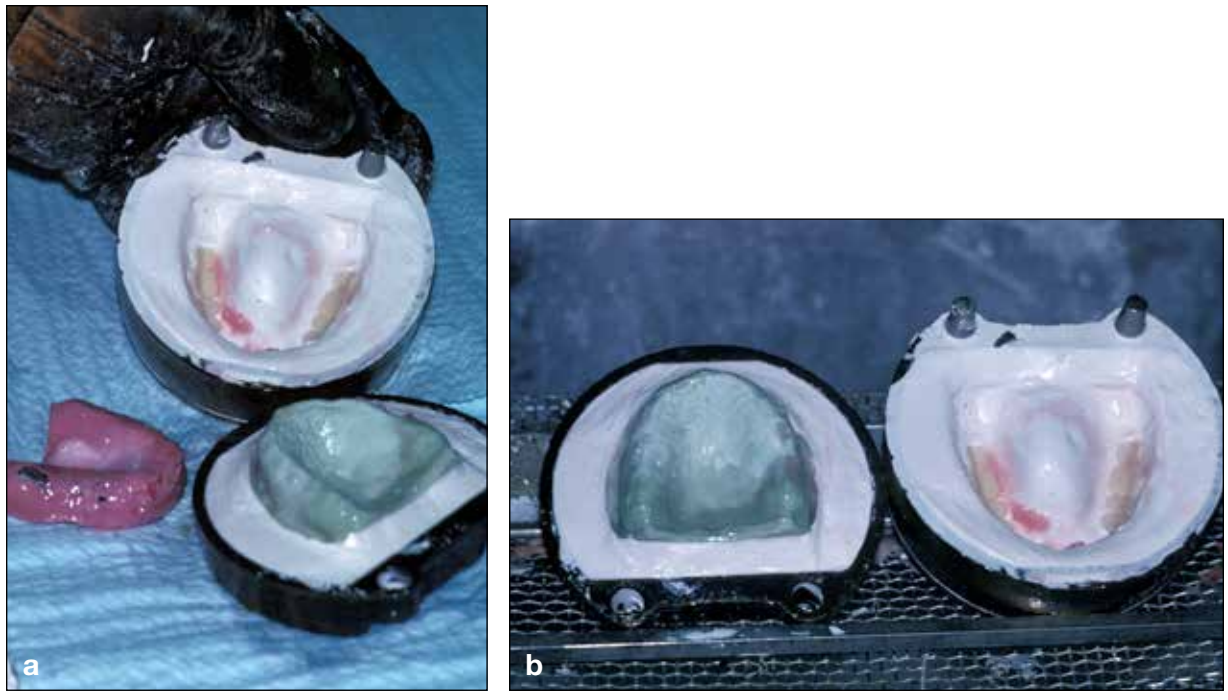
Flasking the Teeth and Waxed Denture Base

The master cast with the teeth on the waxed denture base are separated from the mounting plaster, lubricated, and embedded in stone within the bottom half of a cylindric metal flask (Fig 8-4a). The exposed surface of the stone holding the cast is lubricated when it has hardened (Fig 8-4b). The top half of the flask is attached, and additional stone is added to form the upper part of the mold around the teeth (Fig 8-4c) before closing the lid of the flask (Fig 8-4d).

8-4

Removing the Wax from the Mold

When the stone has hardened, the flask is placed in boiling water for about 20 minutes to soften the wax and then opened to remove the softened wax and record base from both parts of the mold, and the wax residue is flushed from the surfaces of the mold and teeth with boiling water (Figs 8-5a to 8-5c). This leaves the master cast in the lower part of the flask and the back of the teeth protruding cleanly from the stone in the upper part (Figs 8-5d and 8-5e).



8-5

Sealing the Surface of the Stone Mold

The micropores of the stone mold will be penetrated by the acrylic resin unless it is sealed with a separating material (eg, Alcote, Dentsply), whereas the acrylic teeth will bond to the acrylic resin only if they are clean and free of wax residue. Therefore, the separating material is applied very carefully to the stone without contaminating the back of the teeth that bond to the resin.

Packing the Mold with Acrylic Resin

The monomer and polymer of the PMMA are mixed as instructed by the manufacturer and stored for approximately 3 minutes in an opaque jar until the resin polymerizes to the doughy stage, when it is no longer sticky to handle and can be placed easily against the teeth in the upper part of the mold and covered with a thin sheet of plastic (Fig 8-6a). The two parts of the flask with the intervening plastic sheet are reassembled for a trial pack under pressure in an hydraulic press to squeeze the surplus resin from the mold (Fig 8-6b), after which the flask is opened, surplus resin is removed, and the flask is closed again without the plastic sheet and transferred to a spring-loaded clamp together with the flask containing the opposing denture prepared in a similar manner (Fig 8-6c).

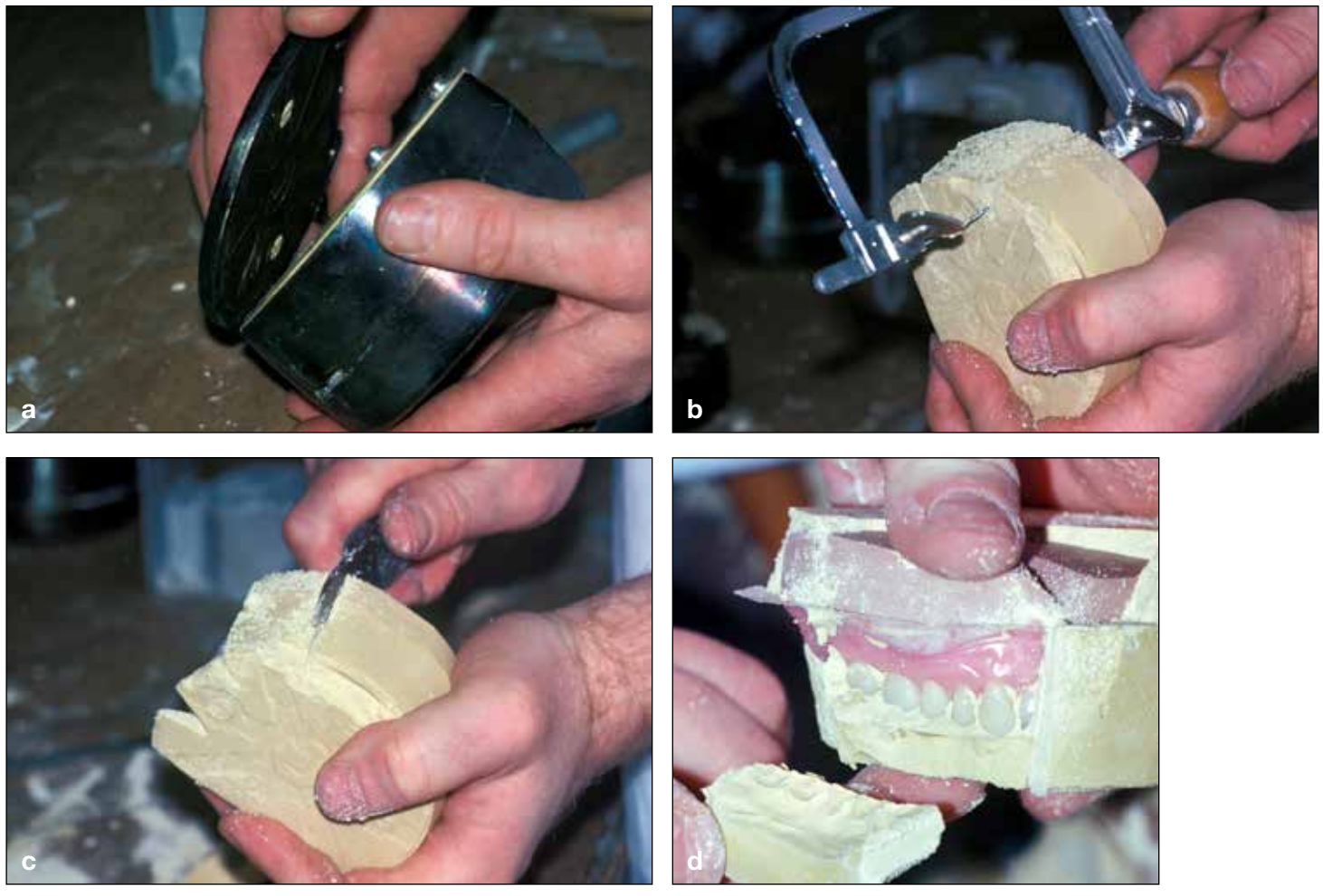
8-6

Processing the Acrylic Resin

Both flasks—one for each denture—are held tightly by the clamp for about 6 hours before they are immersed in water at room temperature. The temperature of the water is raised over 1 hour to about 70°C and processed at this temperature for about 9 hours. The stresses in the resin when packed under pressure are relieved during the 6 hours of rest before the temperature is raised to 70ºC, and the temperature is raised slowly to reduce bubbling of the resin, which would cause excessive porosity in the processed dentures.[6] The resin can be processed more rapidly at higher temperatures but with the increased risk of boiling the monomer and producing large pores in the denture base.

Retrieving the Denture from the Mold

The flask is cooled slowly to room temperature, the mold is removed from the flask, and the denture is retrieved from the mold (Fig 8-7).

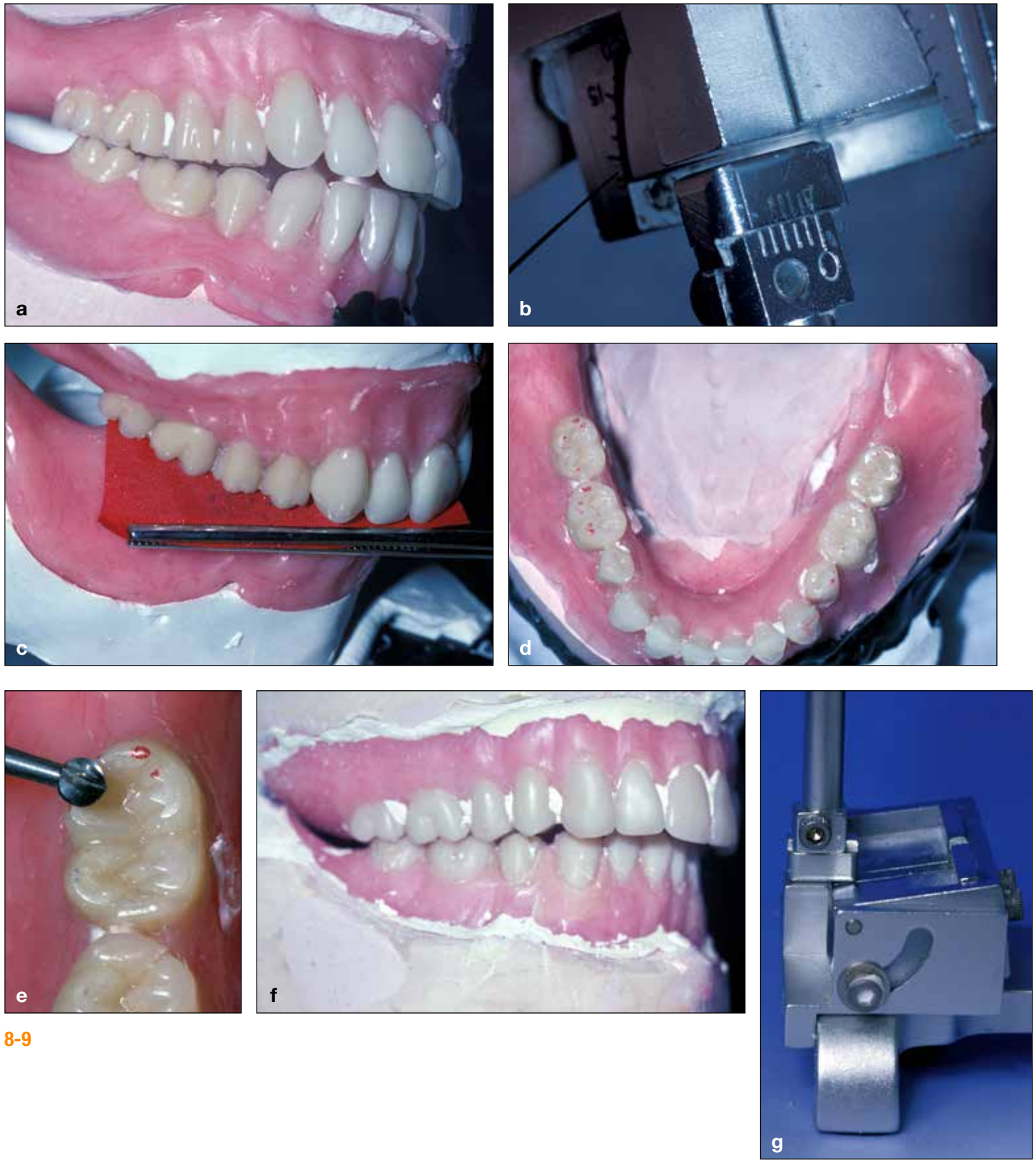


8-7

Removing Processing Occlusal Errors

The dental technician removes occlusal interferences from the processed dentures by remounting the casts on the articulator after they have been removed from the flasks but *before* the dentures are separated from the master casts. Grooves or notches in the base of the casts will align the casts to the articulator's mounting plates, while sticky wax or impression compound holds the casts on the articulator (Fig 8-8). The interferences will prevent the incisal pin from contacting the incisal table of the articulator (Figs 8-9a and 8-9b), so they are marked with articulating ribbon (eg, AccuFilm II, Parkell) and removed with a round bur to restore bilateral occlusal contacts (Figs 8-9c to 8-9f) and allow the incisal pin to contact the incisal table as it did before the dentures were flasked (Fig 8-9g).

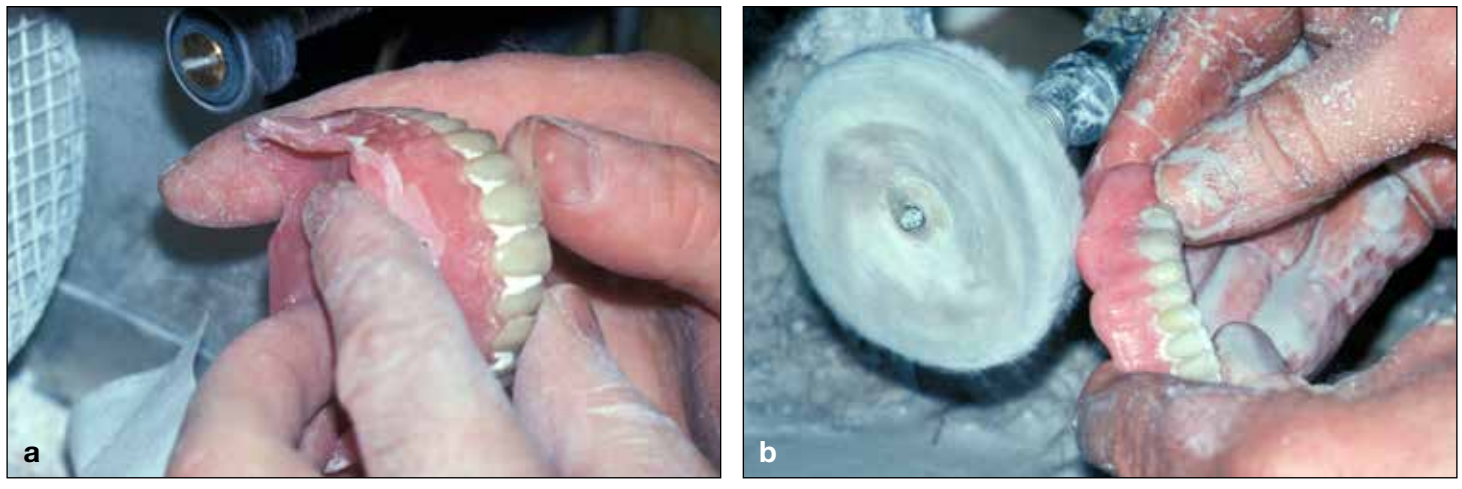
8-8



8-9

Polishing the Acrylic Resin Dentures

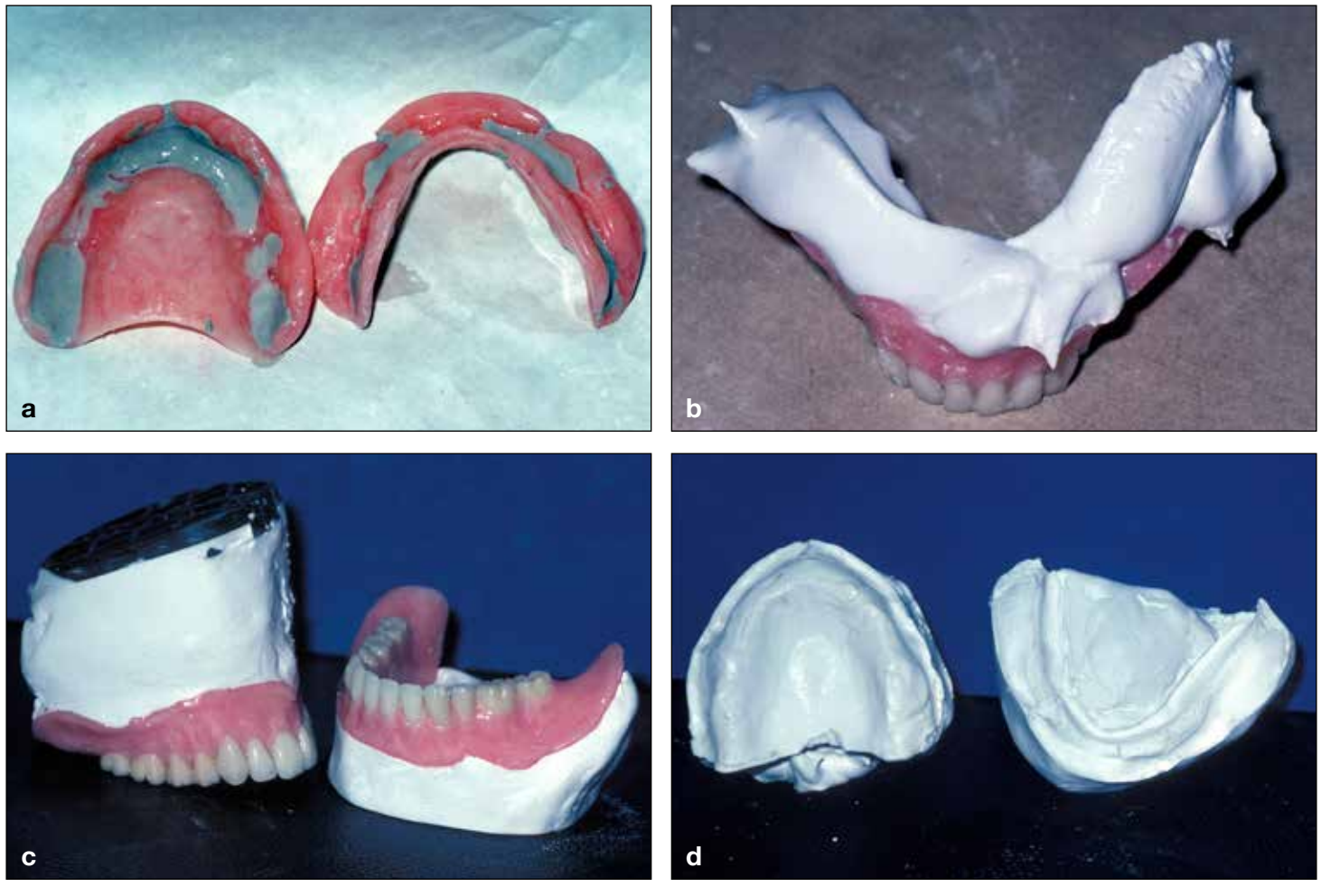
After equilibrating the occlusal contacts, the dental technician removes the dentures from the casts, cleans the remnants of the stone from around the teeth and the tags of resin flash around the periphery of the bases, and polishes the outer surface of the denture with wet pumice on a cloth wheel followed by a dry cloth wheel (Fig 8-10).



8-10

Remounting Casts

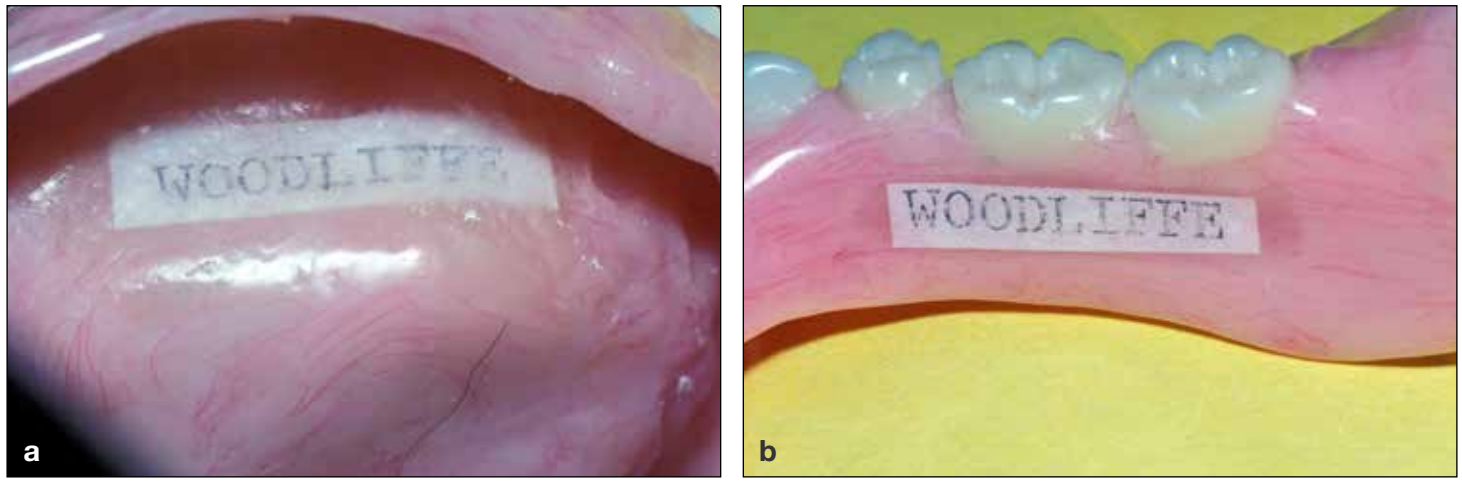
The dental technician should return the polished dentures along with casts. Both casts must support the dentures securely, and the maxillary cast can be mounted on an articulator. The technician will make new casts to support the dentures on the articulator if the master casts were broken when separated from the dentures. Remountable casts are produced by blocking out undercuts with wax or a thick slurry of pumice on the alveolar surface of the denture and pouring a fast-setting stone into the base (Fig 8-11). The clinician can then proceed to remount the mandibular denture against the maxillary denture with a new interocclusal record in preparation for the ultimate refinement of occlusal contacts before the dentures are given to the patient.



8-11

Denture Identification

There are several ways of placing the patient's name or some other form of identification in a denture.[7] Most securely, a space is made on the alveolar surface of the denture for a slip of cheese paper or a metal tag with the patient's name. The space can be made as the acrylic resin is packed into the mold before it is processed or added after the dentures have been processed. A clear resin, in contrast to the usual pink resin in the denture base, is placed over the name so that it can be read when the denture is processed (Fig 8-12). Alternatively, after the denture is processed, the space for the name tag is made on the outer surface of the denture, preferably where it is less visible in the mouth, and the name covered with a clear autopolymerizing resin. Other methods are also quite durable, such as printing the name directly on the processed surface of the denture with an indelible pen and covering it with a clear autopolymerizing resin.[8]



8-12

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7. MacEntee MI, Campbell T. Personal identification using dental prostheses. J Prosthet Dent 1979;41:377–380.
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CHAPTER > 9

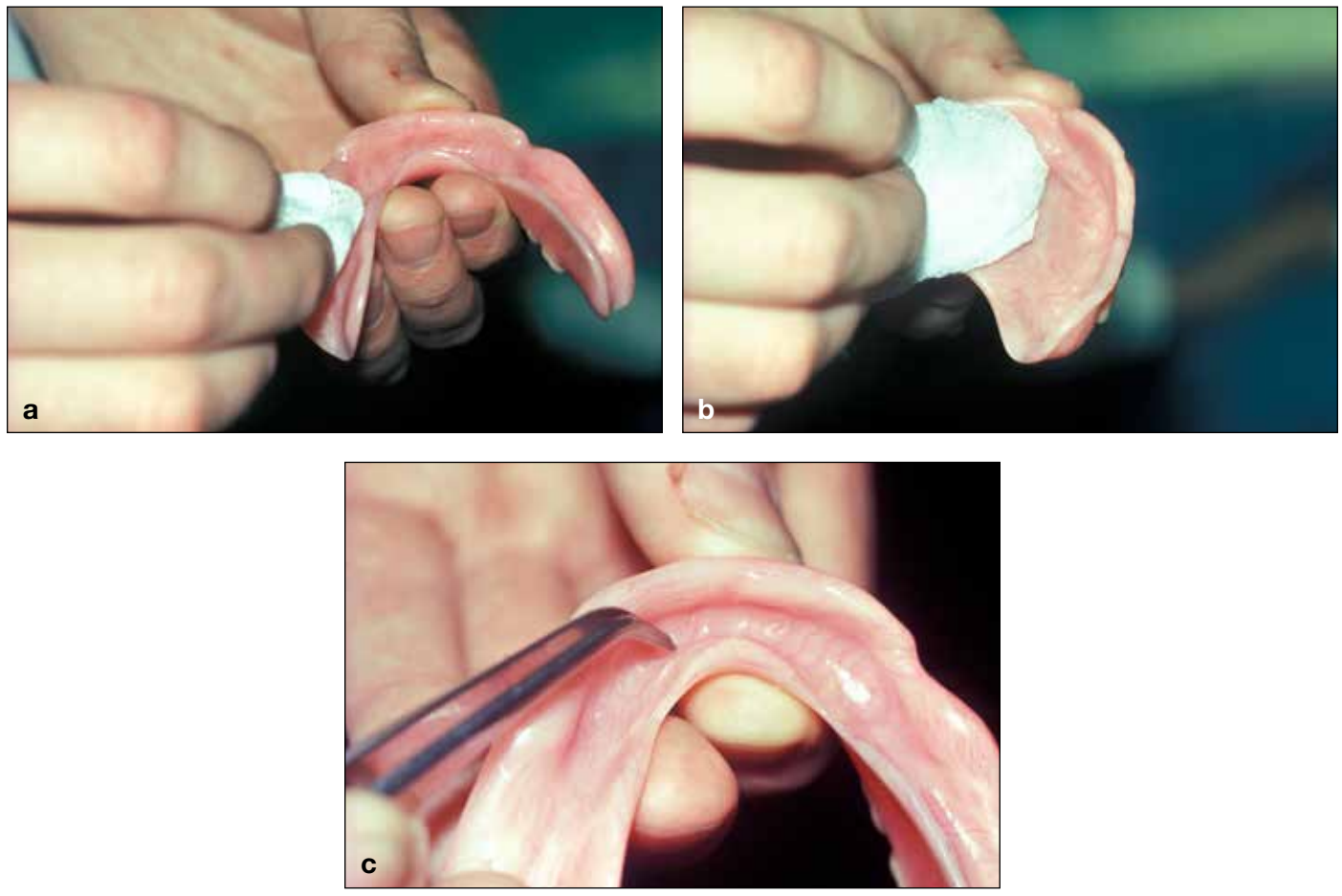
Adjustment and Insertion of the Dentures

Informing the Patient

The patient should be informed that adjustments to the dentures will be needed to accommodate for the normal movements of the muscles around the mouth. A patient's expectations can be unrealistic to the point where minor irritations from new dentures, especially if unexpected, lead to exaggerated responses and rejection of the dentures.[1] It helps greatly if the patient is advised by the clinician that it is normal for the shape and resiliency of oral tissues underlying dentures to change over time[2] and that accommodation to the physiologic and psychologic intrusion of dentures requires patience and practice.[3,4] Furthermore, the success of dentures has much less to do with the anatomical support from the residual ridge or the technical structure of the dentures than with a patient's ability to adapt to and cope with new dentures.[1,3,5–9] Consequently, patients who have been prepared to cope with the new denture will endure the unpredictable adjustment period with less likelihood of rejecting the treatment.

Preparing the Dentures for Insertion

Each denture should be examined for cracks, porosities, and other processing defects *before* the patient arrives for the appointment to receive the dentures. Sharp ridges and tags of resin are revealed by wiping the surface with dry gauze and removed with a bur (eg, V Dual Cut Taper Carbide Laboratory Burs, Buffalo Dental) designed to cut acrylic resin (Fig 9-1).



9-1

Inserting the Dentures

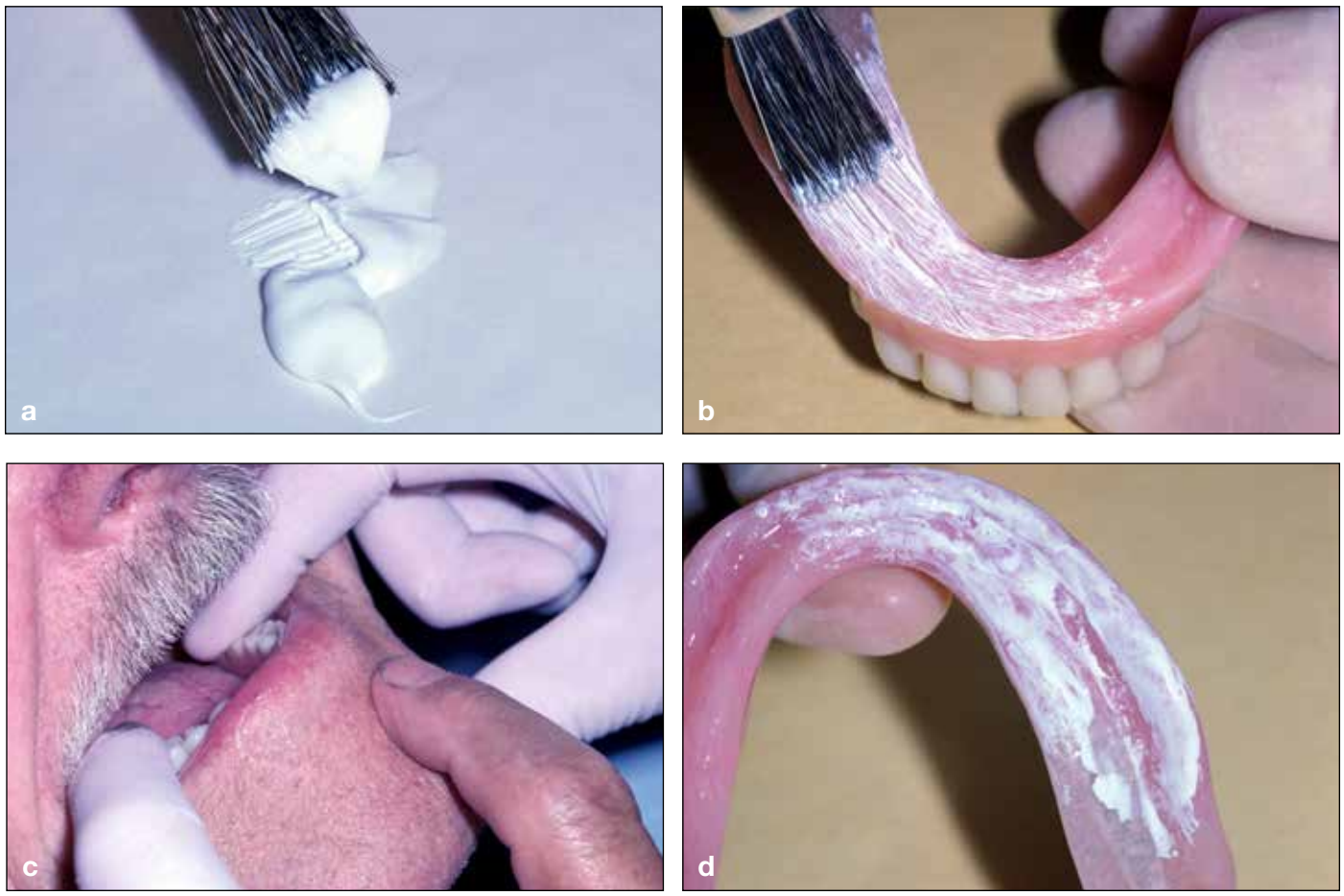
When the patient arrives, each denture can be assessed individually in the mouth and adjusted for comfort, support, and retention before the occlusal contacts are assessed.

Comfort

Uncomfortable or painful pressure from the denture base is more likely from thin mucosa overlying bulbous tuberosities or sharp ridges and along sharp flanges in the functional vestibules. Firm finger pressure on the occlusal surface of each denture will frequently locate areas of discomfort from specific parts of the denture. Arrows in Fig 9-2 indicate areas that frequently require adjustment to relieve discomfort.

If direct inspection of the denture base fails to reveal the source of the discomfort, a thin layer of pressure indicating paste (eg, PIP Pressure Indicator Paste, Mizzy) brushed evenly on the base will help to highlight concentrations of pressure when the denture is pressed firmly against the residual ridge (Fig 9-3).[10,11] Figure 9-3c shows the patient using his finger to help locate the area of discomfort.

9-2



9-3

Support

The size, shape, and resilience of the residual ridges and palate influence the support for the dentures. The maxilla usually gives much more support than the mandible, and a denture on firm mucosa overlying a robust residual ridge will be substantially more stable than a denture on loose mucosa over a soft fibrous ridge. It is unlikely that the size, shape, or resilience of the ridge will have changed since the master casts were made, so an unstable denture will not be improved by relining the denture base. Apart from placing endosseous implants, there is little that can be done to enhance the stability of the base other than to confirm that the teeth are in the neutral zone and getting as much support as possible from the ridges and surrounding structures.[12]

Retention

The maxillary denture should remain on the mucosa when a light incisal force is applied to the teeth and when the patient speaks and chews normally. If it loosens, the usual causes are muscles that need more freedom to contract around the periphery of the base (ie, overextended peripheral flanges) or an inadequate peripheral seal along the post-dam or lateral to the maxillary tuberosities. The base can be recontoured with an acrylic-cutting bur to provide more space for the muscles, whereas an inadequate seal can be detected by adding impression compound to the expected area of the leak. If the compound improves retention, it is replaced with an autopolymerizing resin suitable for use directly in the mouth (Kooliner, GC America).[13] Alternatively, the compound can be replaced in the laboratory by a full reline of the denture with a heat-processed resin (see chapter 10); however, full relines are very rarely necessary on a new denture unless major errors occurred when the resin was processed.

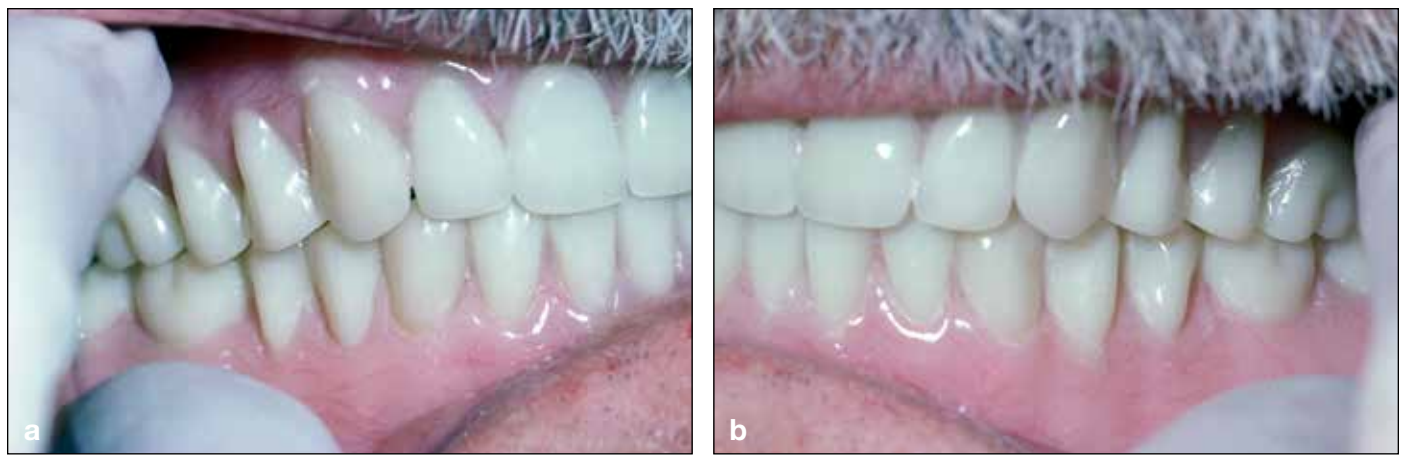
The patient should be able to lick the upper lip and control the position of the mandibular denture without the denture moving noticeably. If this movement is obviously excessive and disturbing the patient, the muscles in the floor of the mouth might need more freedom to contract around the denture. Unless it is obvious clinically where the flanges of the mandibular denture are overextended, the patient should use the denture for a few weeks if possible to assess the extent of the problem before the shape of the base is changed because retention of the mandibular denture can improve dramatically with experience.[12]

Refining the Occlusal Contacts

Frequently there are premature occlusal contacts on one or more teeth in the centric relation (CR) position when fitting new dentures. The reasons for the premature contacts are not always clear but can include difficulties stabilizing the record bases in the mouth when recording the jaw relationship initially, inability of the patient to bring the jaw muscles to the CR position reliably with the teeth on waxed record bases, or failure of the dental technician to remove occlusal irregularities after processing the dentures. However, it is difficult for the clinician to stabilize the mandibular denture, direct the patient's jaw movements, *and* identify the premature contacts all at the same time. Consequently, the most effective and efficient way to refine the occlusion of the dentures at this stage is to obtain a new occlusal record on the processed dentures and to remount the dentures again on the articulator as follows:

- The initial occlusal contact in the CR position should be observed directly in the mouth and confirmed by the patient's proprioceptive awareness of the contacts (Fig 9-4).
- The mandibular denture is then removed and dried, and a single strip of soft wax is placed bilaterally on the occlusal surfaces of the posterior teeth (Fig 9-5a). The denture is replaced immediately in the mouth and stabilized on the residual ridge while the wax remains soft, and the patient is guided to occlude the teeth gently in the CR position (Fig 9-5b and see chapter 5).
- The dentures are removed from the mouth when the wax hardens, the record is examined to confirm that only the initial contact has penetrated the wax, the dentures are replaced on the casts with the maxillary cast on the articulator, and the mandibular cast is joined to the articulator with a fast-setting stone (Fig 9-6).
- The occlusal records are removed from the mandibular denture, the initial occlusal contact is marked with articulating ribbon, and it is confirmed by the previous clinical observation and patient's indication of the contact (Fig 9-7; arrow in Fig 9-7b indicates initial contact).
- This remounting procedure must be repeated if there is any doubt about the accuracy of the mounting in the CR position.
- The dentures are replaced in the mouth to observe occlusal and incisal contacts as the patient gently moves the teeth together, and the condyles of the articulator are readjusted to accommodate similar movements between the teeth before the occlusion is equilibrated on the articulator to produce contacts bilaterally in CR and contacts between anterior and posterior teeth in portrusion (Fig 9-8).
- Finally, the results of the equilibration are assessed in the mouth by the patient for overall comfort and appearance (Fig 9-9).

Occasionally the esthetic requirements of the patient preclude the creation of occlusal contacts posteriorly during eccentric movements, but fortunately eccentric balance does not contribute significantly to the success of complete dentures.[14]



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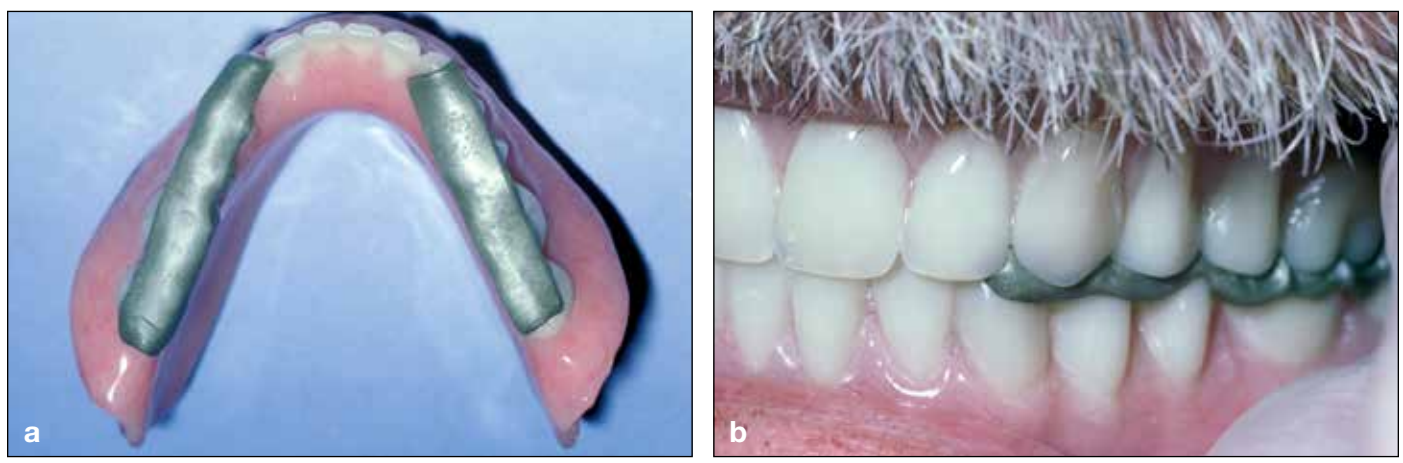

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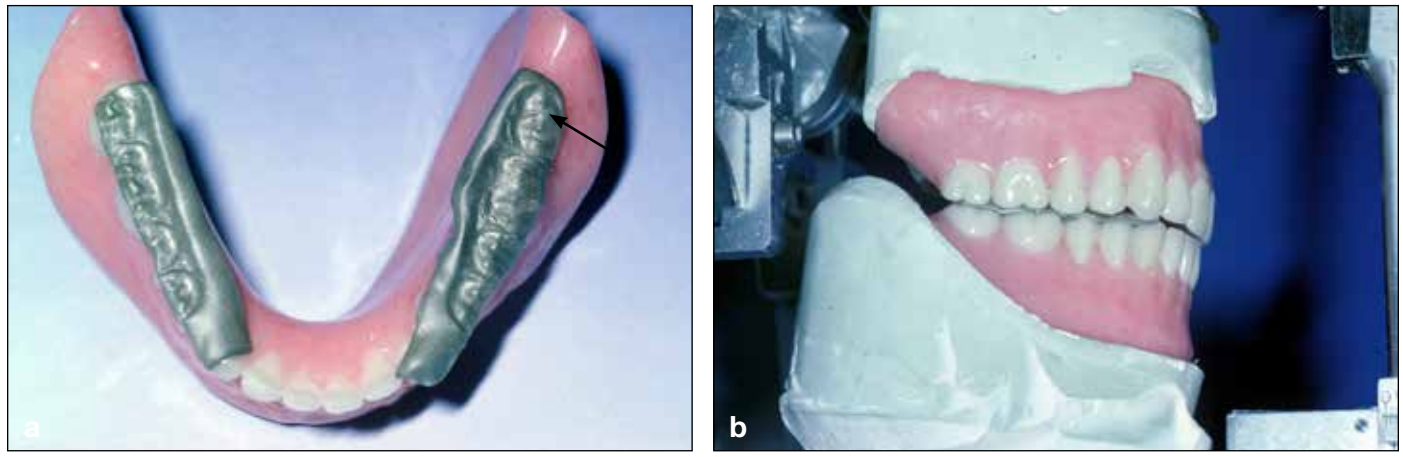

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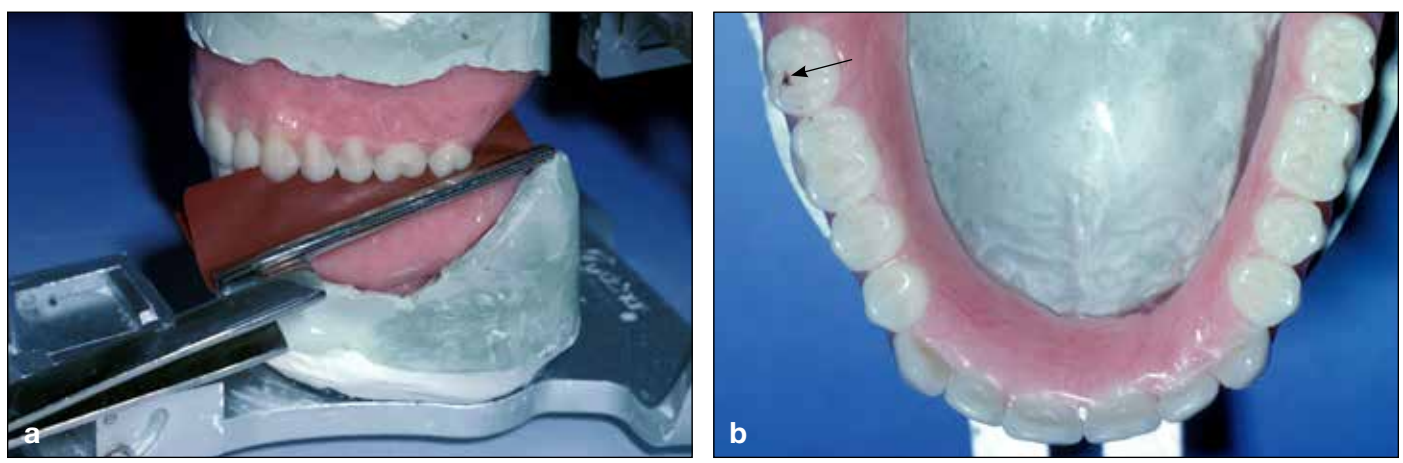

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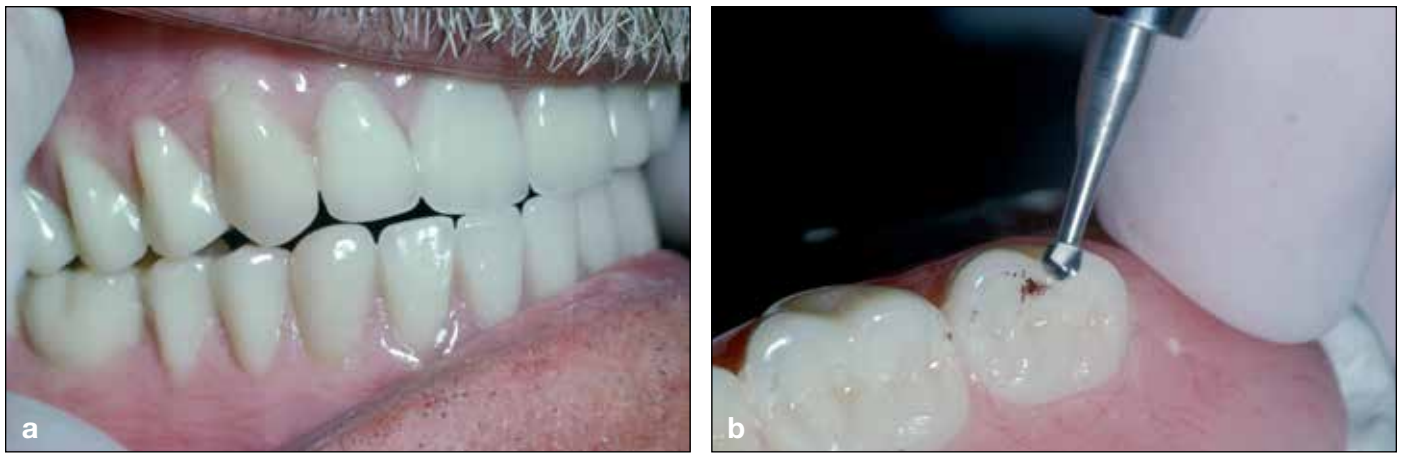

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9-9

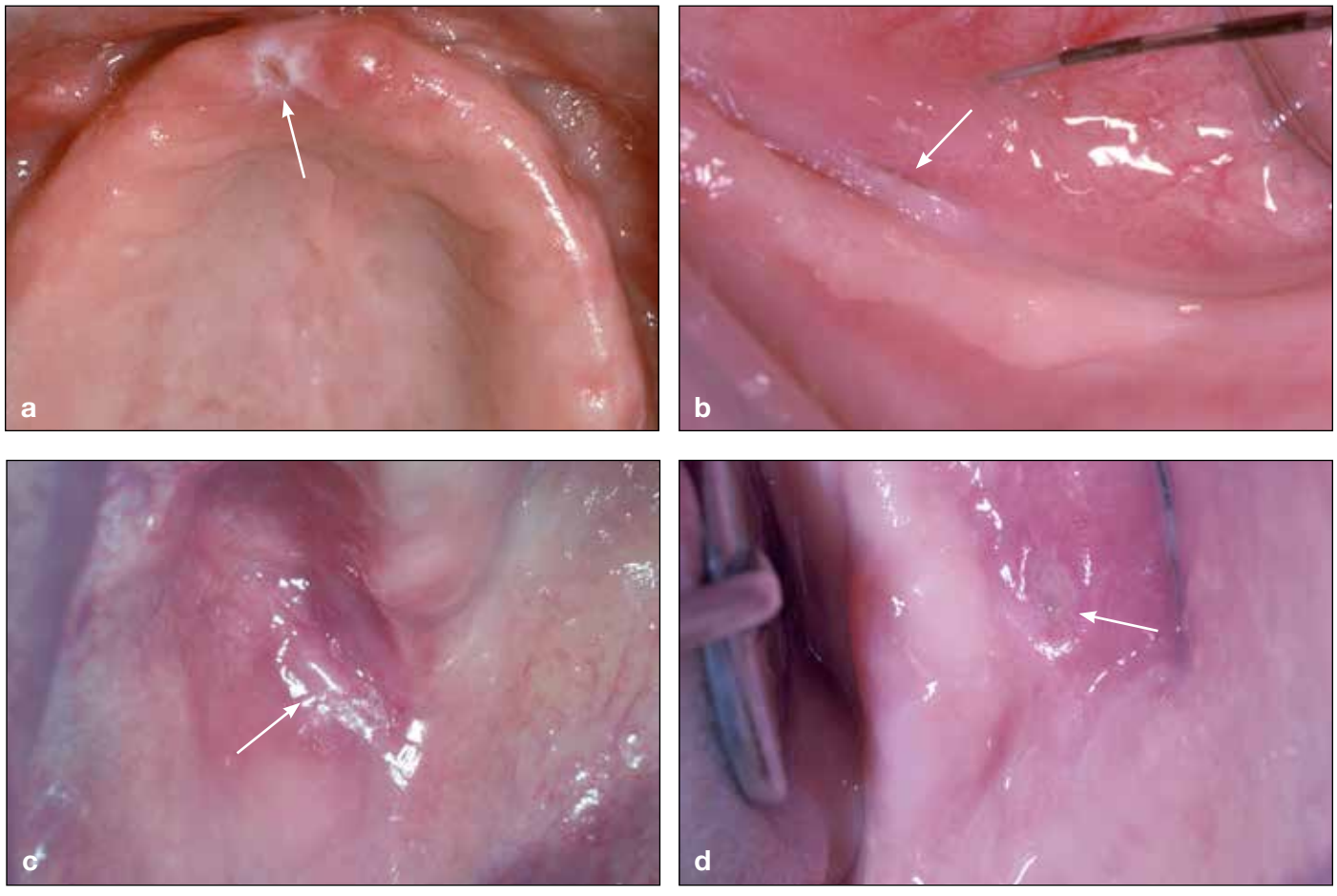
Providing Advice on the Use of Dentures

It is helpful to provide written advice to the patient on what to expect from the new dentures.[15] A short but succinct pamphlet can provide helpful information on the use and limitations of complete dentures, along with advice on the management of problems (see Appendix 2).

Follow-up

Short-term

Several adjustments to the dentures may be required over the weeks following placement but rarely are the problems more than localized inflammatory responses of the mucosa to pressure from the denture or to intrusions of the denture base into the activity areas of the surrounding muscles.[16,17] Mucosal tissues near the crest of the residual ridge (Fig 9-10a) and over the mylohyoid ridge (Fig 9-10b) are especially vulnerable to pressure, while the mucosa lateral to the hamular notch (Fig 9-10c) and lateral to the retromolar pad (Fig 9-10d) can be irritated by contractions of the masseter muscle if the denture is even slightly overextended. The arrows in Fig 9-10 indicate commonly encountered ulcers and mucosal irritations caused by pressure from the dentures.

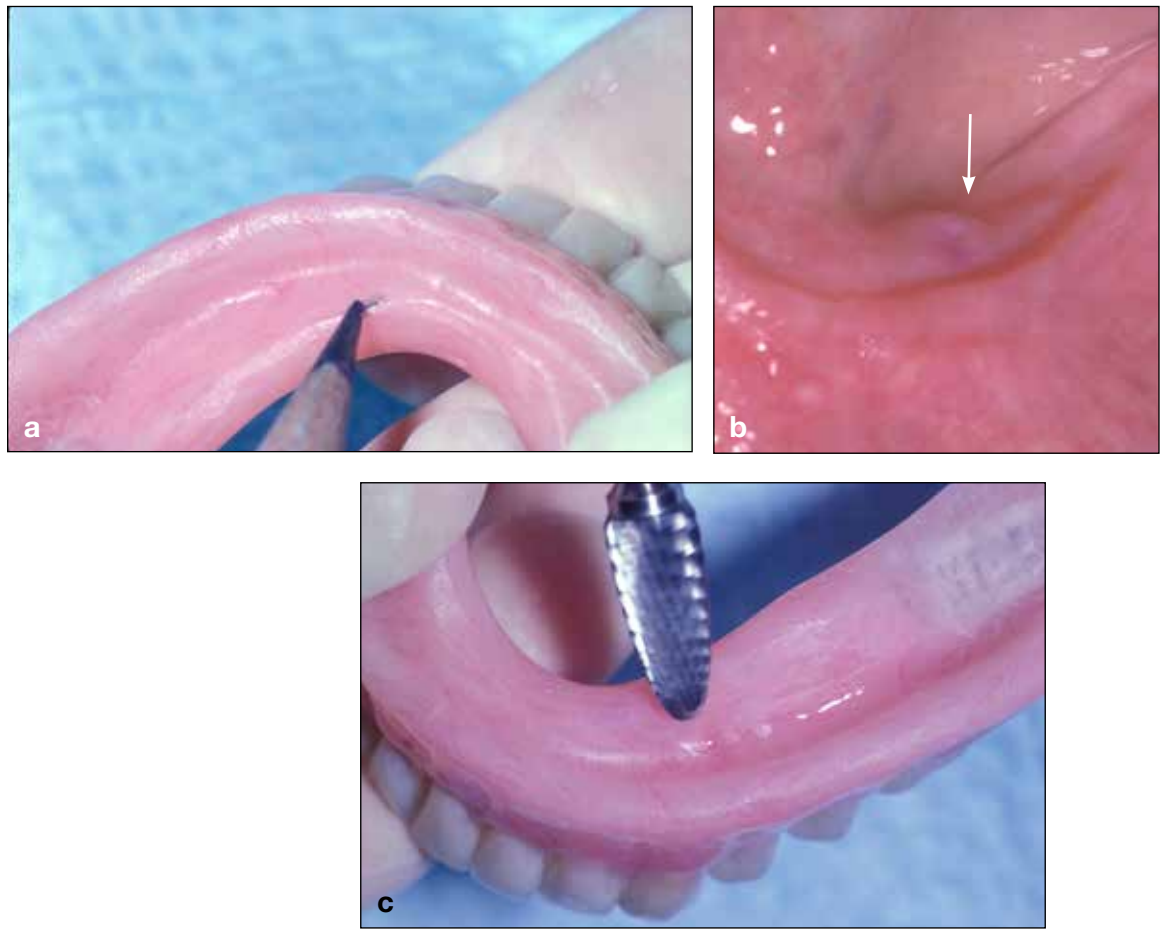


9-10

Occasionally a patient with new dentures will complain of a sore throat when swallowing, caused either by the superior constrictor of the pharynx rubbing against the posterior border of the lingual flange on the mandibular denture or by the peripheral seal of the maxillary denture pressing intolerably on the soft palate. The mucositis might be mild, but the discomfort can be very upsetting for the patient.

A slight adjustment to the shape of the denture base will be sufficient to relieve most irritations. If it is difficult to locate the exact source of the pressure from the denture, a colored mark with an indelible pencil or other applicator (eg, Sanitary Color Transfer Applicators, Great Plains Dental) transferred from the denture to the mucosa will help to identify the source of the irritation (Fig 9-11). The arrow in Fig 9-11b indicates a denture-induced ulcer marked faintly with a purple mark in the lingual vestibule lateral to the lingual frenum.

When the discomfort is less focused, a pressure indicating paste can help to highlight the area of concentrated pressure from the denture as the patient bites on a cotton roll (Fig 9-12). The *arrow* in Fig 9-12c points to the source of pressure.



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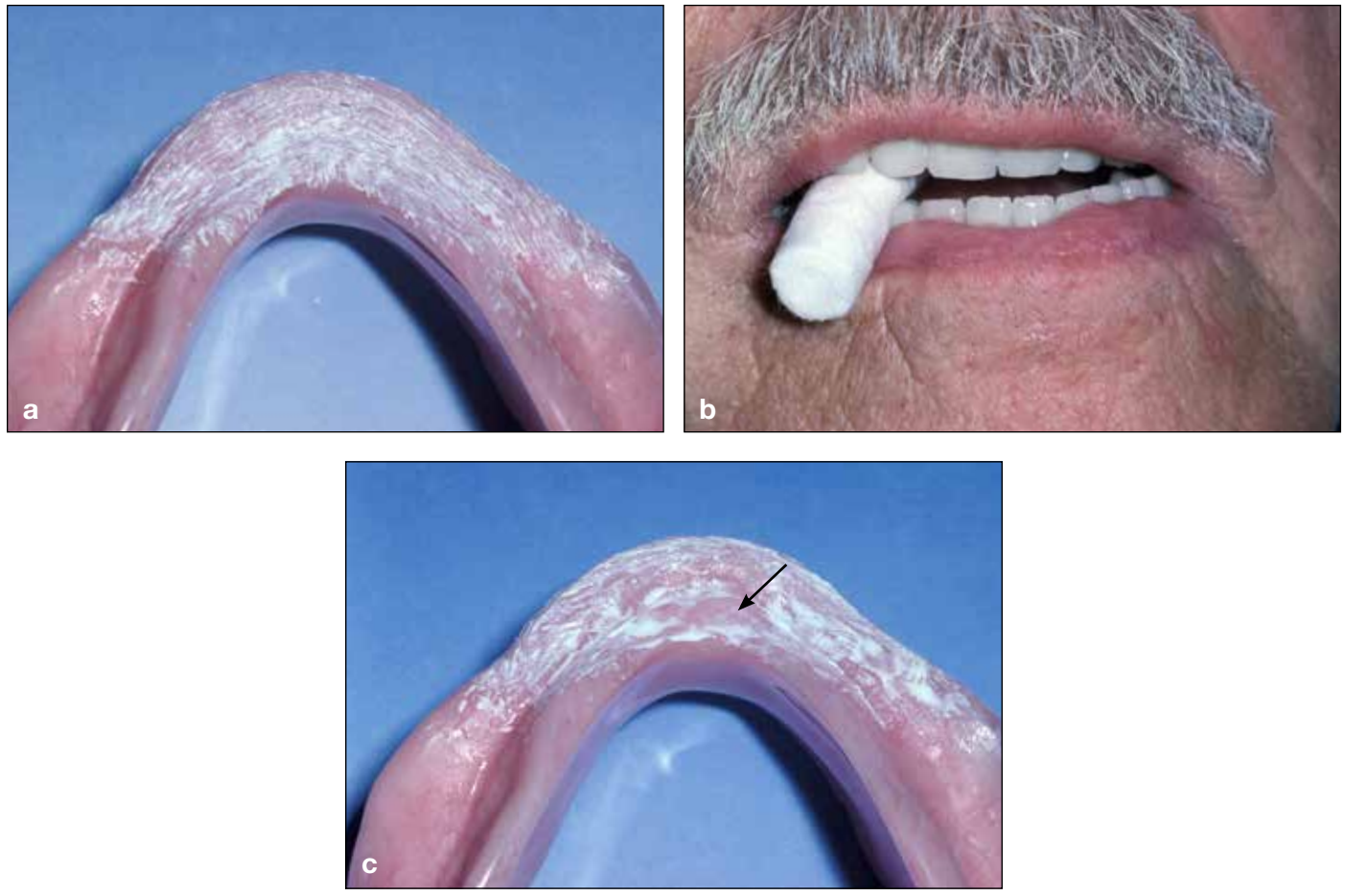


9-12

Hygiene. There are many commercially available cleansers, including hypochlorites, peroxides, enzymes, acids, and mouthrinses, aimed at removing the biofilm from dentures.[18,19]

Generally, acrylic resin dentures can be stored dryly when not in the mouth to limit the growth of *Candida albicans*.[20] Recommendations that resin should be kept moist and stored in water when out of the mouth came from a concern about the denture base distorting when it dries, but the dimensional changes in an acrylic resin denture base when dried in air are of no clinical significance.[21] However, overnight soaking in a peroxide-based denture cleansing solution (Polident, GlaxoSmithKline) containing potassium caroat, sodium perborate, and sodium benzoate can reduce the mass and composition of denture biofilm, which could be helpful for patients who have difficulty with denture hygiene and recurrent denture-related stomatitis.[22]

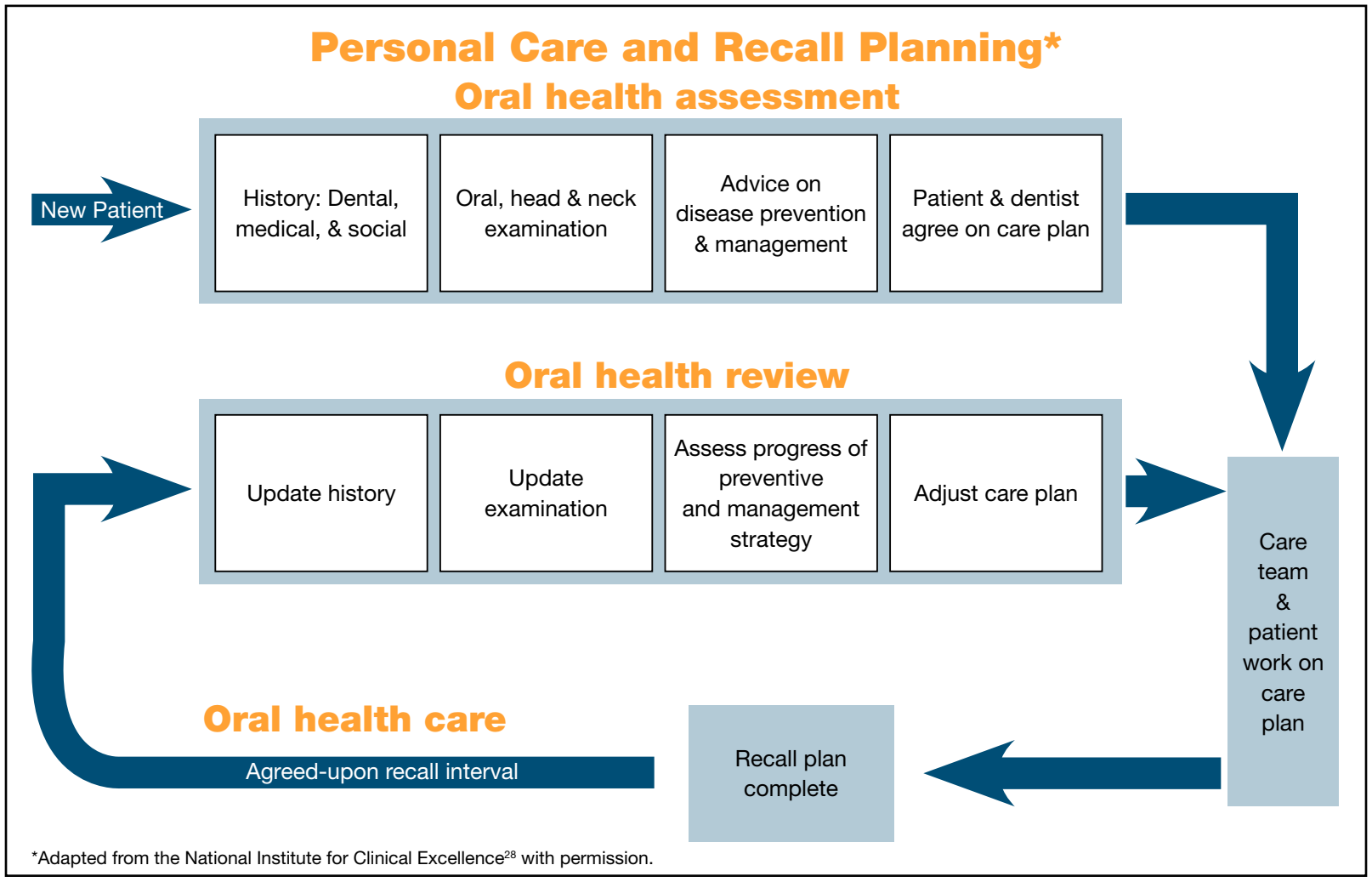
Long-term

There are no clear guidelines on the appropriate recall schedule for complete denture wearers other than the recommendation that the recall schedule should be tailored to the risk of disability and disease in individual patients.[23] Patients with dentures should be advised that dentures and residual ridges change with time, and it may not be obvious to the denture wearer that the mucosa is disturbed by an ill-fitting denture.[24–26] This and other opinions about the comfort patients get from regular clinical assessments support the benefits of a clinical recall program.[27] How regularly this examination should be conducted depends on the wishes and overall susceptibility of each patient to the consequences of this and other physical and emotional disturbances associated with tooth loss and the use of complete dentures. It is reasonable to recommend that most denture wearers be recalled at least every 2 years, or more frequently when there is an elevated risk of recurring diseases from systemic disorders, such as diabetes or immune deficiencies (Table 9-1 and Fig 9-13).[28]

Table 9-1 Establishing appropriate recall intervals for edentulous denture wearers*

Considerations	Recall actions
Modifying factors from the patient's history (medical, social, and dental) and other evidence obtained during the interview and clinical examination	The recall interval can range from 3 to 24 months but is typically established at 12 months once systemic and local disease activity is moderate to low.
Appropriateness of a specific recall interval based on clinical judgment of the integrated diagnostic and prognostic information available at this particular time, with advice when available from other members of the interdisciplinary healthcare team	The recall interval should be gradually increased toward 24 months once clinical judgement indicates that the disease activity is low and controlled.
Patient's preferences and expectations following a discussion of the proposed interval	The recall schedule is established by agreement between the clinician and the fully informed patient
Patient's responses to the oral care and health outcomes achieved following the selected interval and the need to adjust the interval	At each clinical examination, the recall interval is reassessed and adjusted based on the patient's ability to maintain oral health between recall appointments.

*Adapted from the National Institute for Clinical Excellence.[28]



*Adapted from the National Institute for Clinical Excellence[28] with permission.

Clinical Scenarios

Patient A: 65-year-old man

Current complaints: None; had uncomfortable and loose complete dentures replaced 3 weeks ago. New dentures are comfortable and easy to use after one adjustment 2 weeks ago.

Social history: Married, three adult children, socially involved, retired from work, university education, financially independent. Drinks alcohol in moderation and stopped smoking 30 years ago.

Medical history: Unstable weight, compounded by difficulties eating healthy foods due to uncomfortable dentures. High blood pressure managed by diet and weight control. Chronic back pain managed by weight control and exercise.

Dietary habits: Restricted to soft foods by chewing difficulties before dentures were replaced.

Dental history: Natural teeth were extracted 20 years previously because they were broken and loose. He previously had two sets of complete dentures. The last set was used for 8 years and were mostly comfortable until about 1 year ago. He attended a dentist every 4 to 5 years when the dentures became uncomfortable. New dentures were made and inserted 3 weeks ago, were adjusted once, and are now comfortable. He wears the complete dentures, like the previous dentures, 24 hours per day except when brushing them with soap and water and brushing his tongue and ridges with toothpaste.

Clinical evidence: Healthy oral mucosa with normal and comfortable movements of the temporomandibular joints (TMJs). Dentures look clean and seem to fit the mouth comfortably. Saliva looks normal.

Recall interval recommended for next oral health review: 24 months.

Rationale: The new dentures meet his social and dietary requirements. In the past, he visited a dentist only when dentures were uncomfortable, and there is no evidence that this behavior caused problems. He struggles to manage his diet, weight, and blood pressure, so optimally fitting dentures will help this struggle. He seems receptive to the recommendation of a 24-month recall routine, is likely to seek additional help if needed, and has been advised to return sooner if he has problems with the dentures or notices change in the oral mucosa.

Patient B: 45-year-old woman

Current complaints: The new dentures are comfortable after several adjustments. The dentures replace a set of immediate dentures made 18 months ago when the last few anterior teeth got so loose they had to be extracted. The immediate set was reasonably comfortable for a few months before getting loose, but they never looked like natural teeth. The new dentures look more natural.

Social history: Divorced with two teenage children who live with their father. Works as a secretary in a bank but is financially stressed. She would like to be an actor. Occasionally she binges on alcohol and regularly smokes about 10 cigarettes each day. Her father died of heart disease, and her mother has cancer.

Medical history: Unstable weight.

Dietary habits: Restricted to soft foods when dentures are loose and prefers fast food to home-cooked food.

Dental history: Natural teeth were extracted over the last few years as they became loose. Previous dentures were very unstable and loose because of inadequate support from the residual ridges and protrusion of the mandibular incisors. She attended a dentist only for management of loose teeth and toothaches. She wears the new dentures 24 hours per day unless they are painful, at which point she will remove them if she is alone. She cleans them with soap and water and occasionally soaks them in a denture cleaner (eg, Polident).

Clinical evidence: Healthy oral mucosa, normal and comfortable movements of the TMJs, and dentures look clean and seem to fit the mouth comfortably. Saliva looks normal.

Recall interval recommended for next oral health review: 6 months.

Rationale: The new dentures meet her social and dietary requirements. In the past, she visited a dentist only when her teeth or dentures were uncomfortable. She smokes and might drink alcohol to excess, and her mother has cancer; therefore, she is at moderate risk for oral cancer. Denture hygiene is unstable, which increases the risk of mucositis, while her previous history of denture use suggests her residual ridges are resorbing quite rapidly. Consequently, the new dentures should be assessed and might need relining within the next year. In addition, she needs comfortable and hygienic dentures for her social demands as an actor. She also needs encouragement to

consider dental implants to enhance the stability of the dentures when her finances allow.

Appropriate management strategies for patients who have difficulty with dentures are controversial due to the uncertainty of connecting a patient's complaints with appropriate treatment options.[3] Apparently clinicians and patients tend to interpret denture-related problems quite differently. Most clinicians look to the techniques of denture making for solutions to patients' problems, while patients are influenced more by their emotional ability to cope with the loss of natural teeth and the influence of dentures on their ability to interact socially.[1,29–31] Consequently, the uncertainty of treatment options for denture wearers remains a challenge for both patient and clinician that requires at the very least a two-way communication between both parties as they confront the contingency that treatment with dentures has the potential of different outcomes.[32]

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CHAPTER > 10

Relining and Repairing a Complete Denture

Chris C. L. Wyatt and Michael I. MacEntee

Resorption of the alveolar bone and residual ridge is a progressive and inevitable process,[1,2] usually leading to patient discomfort from instability and poor rentention of dentures. However, it is not possible to predict either the rate or pattern of the resorption or to answer questions such as, “When will a denture need relining?” and “How long should dentures last?” Some patients manage the changes in their jaws and dentures for surprisingly long periods without complaint, while others request major refitting or relining of the denture every few years.

Relining a denture involves a new impression of the residual ridge using an elastomeric impression material on the alveolar surface of the prosthesis, pouring the impression in a type III stone, removing the impression material from the denture, and processing it with a thin layer of polymethyl methacrylate (PMMA). A rebase is a more extensive reline in which the entire base is replaced with new PMMA around the teeth. Typically, a rebase is performed more easily around porcelain teeth joined to the base with a physical interlock rather than around the chemical bond that joins resin teeth to the base. However, if the old denture has acrylic teeth, it is usually more efficient and cost effective to make a new denture than to rebase the old one. This chapter describes how clinicians decide to reline, rebase, or remake dentures and explains the clinical and laboratory procedures associated with relines and repairs.

Reline, Rebase, or Remake

A clinician recommends relining, rebasing, or remaking dentures following an interview with the patient and a clinical examination of the mouth, denture, and occlusion. Complaints from a patient about increasing looseness and discomfort of the denture or trapping food under it suggest that the residual ridge no longer supports or retains the denture adequately. Although the request to have the denture relined usually comes from the patient, it is surprising how dentures are tolerated by some patients with little or no complaint, even when badly discolored, worn, and fractured.[3,4] However, it is appropriate to reline a denture following a request from the patient if the occlusal surfaces of the teeth have sufficient occlusal contours to maintain bilateral contacts in centric relation (CR) and the patient is content with the overall appearance of the denture teeth.

Examination and Diagnosis

Clinical criteria have been suggested for epidemiologically assessing the looseness and instability of a denture, but for individual patients it is usually difficult to interpret the clinical significance of the criteria, especially if there is extensive resorption of the ridge.[5] More importantly, the clinician must base judgments on the patient’s complaints and whether or not the occlusal surfaces of the teeth will provide bilateral occlusal contacts with one or both dentures relined or rebased at the original VDO. This dimension is assessed from the appearance of the face with the teeth contacting in CR and with the teeth at rest without contact (see chapter 5). As the ridge resorbs, the lower third of the face will look short relative to the rest of the face, and a reline with occlusal adjustment of the denture might reestablish the original appearance of the face. This esthetic objective can be tested by adjusting the occlusal contacts and adding a temporary soft liner (see below) in an attempt to reestablish the original VDO.

The clinical examination includes also the face, temporomandibular joints, lips, mucosa, tongue, glands, and underlying bone and muscles. The need for a radiographic examination, usually with a panoramic view, depends

on the clinical findings. Current guidelines in Europe[6] and North America[7] discourage radiographs of edentulous jaws unless there is obvious clinical evidence of submucosal or osseous problems (see chapters 1 and 9). Some mucosal abnormalities, most notably denture-induced hyperplasia, can be resolved by a series of adjustments to the denture with soft lining materials.[8–11] Obvious occlusal irregularities should be removed before the denture is relined, if necessary by mounting the denture on an articulator as described in chapter 9. In summary, all atypical clinical observations should be explored and if possible resolved either before the denture is relined or as part of the treatment associated with the reline.

Hard Liners

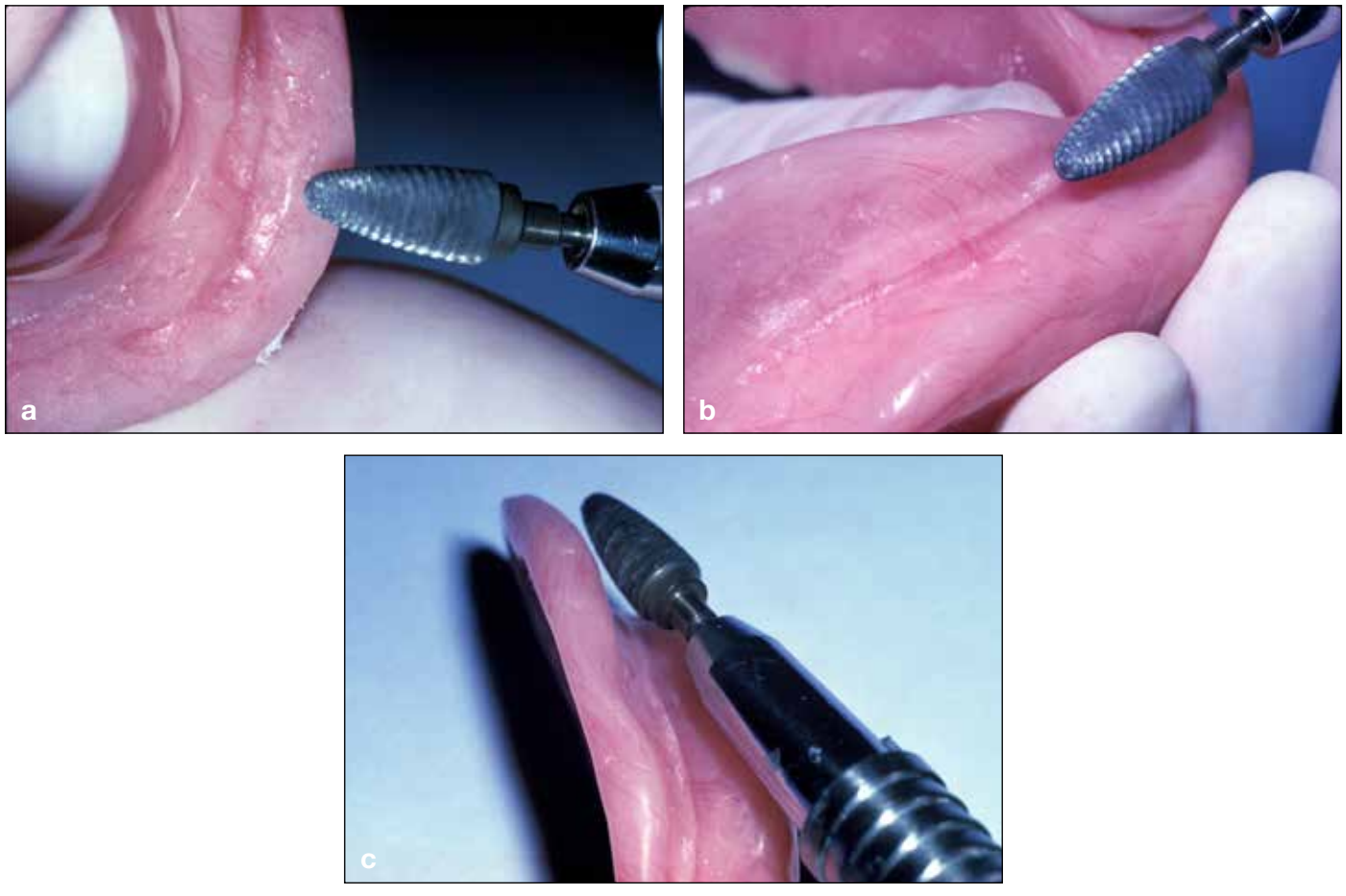
Indirect technique

The classical procedure for relining a complete denture modifies the alveolar surface of the base with a heat-processed PMMA resin. The denture carries the impression material to the denture-bearing area as the acrylic tray carried similar material when making the impression for the original master cast for a new denture. When one or both complete dentures are relined, the occlusal relationship between the dentures must be maintained. Consequently, the impression on the base of the denture is made as the patient occludes in CR while the impression material polymerizes.

Modifying the denture base

The denture is modified slightly to prepare for the impression:

- The extension of the base is assessed to maximize the area covered by the base within the functional limits of the surrounding muscles (see chapters 1 to 3).
- Sharp ridges and undercuts relative to the path of insertion of the denture and removed from the alveolar surface of the denture (Fig 10-1).
- If necessary, impression compound is used to extend the periphery of the denture base and restore the peripheral seal (Fig 10-2); this will not be necessary if the bases were extended correctly and tolerated well when the denture was made.



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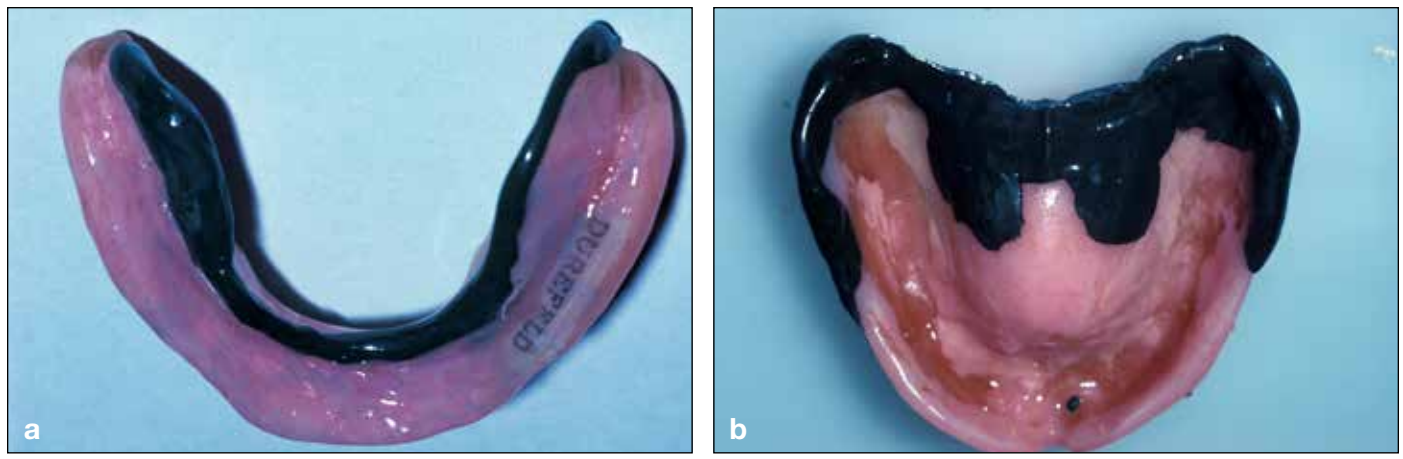


10-2

Impressions

There are two clinical methods—static and functional—of making the impression for the master cast on which the denture will be relined. The static method uses a vinyl polysiloxane material as described in chapter 3, whereas the functional method uses a resilient material on the base of the denture that molds to the shape of the ridge and functional vestibules as the patient wears the dentures.

Static impression. The static impression is made by:

• Applying a silicone adhesive and spreading impression material of low viscosity evenly over the denture base (Fig 10-3)

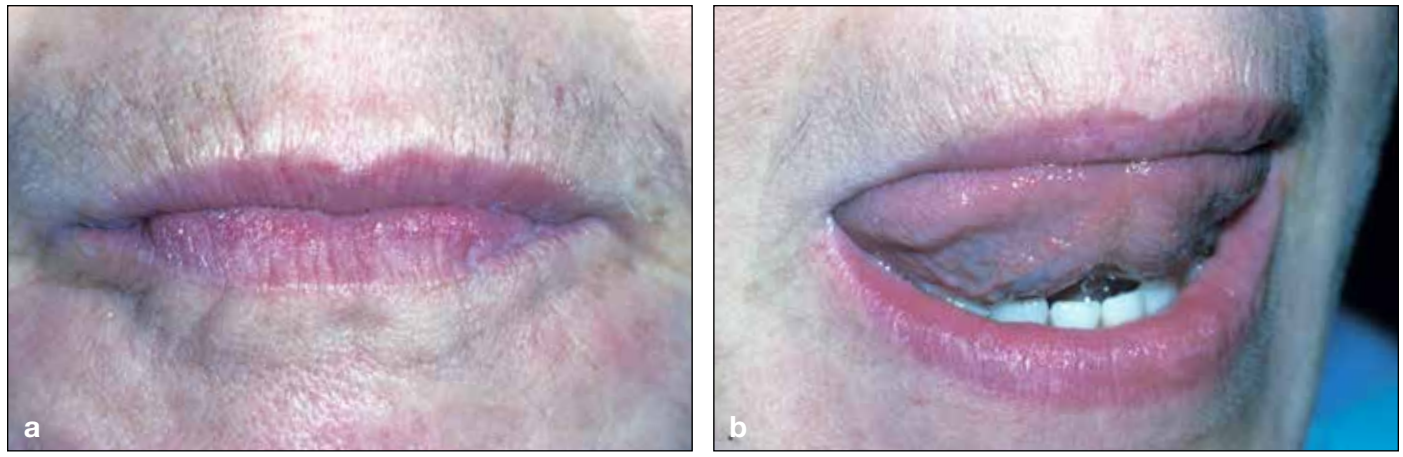
• Orienting the denture directly over the ridge and bringing it slowly into position on the mucosa. It may be necessary to remove excess impression material away from the throat with a cotton-tipped applicator if the patient feels uncomfortable or distressed

• Guiding the patient to occlude in CR

• Helping the patient to alternate between occluding in CR and licking the upper lip to maintain the original occlusal contacts in CR and mold the impression material as it sets around the periphery of the denture. This approach will record the shape of the residual ridge and the functional vestibules at the appropriate VDO as the material polymerizes (Fig 10-4)

When taken from the mouth, the denture (Fig 10-5) is disinfected as described in chapter 2 before it is removed from the clinical area.[12]

10-3



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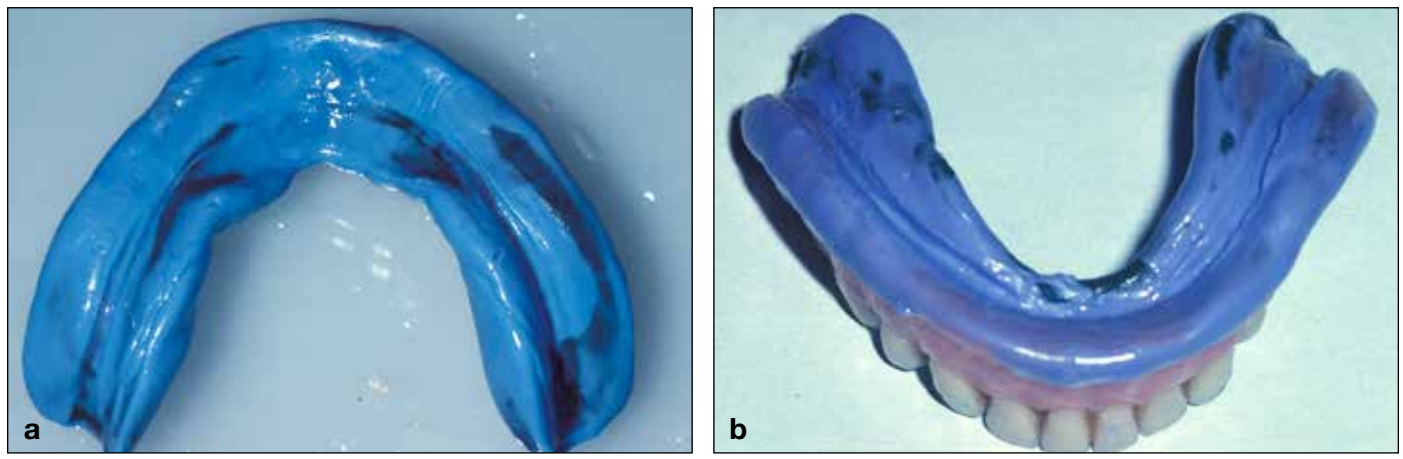

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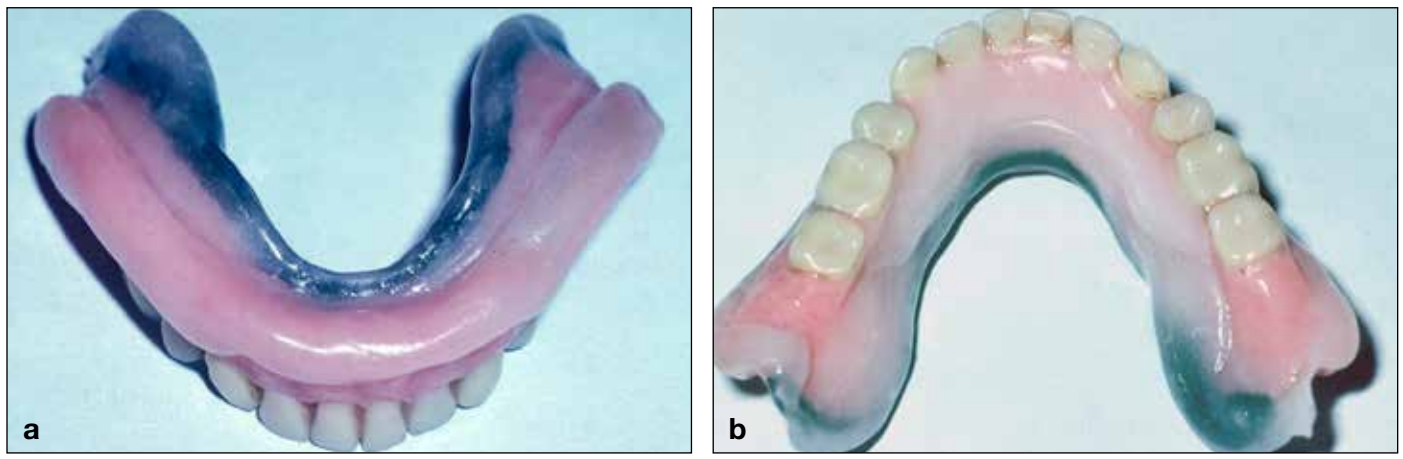
When both maxillary and mandibular dentures are being relined, each impression is made separately, starting usually on the maxilla to maintain or restore the appropriate orientation of the occlusal plane and appearance of the incisors.

Functional impression. The functional impression is made with a resilient resin made by mixing liquid ester and ethyl alcohol to a powder of PMMA.[13,14] At the outset, when flowed onto the alveolar surface of the denture base, the gel (eg, Visco-gel, Dentsply) can be very sticky and difficult to remove if it flows onto the teeth, unless they have been lubricated before the material is placed on the denture base (Fig 10-6). Moreover, it is difficult to remove from the denture base unless a film of polyvinyl siloxane adhesive has been painted on the base before applying the gel to the base.[15] Polymerization of the viscous material continues for about 10 to 15 minutes as it transforms to a doughy state in which the denture can be inserted onto the ridge, and the material moved about with a lubricated finger and by the patient puckering and licking the lips. The material changes for a further 20 to 30 minutes to a rubbery state as the patient continues to move the facial muscles. This slow process of polymerization allows the muscles of the mouth to mold the material to a shape that helps to stabilize the relined denture (Fig 10-7). Finally, the impression is disinfected before it is removed from the clinical area to be cast in stone.

10-6



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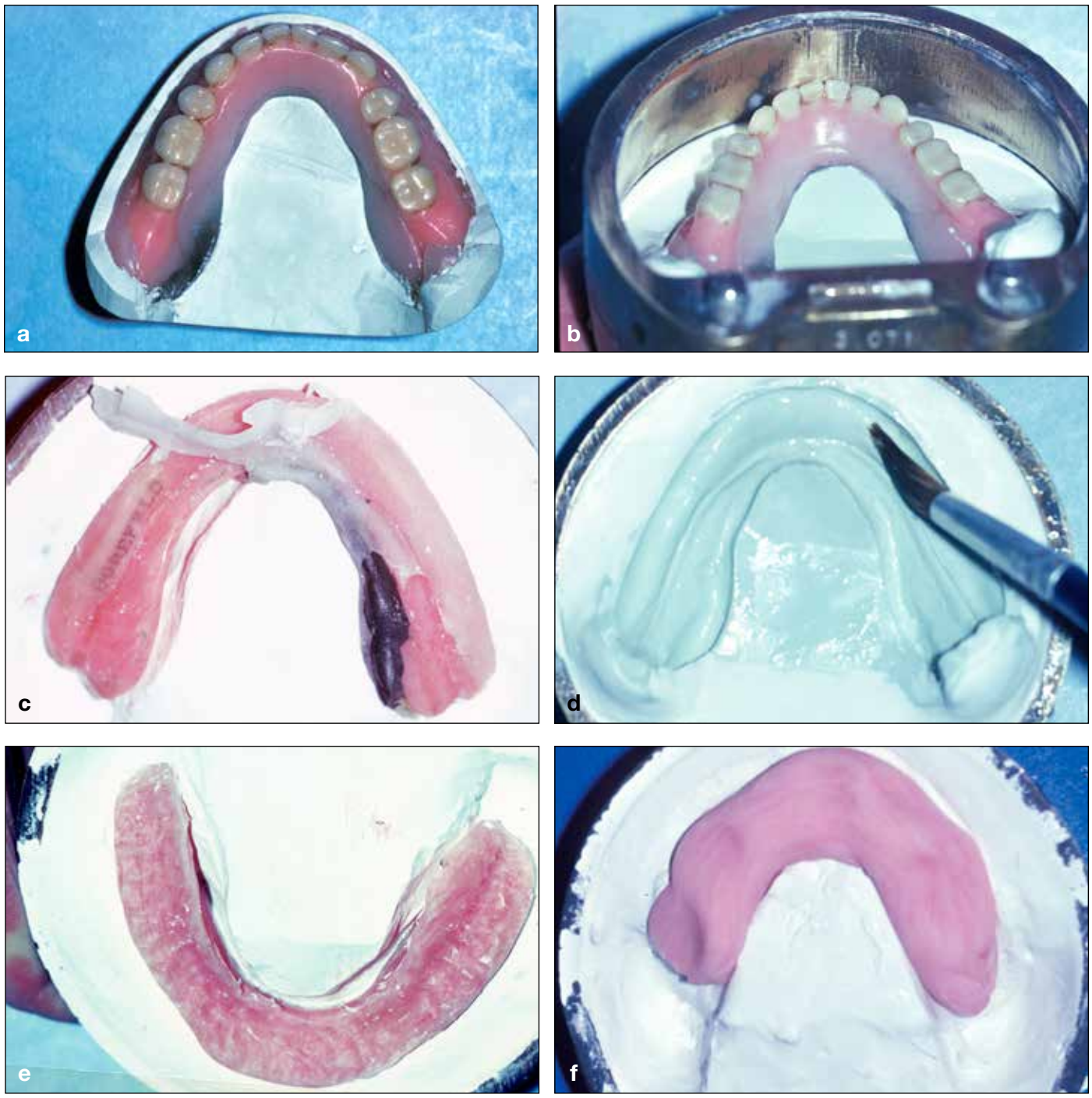
Alternatively, the denture can be worn for several days or weeks to provide a new clean surface on the denture and reestablish the retention and stability of the denture base. This treatment can help to reduce the mucosal inflammation associated with chronic denture-induced stomatitis.[16] Like the static impression, when both maxillary and mandibular dentures are being relined, the impressions are made separately until the material reaches the rubbery state.

Processing the reline

Heat. The method of replacing the impression material with new resin is the same for both the static and functional impressions. The usual resin polymerized by heat is processed in a flask at about 70°C under pressure for 9 hours. Essentially, the master cast is made around the impression on the denture base (Fig 10-8a) to provide the surfaces against which the denture is relined by embedding it in a processing flask (Fig 10-8b), warming the flask to soften the impression compound before opening it to remove the impression material (Fig 10-8c), removing about 2 to 3 mm of old resin from the denture base (Fig 10-8d), and packing the mold with acrylic resin (Fig10-8e) to process in the flasks (Fig 10-8f).

When the acrylic is processed, the flask is cooled slowly before the denture with the relined surfaces is retrieved from the flask (Fig 10-9).



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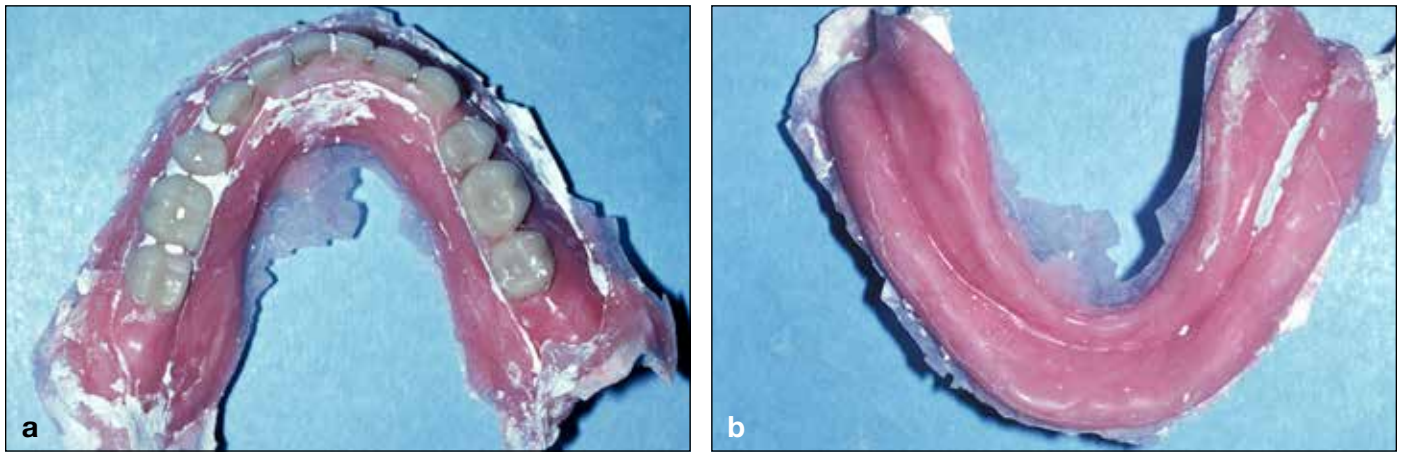

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Microwaves. Most patients prefer to have their denture relined and returned within a few hours, so resins made specifically for microwave polymerization can be processed and returned to the patients within a day. The following description of a microwave process is based on a study by Compagnoni et al,[17] who showed that the porosity of resins for microwaves is similar to the porosity in a more traditional heat-processed resin:

1. The denture is invested with the reline impression within a high-viscosity silicone (eg, Zetalabor, Zhermack) supported by dental stone (eg, Herodent, Vigodent) in a flask designed specifically for use with microwaves.
2. The flask is opened when the investment materials has hardened and the impression material is removed from the denture base within the silicone mold.
3. Resin suitable for microwave processing (eg, Onda-Cryl, Artigos Odontológicos Clássico) is mixed according to the manufacturer's instructions (7 mL of monomer to 21 mL of polymer).
4. The resin is left to polymerize for about 15 minutes at 23°C until it reaches the doughy state.
5. The resin is packed onto the surfaces of the denture in the silicone mold.
6. The flask is closed with a press for a trial pack at 1,500 psi.
7. Excess resin is removed from the flask, and it is closed again at 3,500 psi and maintained for 1 hour.
8. The resin is polymerized in a microwave oven (Continental AW-30, Bosh Eletrodomésticos) at 3 minutes at 500 W.
9. The flask is cooled on the bench for as long as possible before the relined denture is retrieved and finished for the mouth.

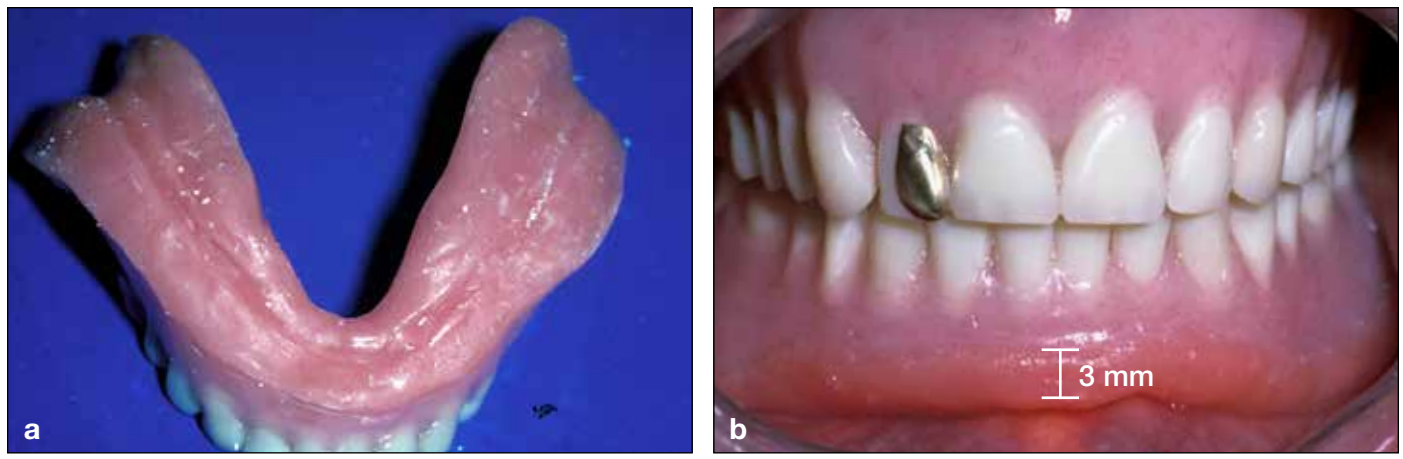
Chemical autopolymerization. Chemically cured acrylic resins that polymerize without external stimuli, such as heat or microwaves, are available for relining dentures directly in the mouth. There is a large variation in the reactions from different products as they process chemically in the mouth and in the final structure of the relined surface.[18] The chemical reactions can produce unpleasant smells and uncomfortable temperatures. Consequently, the denture must be removed repeatedly from the mouth to rinse with cold water during the process, and the final chemically processed surface is more porous than the surface produced by a heat-cured resin. Moreover, cases of contact dermatitis among dental staff who handle methyl methacrylate have been reported, although it is unlikely that the residual monomer leaching from the resin can cause mucositis in denture wearers as some reports suggest.[19] Overall, chemically processed resin provides a temporary reline to help stabilize or repair a damaged or ill-fitting denture.

Resilient Liners

Short-term (< 1 month) and intermediary (1 to 9 months) resilient denture liners are made from polyethyl methacrylate and other acrylic copolymers compounded with plasticizers, as described above for functional impressions. They are used primarily to ease the pressure on denture-bearing tissues that are healing from trauma or undergoing unusually rapid residual ridge resorption. More durable (approximately 1 year) materials for very sensitive and fragile residual ridges are made from heat-polymerized silicone rubber.[20]

Materials currently available will not bond reliably to denture bases that have been used in the mouth, so they are added to the hard processed base when the denture is newly made or relined. Indeed, the bond between acrylic resin and silicone is not completely reliable under any circumstances and needs careful attention to manufacturer instructions to reduce the likelihood of separation of the liner from the denture.

The minimal thickness of the resilient liner should be about 3 mm, even along the periphery of the denture base for optimal comfort and durability (Fig 10-10). The silicone can be adjusted or trimmed with a special abrasive wheel (eg, Red Acrylic Wheels No. 5111, Dedeco International) rather than the usual acrylic-cutting burs that have little cutting or abrasive effect on silicone rubber.



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Hygiene and durability

Silicone rubber is much more porous than acrylic resin and tends to harbor fungi and bacteria that cause stomatitis. Consequently, resilient liners should be brushed frequently with soap and water and soaked overnight in a peroxide-based denture-cleansing solution (eg, Polident, GlaxoSmithKline) that contains caroat, sodium perborate, and sodium benzoate to reduce the mass and composition of the biofilm.[21,22]

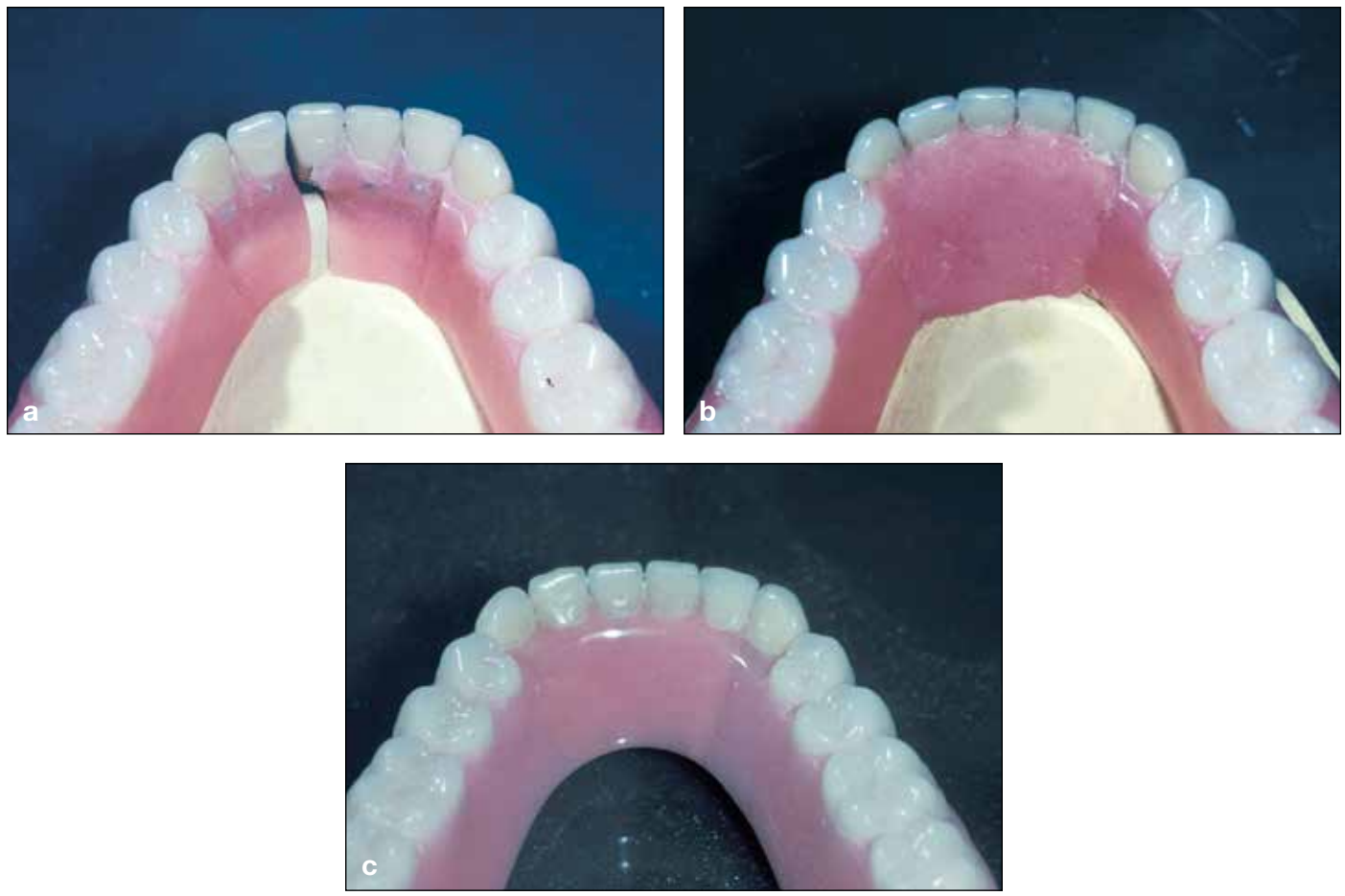
The resiliency of the longer-term silicone rubber depends on the polymer structure rather than the leachable plasticizers that keep the shorter-term resins soft. At least one report suggests that they can remain useful for about 5 years, but this will depend largely on the biochemistry of the mouth and how the patient cares for them.[23] Unfortunately, the response to a resilient liner is not always favorable because some patients continue to experience discomfort from a denture despite the softness of the material, probably because of uncontrollable habits such as clenching and grinding, biting, pushing against the dentures with the tongue, and frequently dislodging the dentures.[24]

Repairing Fractured Dentures

Fractures occur on dentures most frequently when the residual ridge resorbs to the point where the denture is unstable. Occasionally, teeth are knocked off a denture by a traumatic blow or because the denture tooth did not bonded adequately to the base when the denture was processed. In any case, the denture or tooth is reassembled by hand and held together temporarily with a sticky wax until stone is poured into the base to splint the parts so that the fracture can be repaired with resin (Fig 10-11).

Repairs are stronger, according to Filho et al,[25] if made with heat or microwave polymerized resins rather than autopolymerizing resins. They repaired the fractured resin with *(1)* a heat-processed resin (eg, Lucitone 550, Dentsply) polymerized by compressing within a flask to 1,250 g for 30 minutes at room temperature followed by 1 hour in a water bath at 100ºC and *(2)* with a microwave resin (eg, Acron MC, GC America) also compressed within a flask at 1,250 g for 30 minutes at room temperature but followed by 3 minutes at 500 W in a microwave oven. The weaker repairs were made with the chemically (auto)polymerized resin using similar compression followed by placement of the joint in a water bath at 55ºC for 15 minutes.

When the repair is complete, the cause of the fracture should be explored carefully and eliminated if possible. Typically, the denture needs to be relined to compensate for the resorption of the residual ridge.



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CHAPTER > 11

Immediate Dentures

Caroline T. Nguyen and C.L. Wyatt

The Problem

Patients who are about to lose all of their remaining teeth in one or both jaws face the challenge of disablement that can be very disturbing unless they are managed appropriately.[1,2] After teeth are extracted, resorption of the buccal bone is more pronounced than the loss of lingual or palatal bone. Healing of the extraction wound goes through various stages of osseous formation, beginning with a blood clot, progressing through granulation and connective tissues (1 to 3 weeks), and followed by a provisional matrix and projections of mineralized woven bone into the connective tissue over the following 3 months.[2] The crestal opening of the socket is closed by epithelium growing over the granulating blood clot.[3] Development of woven bone is underway after a couple of weeks; however, ossification of the sockets varies substantially, and replacement of woven bone by lamellar bone and marrow can take about 1 year. Generally, remodeling of the alveolus is a prolonged process leading to loss of about a third of the buccolingual plate after 3 months and half of the plate after 1 year.[3-9]

Benefits

Most patients prefer to have their teeth replaced immediately with a denture after the teeth are extracted. It is easier for the clinician to replicate the natural form, color, and arrangement of the teeth when the denture is made before the natural teeth are extracted.[10] The extraction sites may also heal more comfortably if protected by a clean denture, much as skin wounds heal with fewer complications when covered by a bandage. An immediate denture also may help to preserve the labial plate of alveolar bone, retard resorption of the residual ridge, help to maintain the tone of the facial muscles, and ease social transition to a denture.[11]

Risks

Patients who do not understand the potential complications of placing a denture on a wound should not be treated with immediate dentures. The outcome of treatment is not always predictable, and the denture will almost certainly need relining within the first year if not sooner to maintain stability as the residual ridge resorbs. Furthermore, despite the protection offered to extraction sites, a denture with a thick layer of biofilm because of poor oral hygiene predisposes the bone and mucosa to infection.[12]

Methods

Examination and treatment planning

The clinical procedures for an immediate denture are similar to those for a conventional denture, although the uncertainty of estimating the shape of the residual ridge before the natural teeth are removed complicates the process considerably. Frequently, the presence of bony prominences, especially around the anterior teeth and alveolus, complicates making an impression.[10] Natural teeth that are misplaced or noticeably mobile are also difficult to manage when making impressions and when recording the maxillomandibular relationship.

A good treatment plan is based on a perceptive interview along with astute clinical observations and measurements supplemented by radiographs and study casts. Particular attention should be paid to frena and other anatomical structures that might interfere with a smooth insertion of the denture after the teeth are extracted. Examination of the occlusal contacts in the mouth and analysis on the study casts will indicate whether the occlusal orientation of the natural teeth should be reproduced or altered on the denture, whereas the patient's opinions on the shape, size, arrangement, and color of the teeth contribute substantially to selecting and arranging the denture teeth (see chapter 4).

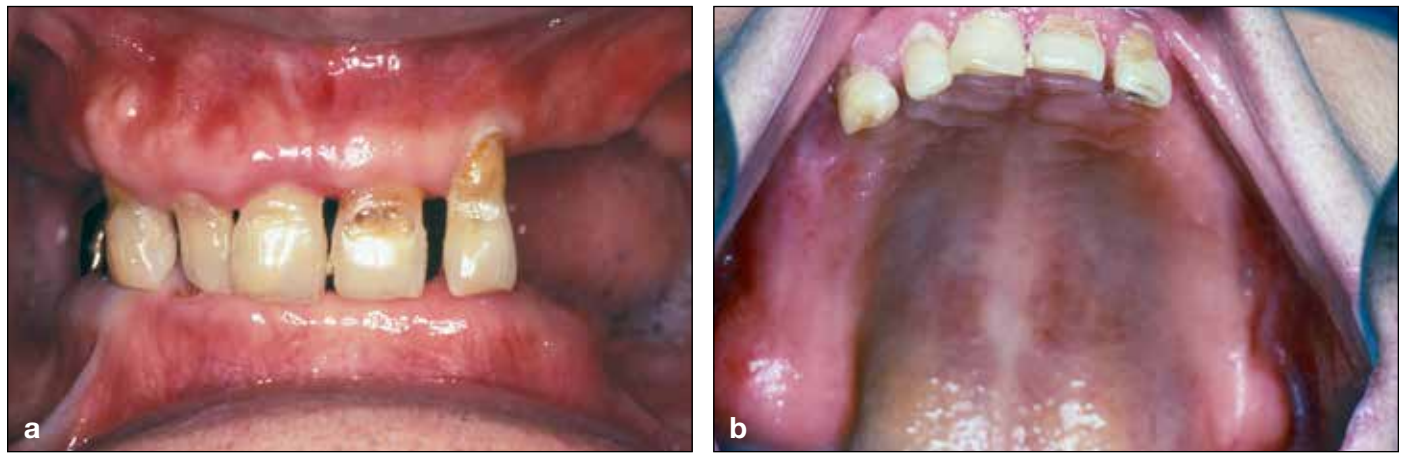
Disease control and occlusal adjustments

Oral diseases should be controlled as much as possible before making the final impression for the master cast. Part of this process includes extracting most of the posterior teeth and preserving the anterior teeth for social activities. Although not present in Fig 11-1, it is helpful when establishing the occlusal contacts on the new denture to have a few natural teeth still in place with occlusal or incisal contacts at the patient's customary vertical dimension of occlusion (VDO). Further treatment is rendered when most of the posterior teeth are removed to eliminate other sources of infection, abnormalities, and inflammation before continuing to make the new denture. Occlusal contacts interfering with a smooth movement of the mandible to the centric relation (CR) position should be identified also and eliminated at this stage.

Making an impression

There are several methods for making an impression for an immediate denture; the primary ones include:

- An irreversible hydrocolloid impression made in a stock impression tray
- An elastomeric impression made in a border-molded custom impression tray
- A combination or dual impression technique



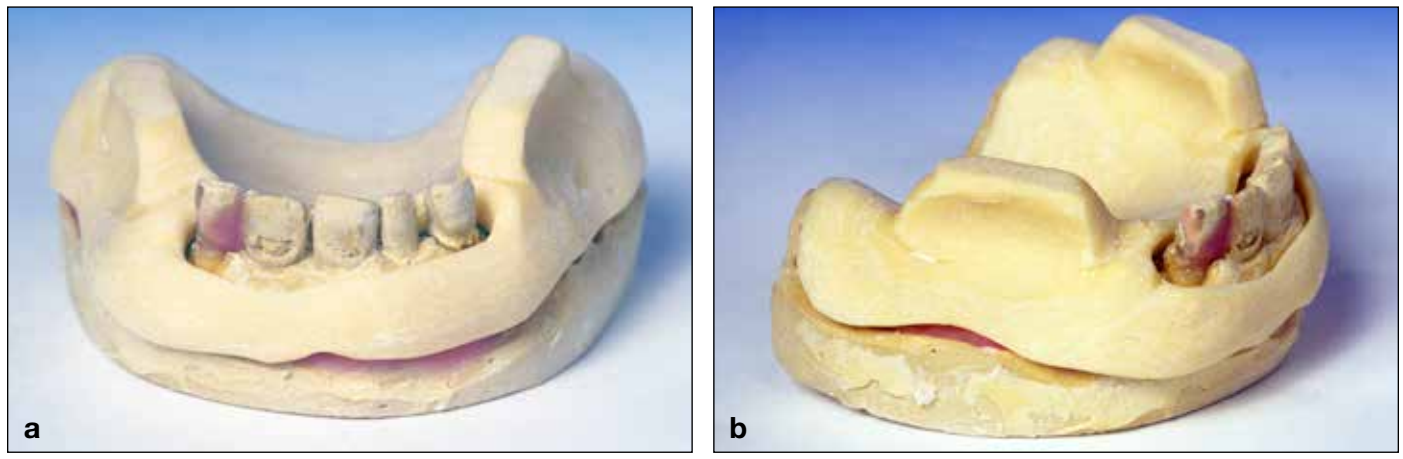
11-1

The dual impression technique is particularly useful because it provides the opportunity to focus on the shape of the residual ridge and surrounding soft structures before focusing on the position and shape of the natural teeth.[8,13] It records the contours of the residual ridge, including the functional vestibule in the first impression and then the natural teeth in a connecting overimpression:

- Hard baseplate wax is used to fill in soft tissue undercuts on a study cast of the dental arch and residual ridge.
- An acrylic tray with an opening for the remaining teeth and a handle grip on both sides is made on the study cast (Fig 11-2).
- The periphery of the tray is adjusted to sit within 2 to 3 mm of the vestibular depth, along the vibrating line from one hamular notch to the other on the maxilla, and over the retromolar pads on the mandible as described in chapter 3.
- The periphery is then modified with impression compound to fit the functional vestibule, the intaglio of the tray is prepared with an adhesive, and the mucosal impression is made with a low-viscosity vinyl polysiloxane.

• The tray with the impression is removed from the mouth (Fig 11-3), modified if necessary to remove excess material beyond the denture-supporting area, and repositioned in the mouth to form the posterior part of the dual impression when a stock tray with alginate is placed over the acrylic tray and around the natural teeth (Fig 11-4).

• Both impressions are removed together from the mouth, disinfected in 2% gluteraldehyde for 10 minutes, and poured as soon as possible in dental stone because of the instability of the alginate impression (Fig 11-5).



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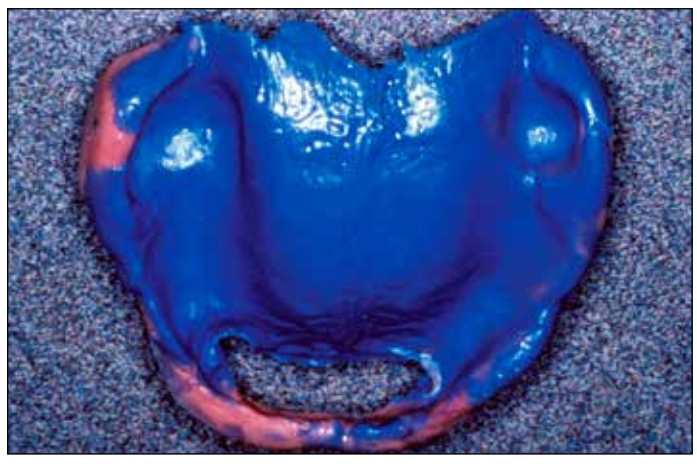

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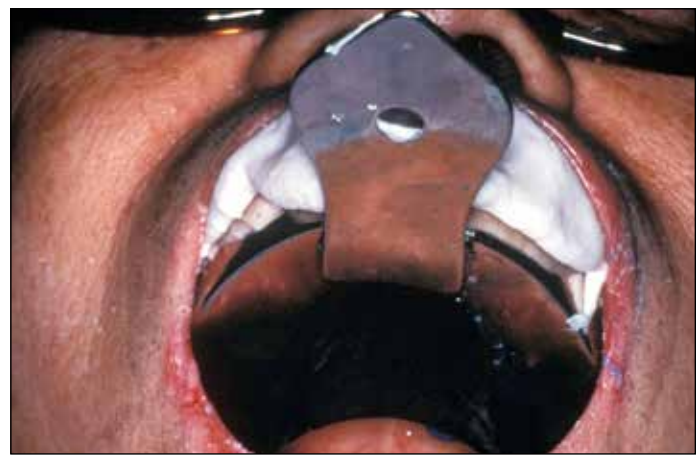

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Occlusal records and selection of tooth color

The record base and occlusal rim are made and used as described in chapter 5 except that they fit around the natural teeth to accommodate the teeth when they occlude (Fig 11-6). Alternatively, the VDO can be established using the esthetic and anatomical principles described for the completely edentulous patient. Lastly, an appropriate match for the color of the natural teeth under different light sources is made to suit the patient's wishes.

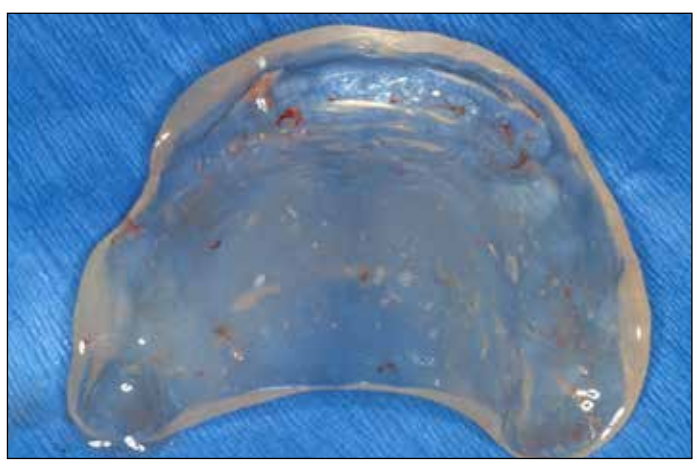
11-6

Arranging the denture teeth

Natural teeth in the alveolus offer a natural reference to the optimal shape and position of adjacent denture teeth. As a general principle, denture teeth are arranged as closely as possible to the position of the natural teeth except that they should occlude maximally in CR,[14,15] unless there are strong indications clinically that the natural teeth are misplaced in a position incompatible with the comfortable activity of the surrounding muscles. If they are in an incompatible position, the denture teeth should be arranged following the principles explained in chapters 4 and 6 to occlude maximally on the articulator in CR and assessed in the mouth to confirm that the contacts are the same as on the articulator. If they are different, a new occlusal record is made to remount the cast on the articulator. When the patient approves the arrangement of the denture teeth, the remaining tooth replicas are removed from the master cast, and the surrounding stone is contoured to simulate the alveolus after the first week of wound healing following the extraction. Subsequently, missing teeth are added to the cast, and the supporting wax is carved to simulate natural gingiva and alveolus. Finally, an index is made to preserve the orientation of the maxillary cast on the articulator for occlusal adjustment after the denture is processed (see chapter 8, Fig 8-3).

Surgical guide

The master cast and denture teeth are imbedded in a stone mold within a processing flask. The flask is heated, and the wax is removed from the mold as described in chapter 8. An alginate impression is made of the denture-bearing area of the cast in the mold, and, on the cast made from this impression, a surgical guide is formed from a clear acrylic resin or polycarbonate material (eg, Precision Vacuum Adaptor, Omnidental). This guide (Fig 11-7) provides a transparent replica of the denture base to help see areas causing excessive pressure and blanching of the underlying mucosa (Fig 11-8).



11-7

11-8

Processing the denture

The dental technician packs the mold with acrylic resin, processes the resin, refines the occlusal contacts, and polishes the denture as described in chapter 8. The denture, along with the surgical template, is disinfected in preparation for the tooth extractions.

Inserting the immediate denture

The teeth are extracted with limited flap elevation, and the surgical guide is used to show areas of excessive mucosal blanching where there might be uncomfortable pressure from the denture when the anaesthetic subsides (see Fig 11-8). The denture can be adjusted or the alveolar bone and soft tissue adjusted surgically if necessary to relieve the blanching. Other adjustments to the denture-supporting tissues are completed, also with the help of the surgical guide, before flaps are replaced and sutured and the denture is inserted (Fig 11-9).

11-9

11-10

If a large amount of alveolar bone was removed with the extracted teeth, an attempt can be made to regenerate bone volume to reduce loss of alveolus or prepare the site for potential future implant placement. Although the results of tissue regeneration are still unpredictable, the possibilities are optimistic from osteoinduction with growth factors, osteoconduction with grafted materials, distraction osteogenesis, and guided tissue regeneration.[7,16]

Occlusal irregularities can be adjusted at this point if they are interfering with the use of the denture, but usually it is easier to remount the denture on the articulator the next day when the patient's proprioception is undisturbed by the anaesthetic.

Postsurgical management

Usually, an immediate denture is surprisingly comfortable over the first 24 hours and should not be removed by the patient until the clinician removes it the next day. If it is removed too soon after surgery, swelling of the mucosa near the surgical wounds will make it very difficult and uncomfortable to reinsert. Consequently, the patient should return the next day to have the denture removed, the wounds inspected and cleaned, and the denture adjusted if necessary.

The following management protocol helps the patient to adapt and cope with the new denture.

First 24 hours

• Pain and discomfort can be controlled effectively with little more than nonsteroidal analgesics (eg, 400 mg ibuprofen three times per day), gentle mouthwashing with saltwater every few hours to clean the mouth without dislodging the blood clot underneath the denture, and gently brushing the denture without removing it from the mouth.

Next day

• The clinician removes the denture and cleans the wounds without dislodging the clots while using a 3% solution of hydrogen peroxide mixed 50:50 with saline,[17] with 10% carbamide (urea) peroxide,[18] or with saline alone.[19]

• The denture base can be adjusted after locating the source of any pressure-induced pain (see chapter 9).

• When the denture is comfortable, the occlusal contacts are checked carefully, and if necessary the denture is remounted on an articulator to equilibrate the contacts in CR (see chapter 9).

Over the next week

• The patient removes the denture to brush it after meals with soap and water.

• If socially acceptable, the denture is best removed and stored in a dry container when the patient is sleeping.[20]

• Salt mouthwashes or hydrogen peroxide mouthwashes (eg, Peroxyl, Colgate Palmolive) also can help to keep the wound clean during the first 10 days or so until the epithelium has closed the surgical sites (Fig 11-10).

• Sutures are removed if they have not resorbed after 1 week.

After 1 week

• When the patient is comfortable, an assessment is scheduled every month for at least 3 months. If the denture loosens substantially or becomes intolerably unstable during this period, it can be relined directly with a resilient material if the problem is due to instability within a month of receiving the new denture (see chapter 10); a hard relining material is used if either looseness or instability are due to large deficiencies in the base. Either way, a patient receiving an immediate denture should be advised that the denture will almost certainly need to be relined in the near future with a hard resin, although it is impossible to predict precisely when or how frequently this will be necessary, since it depends on the rate at which the residual ridge resorbs.

Transition from natural teeth to a complete denture is never easy for a patient, and it can inflict psychologic scars that persist indefinitely. The immediate denture offers a transition that should allow the patient to continue with a normal social routine. Complete healing with calcification of the dental sockets takes about 1 year, usually with unsettling horizontal and vertical bone loss after 6 months following tooth extractions (see Fig 11-10).[7] Usually an indirect (laboratory) processed reline of the denture is needed sometime between 6 and 12 months as the residual ridge continues to resorb. Eventually resorption becomes more stable,[21] but the patient must be informed that the edentulous mouth and denture will need ongoing care and attention.

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CHAPTER > 12

Implant Overdentures

Joanne N. Walton and S. Ross Bryant

Conventional complete dentures can be a successful treatment for the edentulous patient, but there are situations in which they do not satisfy the patient's needs, particularly in the mandible, where denture support, stability, and retention are more frequently compromised than in the maxilla. Prior to reports by Brånemark and colleagues[1,2] on the successful integration of endosseous implants in the mandible, options for managing a severely resorbed mandible were limited to unpredictable surgical procedures, but since then the use of two implants to retain a mandibular denture has become a reasonably predictable treatment option.[3–5] More recently, studies have demonstrated the effectiveness of even a single implant in the anterior mandible to help stabilize and retain a mandibular denture.[6,7] While the option exists for patients who are dissatisfied with conventional complete dentures to seek fixed prostheses that are fully supported by implants, there are many patients who will be satisfied with a removable prosthesis supported by both the residual ridge and implants.[8] Indeed, a removable implant overdenture may present advantages over a fixed implant prosthesis because of decreased costs, easier hygiene, improved facial support from the flanges of the denture, and better esthetics and phonetics.[9] There is evidence that implant overdentures are more time-consuming and expensive to maintain because the residual ridge, which supports the removable denture, continues to change.[10,11]

This text differentiates between an implant-supported prosthesis, which is typically fixed to the implants and does not rely on the residual ridge for support, and an implant-retained prosthesis (ie, an implant overdenture), which uses the implants for retention and stability but is supported by both the residual ridge and the implants. This difference is important in fitting and maintaining the finished denture to ensure that support is shared between the ridge and the implants and that neither is overloaded as the residual ridge continues to resorb.

This chapter focuses on the mandibular implant-retained overdenture by considering patient selection, denture attachments, treatment coordination, postsurgical prosthodontic management, denture fabrication and fitting, hygiene, and long-term maintenance.

Patient Selection

The interview with the patient will reveal concerns about the comfort, stability, or retention of the mandibular denture that should be related to observations during the clinical examination. If, for example, a patient complains about a loose mandibular denture, but on clinical examination the denture appears to be technically acceptable with as much retention and stability as the residual ridge and surrounding structures will allow, it is appropriate to discuss the potential benefits of one or more implants in the anterior mandible with the aim of improving the retention of an existing or new denture. Of course, the patient's overall health and ability to tolerate surgery must be considered,[12] and the discussion should include the relative advantages and disadvantages of a removable prosthesis compared with a prosthesis fixed to the implants.[13]

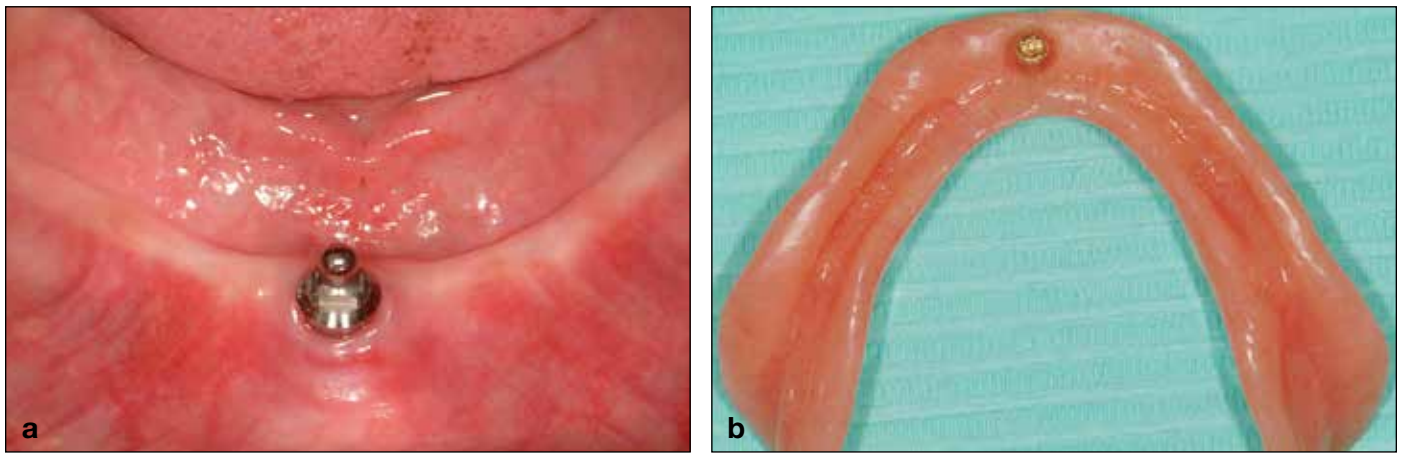
If the initial discussions with the patient indicate interest in implants, additional diagnostic records, such as diagnostic casts and photographs are indicated to record the patient's preoperative state, while panoramic and possibly computed tomography images help the assessment of the volume and quality of the mandibular bone. Finally, before commencing treatment, the patient must be informed, both verbally and in writing, about the risks, benefits, and associated costs of both the proposed and alternative treatment options, and they must consent in writing to the treatment plan.[14] If there is reason to believe that a new conventional mandibular denture without implants might be successful, the patient should be informed of this possibility and advised to postpone the implants until there is further evidence that they are needed. The new denture can usually be modified later with relative ease by relining the fitting surface and adding attachments for implant retention.

Options for Implant Retention

The number of implants to retain a mandibular overdenture will depend upon several factors, including: the quantity and quality of bone available, the type of implant attachment mechanism, the anticipated morbidity associated with the treatment, and the patient's preferences for the extent of the surgery and financial costs.[15] The least expensive, least invasive surgical option is probably a single implant placed close to the midline of the mandible (Fig12-1). More commonly, two implants are placed in the canine regions bilaterally with either a bar joining the two implants and clips in the denture base (Fig 12-2) or individual attachments on each implant (Figs 12-3 and 12-4). Individual attachments, whether used on one implant or more, generally come in two parts—a projecting component (the patrix) and a receptacle (the matrix)—that snap together to retain the denture and separate to remove the denture. The patrix and matrix can be attached to either the implant (see Fig 12-3) or to the denture (see Fig 12-4), depending on the design offered by each manufacturer.

Magnets are yet another possibility for retaining overdentures on implants by fixing ferromagnetic abutment "keepers" to the implants and embedding magnets in the denture base (Fig 12-5).

Overall, individual attachments are easier to keep clean and usually require less expensive components and dental laboratory costs when compared with bar-clip attachments.[16] However, there is conflicting evidence about the time and costs involved in maintaining each design.[17–19]



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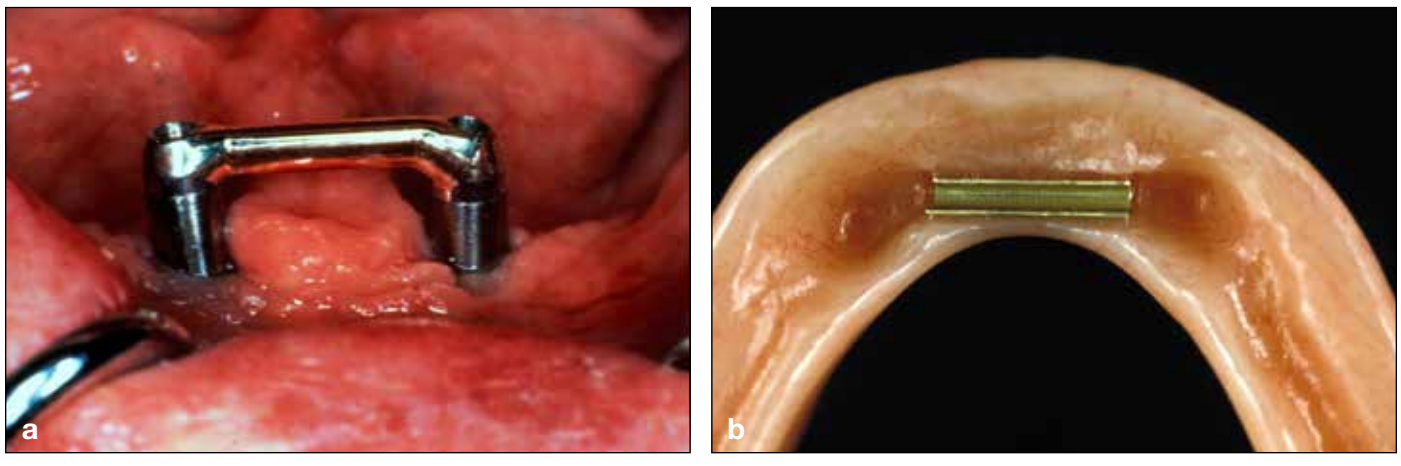

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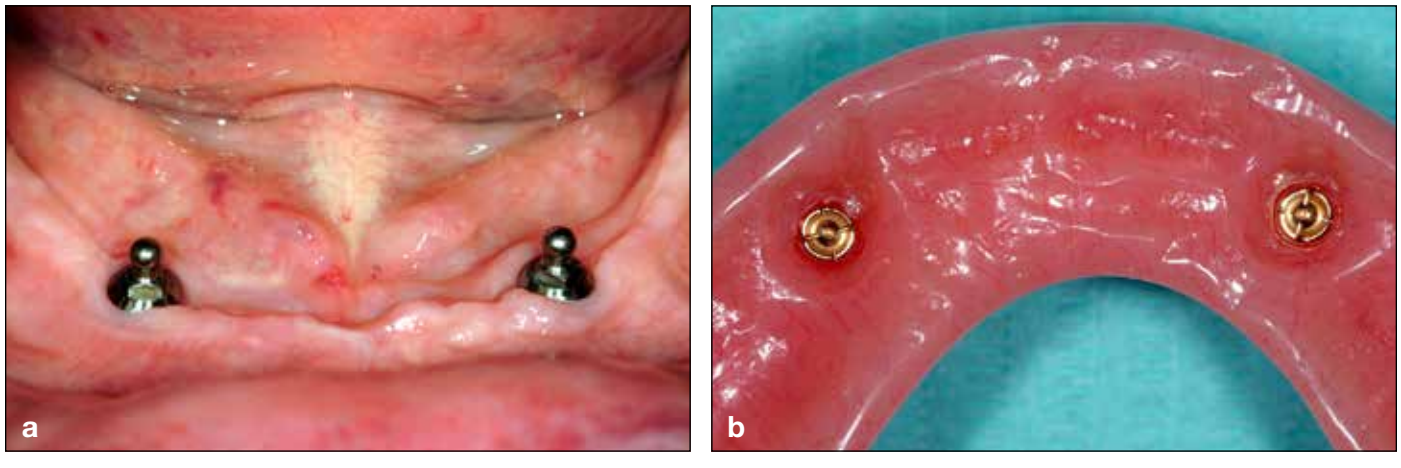

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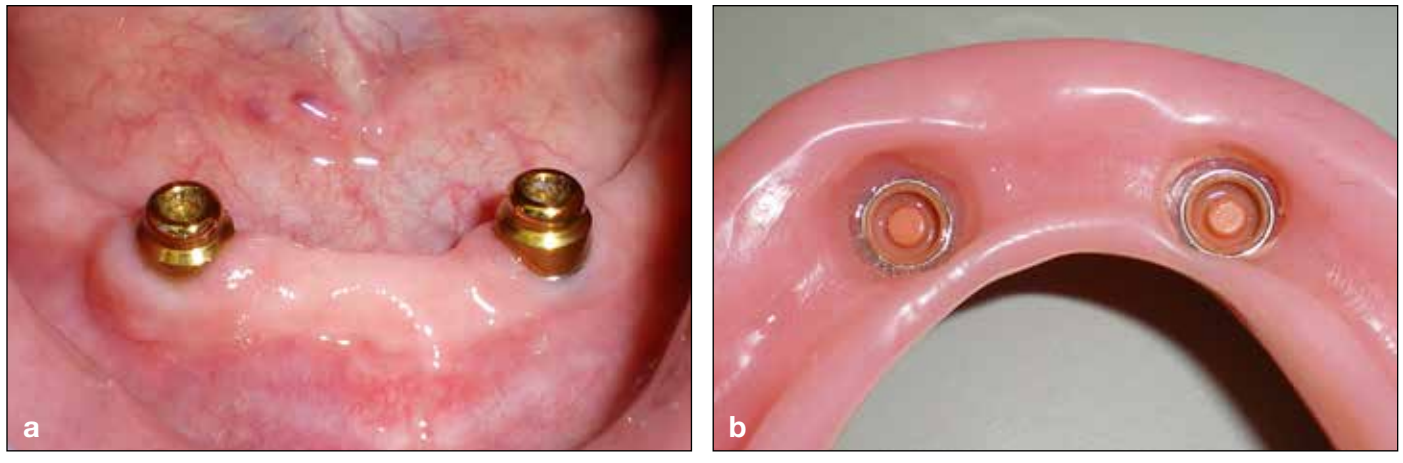

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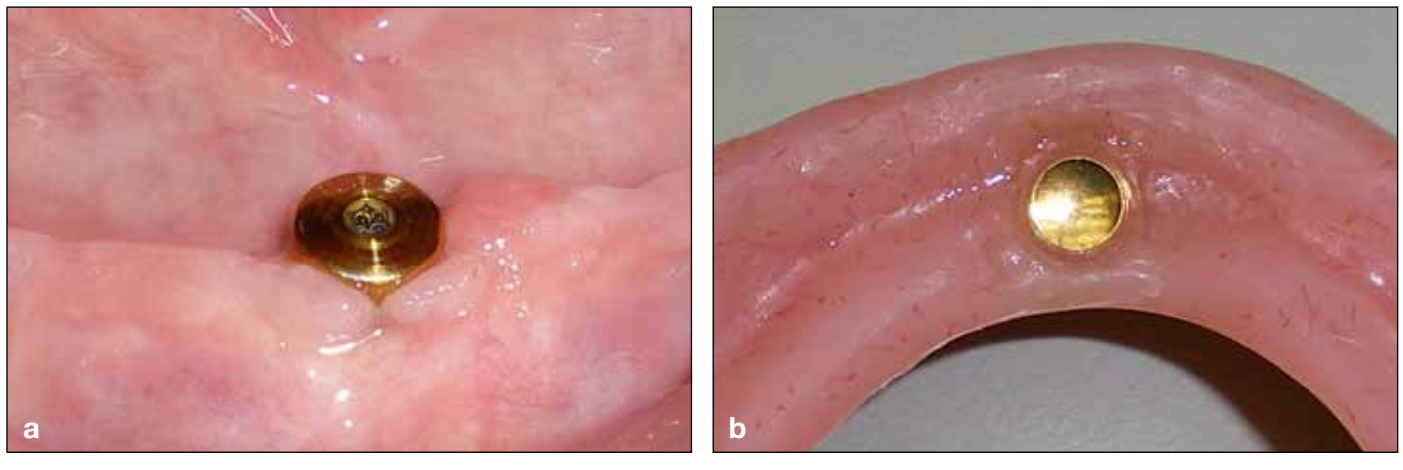


12-5

Treatment Planning and Coordination

A thoughtful plan of treatment is necessary to reduce the risk of placing implants where they cannot be used effectively, and this can be a difficult challenge when surgical and prosthodontic phases of the treatment are completed by different clinicians. Consequently, the division of responsibilities should be defined clearly before treatment begins so that everyone, including the patient, understands how and by whom the treatment will be rendered. Generally, if the surgery is performed by one clinician, and the prosthesis is made by another, the patient should start with advice from the clinician who will make the prosthesis and knows where the implants should be placed. Then advice can be obtained from the surgeon on the feasibility of the surgery for the implants. In any event, when there are shared responsibilities, it is essential that everyone involved, including the patient, understands and accepts the individual and shared responsibilities.

Joint prosthodontic and surgical responsibilities typically include:

1. Assessing the patient's suitability for implants
2. Selecting the number, design, and location of the implants
3. Confirming responsibility for posttreatment maintenance
4. Establishing who will modify the existing prosthesis during the surgical follow-up phase
5. Helping the patient to remain healthy during treatment

Prosthodontic responsibilities

The clinician who assumes responsibility for making the overdenture will:

1. Provide diagnostic casts and, if required, a diagnostic wax-up or trial arrangement of teeth in wax
2. Design the implant overdenture and specify preferred attachments
3. Give the prosthetic design to the surgeon who will place the implants and confirm that it is surgically feasible
4. Prescribe a surgical guide to the dental technician, confirm the design of the guide, and forward the guide from the technician to the surgeon
5. Specify the implant denture abutments and identify who will place them
6. Obtain the prosthodontic components for attaching the denture to the implants
7. Modify and maintain existing dentures when the implants are integrating with the bone (the surgeon will modify the existing denture immediately after implant placement surgery)
8. Make the implant overdenture

Surgical responsibilities

The clinician who assumes responsibility for surgically placing the implants will:

1. Assess the patient's suitability for surgery, approve the surgical plan, and manage the surgical risks
2. Confirm with the prosthodontist that the design of the overdenture and implant sites are appropriate for the quantity and quality of the patient's bone
3. Select, in consultation with the prosthodontist, the optimal dimensions and surface characteristics of the implants
4. Approve the surgical guide for positioning the implants
5. Place the implants with or without abutments as planned and modify the existing denture after surgery until the patient is ready to return to the prosthodontist
6. Manage the healing of bone and mucosa around the implants until they are stable
7. Perform follow-up surgery if needed to place and expose the implant abutments
8. Inform the prosthodontic clinician and patient when the implants are integrated with the bone and confirm that the prosthodontic treatment can proceed as planned

Implant Placement

Where a bar-clip retentive mechanism is planned, it is important that the surgeon place the two implants so that a straight line joining them does not cross the labial or lingual vestibules; otherwise, the bar joining the implants will interfere with the optimal contours of the new denture base. Similarly, separate attachments on each implant must be close to parallel if the connecting components embedded in the denture base are to align correctly.

Surgical guide

One of the most important aids for placing the implants is the surgical guide to indicate where the implants should be placed relative to each other, the residual ridge, and the teeth on the denture. If the denture teeth are arranged correctly on the existing mandibular denture, the dental technician can make the guide by duplicating the denture in a clear acrylic resin and remove the lingual flange between the premolars (Fig 12-6). Removal of the lingual flange allows the surgeon to reflect the mucosal flap lingually with the guide on the residual ridge. If there is no mandibular denture or the teeth are unsuitably arranged, a provisional denture base with a more acceptable arrangement of anterior teeth in wax is needed to produce the guide. This base can be made on a stone cast made from an alginate impression of the mandibular ridge, and teeth can be arranged within the lingual and facial limits of the functional vestibules (see chapter 6, Fig 6-1). The decision about the suitability of the existing denture as a template for the surgical guide is made during the initial examination because of the extra clinical and technical time needed to make the provisional base as the template for the guide.

12-6

Modifying the Existing Denture After Surgery

There is some evidence that implants can be loaded immediately after they are inserted into the jawbone; however, the conditions under which this is possible are not certain, and consequently, it is usual practice to avoid loading or disturbing the implants for 6 weeks or so as they integrate with the bone.[20–22] In any event, the existing denture must be modified, usually on several occasions as the surgical wound and surrounding residual ridge change shape. The initial modification to the denture to minimize pressure around or overlying the implants can be large, particularly if the depth of the vestibule was altered when replacing the surgical flap.

A thick mixture of a temporary, soft autopolymerizing reline material (eg, Visco-gel, Dentsply) is used to extend or modify the contours of the denture flanges and adapt it to the ridge, and usually it is necessary to reshape the denture base with an acrylic cutting bur before adding the liner. The liner usually deteriorates after a few weeks and is replaced when visibly porous and polluted with fungi and bacteria. It might be necessary also to reline the denture with a hard autopolymerizing resin if the implants are left undisturbed for more than 6 weeks. Typically, however, the soft liner will be replaced several times to maintain the patient's comfort as the implants stabilize in the bone. In any event, the patient should be examined at least every month to monitor both the wound and the denture until it is safe to construct the overdenture.

In general, infection, pain unrelated to the denture, and other surgical complications are managed by the clinician who placed the implants, while mucosal irritations from the denture and other denture-related complications are managed by the clinician who will make the overdenture. If additional surgery is needed to expose the implants, the soft liner is replaced again to reestablish the fit of the denture base over the abutments.

Denture Fabrication and Fitting

The conventional maxillary denture and mandibular implant overdenture are made together for optimal esthetic and occlusal arrangement of teeth, using methods that are essentially the same as those for conventional maxillary and mandibular dentures.

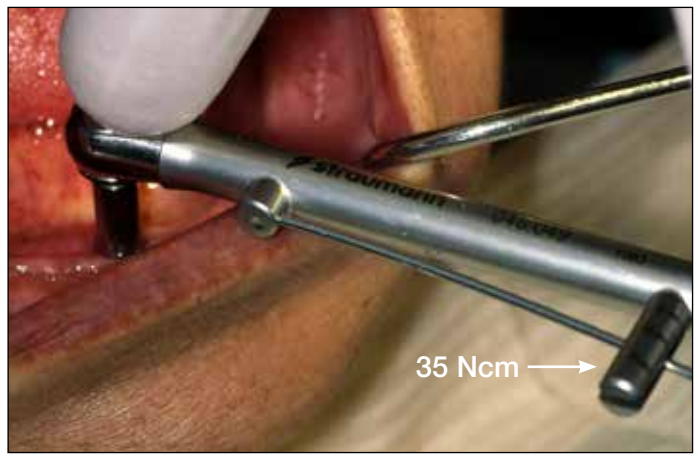
Impressions

A new mandibular impression is made after the abutments are attached to the implants so that the custom tray for the final impression can be fabricated accurately. The alginate impression is made to produce a diagnostic cast. This cast is modified with wax applied liberally around the implant sites and over sharp ridges or undercuts as described in chapter 3 (see Fig 3-1). Subsequently the impression in the custom tray is managed as for the complete denture (see chapter 3). There are other ways of making the impression of the implants, with an open-top tray, for example. However, most clinical situations can be managed effectively as described here.

Prior to making the final impression, the fit of each abutment is confirmed, and the retentive screw on each implant is tightened to about 35 Ncm with a torque wrench (Fig 12-7). The tray is then modified with impression compound to the shape of the functional vestibules before the final impression is made with a vinyl polysiloxane or polyether impression material. The elastomeric impression is made in three steps. First, the material is dispensed from its container into a large syringe with a fine tip and also into the acrylic tray. Second, the material

is deposited from the tip of the syringe around both implant abutments. Finally, the tray is seated in the mouth, and the muscles around the periphery of the tray are activated until the impression material has polymerized, as described in chapter 3.

The polymerized impression is removed and assessed for accuracy before the abutment replicas (also called *lab analogs*) are placed into the impression of the abutments (Fig 12-8a). The cast is poured in stone (Fig 12-8b), and the replicas are covered in wax (Fig 12-8c). The wax provides a space between the replicas and the record base made on the cast so that the base sits on the mucosa in the mouth without contacting the implant abutment when recording the jaw relations. The jaw relations are recorded, and the teeth are arranged in wax on an articulator, as described in chapters 4 and 5.



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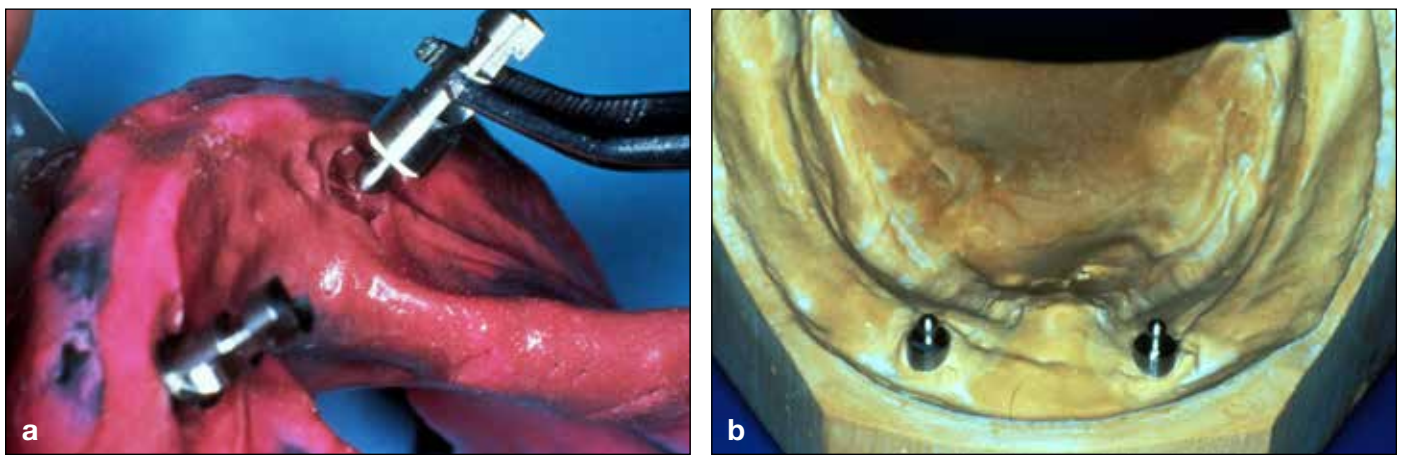


12-8

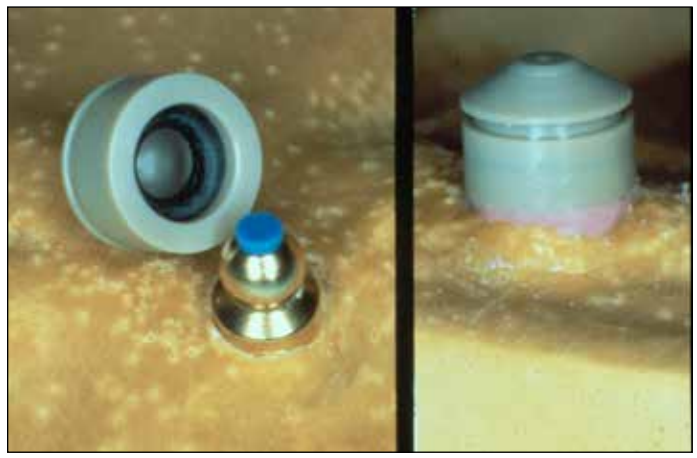
Processing the denture

The next variation in technique compared with the conventional complete denture occurs when the dentures are processed. The laboratory technician is directed to process the overdenture with (Fig 12-9) or without the attachments embedded in the denture base. In the latter situation, the technician will create space within the denture for the clinician to connect the attachments with autopolymerizing or dual-cured resin directly in the mouth (Fig 12-10). This approach can reduce laboratory costs compared with having the technician process the attachments into the denture.

After processing the dentures and refining occlusal contacts in the dental laboratory as described in chapter 8, the cast with the implant replicas is preserved if possible for future modifications, relines, or repairs to the

overdenture.

Regardless of whether the retentive mechanisms have been processed into the denture base by the dental laboratory or will be attached to the denture intraorally by the clinician, the abutments should be checked for tightness with a torque wrench set to 35 Ncm before the processed implant overdenture is seated in the mouth.



12-9

12-10

Connecting the Attachments to the Overdenture in the Mouth

The attachments are connected to the denture base directly in the mouth in several steps:

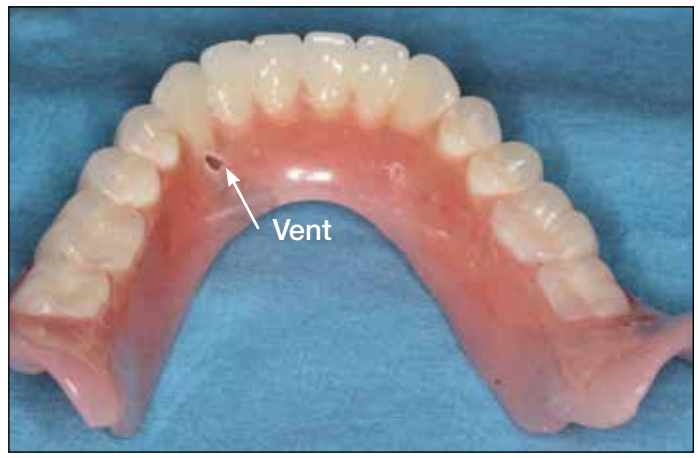
1. The denture is seated in the patient's mouth to ensure that it does not bind on the implant abutments; if it does, the internal surface of the denture is relieved with an acrylic cutting bur until it seats passively. The denture should then be examined for appropriate extension and assessed for comfort as described in chapter 8.

2. The occlusal contacts with the opposing denture are assessed and refined by remounting the denture on the articulator to obtain even bilateral contacts in centric relation (CR) as described in chapter 9.

3. Retentive mechanisms are connected to the denture one at a time to avoid locking the denture in the mouth should the connecting resin engage an undercut when polymerizing around the abutment. To begin this step, the matrix and patrix are connected together on one implant (Fig 12-11), and the passive fit of the denture is again confirmed, adjusting the internal attachment recesses as necessary to remove any contact between the retentive mechanism and the denture base.

4. A vent hole may be made in the lingual flange of the denture in the area of the implant for excess resin to escape

12-11



12-12

when connecting the attachment to the denture (Fig 12-12).

5. The inside of the passively fitting denture should then be cleaned and dried to maximize adhesion of the resin. If a bis-acryl composite resin is to be used (eg, ERA PickUp Resin, Sterngold Dental), the light-curing primer that comes in the resin kit must be painted on the clean, dry recess inside the denture and then cured in order to ensure bonding of the resin to the denture base.

6. All undercut areas around and below the abutments must be blocked out with a piece of rubber dam (Fig 12-13a) or a block-out ring (Figs 12-13b and 12-13c) supplied by the attachment manufacturer to prevent the resin from locking the denture in the patient's mouth as it hardens.

7. A small amount of the automixed resin is then injected around the exposed retentive mechanism (Fig 12-14a) in the mouth, and additional material is dispensed into the corresponding recess in the denture (Fig 12-14b). The denture is then placed in the mouth with the patient occluding in CR until the resin hardens.

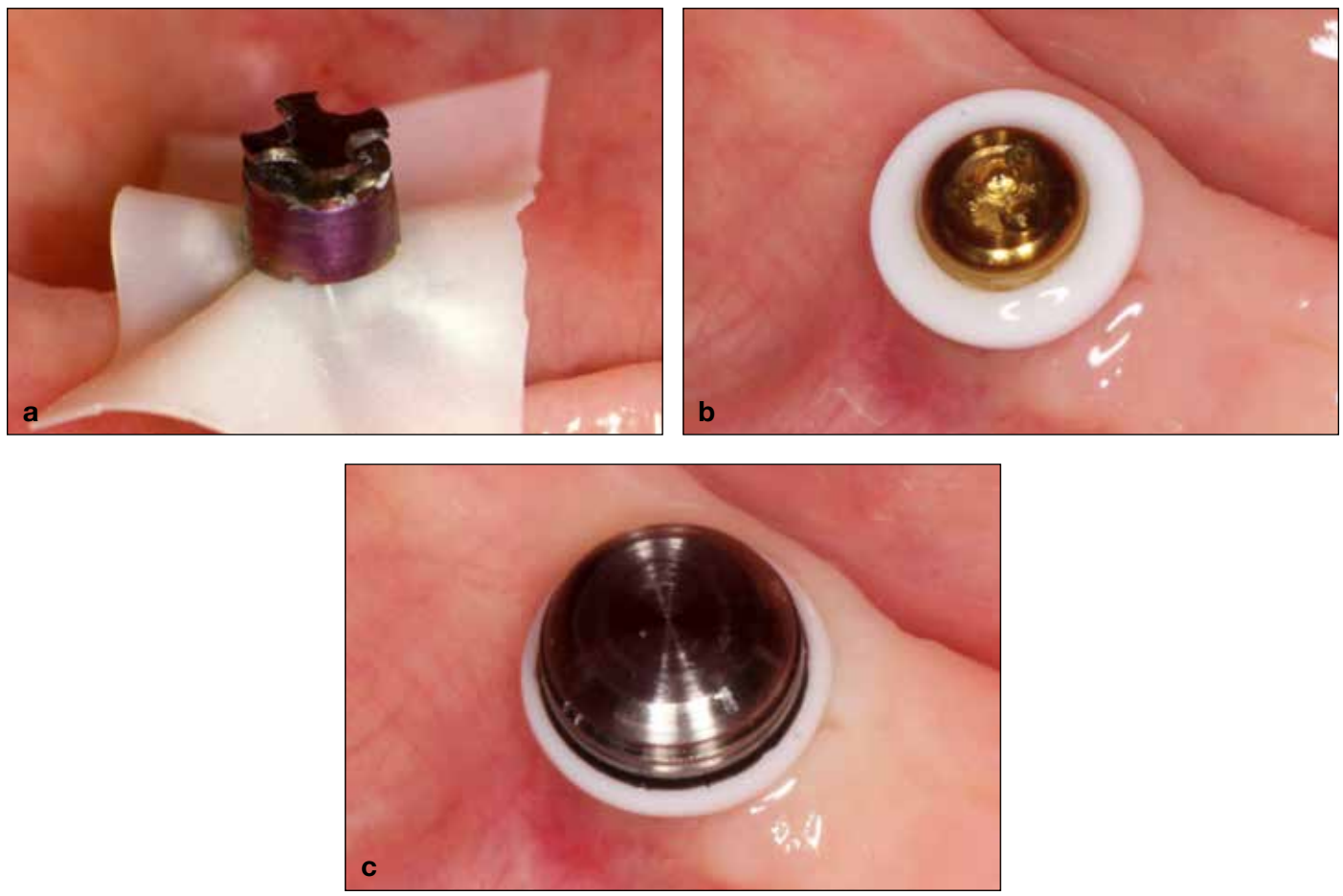
8. Excess resin that extrudes onto the outer surface of the denture and around the alveolar surface beyond the attachment can be removed with an acrylic cutting bur.

9. This procedure is repeated for the second attachment after confirming that the denture clicks into place on the first implant and continues to fit comfortably on the residual ridge.

10. There should be a noticeable click as the patrices and matrices attach the denture to the implants (Fig 12-15) and the denture comes to rest comfortably and stably on the residual ridge.

11. The resin is checked for integrity around the vent holes and matrices, and defects are repaired with additional resin before the lingual surface is polished.

12. Finally, the occlusal contacts are rechecked and, if necessary, refined in CR.



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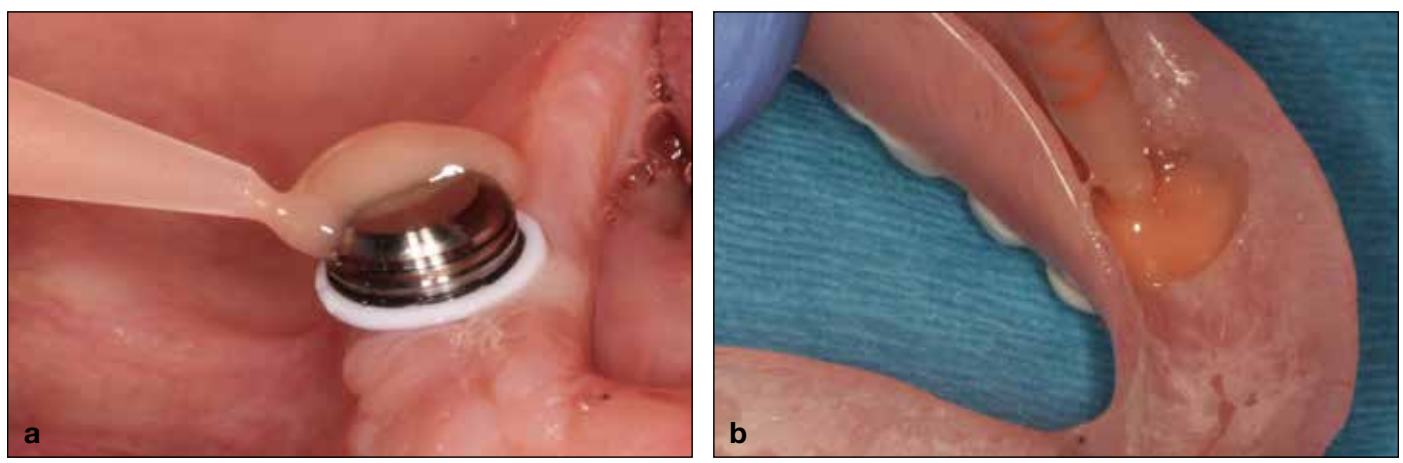

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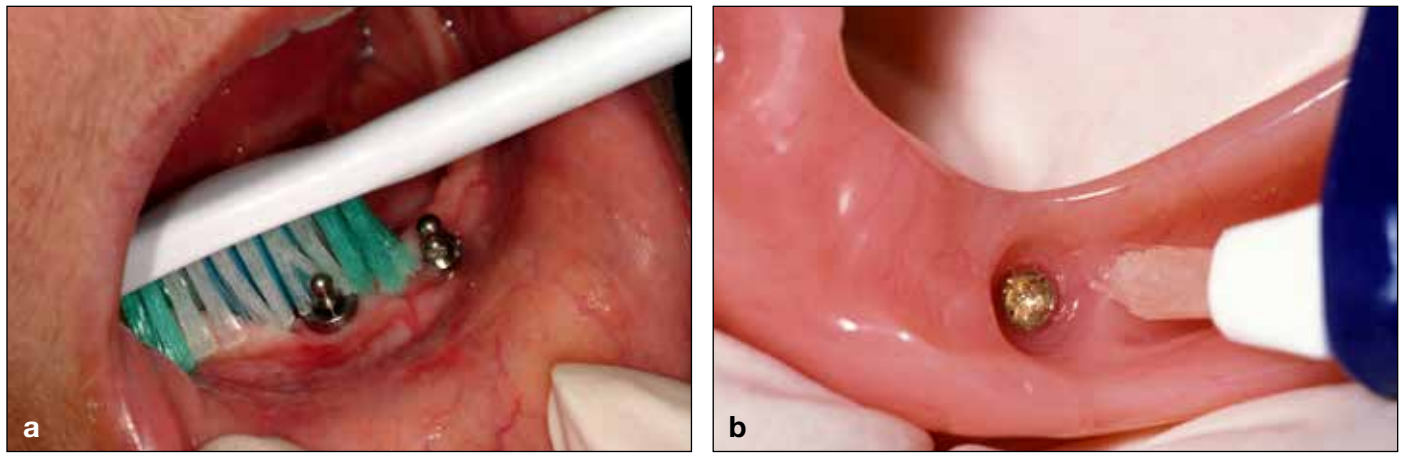
12-15

If the attachments on one or both sides fail to engage, the clinician must determine which side is most likely to be misaligned, carefully cut out the attachment from the denture base, and reattach it. Typically, only one side is misaligned, which will be apparent when the offending attachment is removed; however, if the other also fails to engage, it too must be removed.

When the attachments are engaged securely, the overall stability of the overdenture can be confirmed on the implants and residual ridge by applying moderate finger pressure alternately to the anterior and posterior occlusal surfaces of the denture to mimic moderate pressures from incising and chewing food. There should be very little movement of the denture during this test, and certainly none that is uncomfortable or bothersome for the patient. Pressure indicator paste may be helpful to identify the source of discomfort as explained in chapter 9. Occlusal contacts are rechecked in the mouth and, if necessary, the dentures are remounted on the articulator with a new centric relation record. Overall, the denture should be comfortable, stable, and retentive; have even occlusal contacts bilaterally in CR; and be free to move protrusively to contact on the incisors and laterally without uncomfortable interferences.

Oral Hygiene and Long-Term Maintenance

Instructions on oral hygiene and maintenance are given to the patient along with a demonstration on how to insert and remove the overdenture. A toothbrush can clean effectively around most free-standing abutments, supplemented if necessary with a small brush to clean the retentive element in the denture (Fig 12-16). The patient should be able to demonstrate use of these cleaning aids and their ability to insert and remove the denture themselves before they leave the denture delivery appointment.



12-16

Discomfort from the denture is addressed as soon as possible, but the abutments should be checked and tightened if necessary no later than 1 week after the denture is delivered to the patient. Abutments occasionally loosen a short time after they are placed on the implants, which can disturb the patient if they have not been alerted to this possibility and reassured that it is a relatively simple matter to tighten the abutment (see Fig 12-7).

Arrangements are made also for regular follow-up of the patient to assess implant and mucosal health, along with the stability, retention, and overall comfort of the denture. Resorption of the residual ridge continues, with the

added complication now that the implants could bear a disproportionate amount of the occlusal load unless the dentures are relined as needed to keep pace with the resorption.[23] Evidence of resorption is suspected if the patient, after several months of comfort, complains that the denture feels unstable; food stagnates under the base; the mucosa is sore around the abutments; or in more extreme situations, the denture cracks or fractures.

It is good practice generally to schedule the patient for another examination of the denture and the attachments approximately 3 months after the denture is delivered to the patient and thereafter every 6 to 12 months as explained in chapter 9.[24] At each follow-up appointment, tissue and implant health, oral hygiene, abutment tightness, denture base fit and comfort, occlusion, and patient satisfaction are assessed. Fortunately, satisfaction with the implant overdenture is generally very high,[7,14,25] although patients are more likely to comply with a periodic maintenance schedule if they understand the limitations of treatment and the need for ongoing care.

Acknowledgment

Figures 12-2, 12-8, and 12-9 courtesy of Nobel Biocare Canada.

Figures 12-7, 12-10, 12-11, 12-12, 12-13b, 12-13c, 12-14, and 12-15 courtesy of Dr Ian Thornton, graduate student in prosthodontics, University of British Columbia.

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APPENDIX > 1

The Complete Denture: A Step-by-Step Summary

Appointment One: Consultation, Examination, and Preliminary Impressions

Preparation

- All necessary documents for recording a medical and dental history
- Selection of maxillary and mandibular trays for edentulous jaws
- Irreversible hydrocolloid (alginate) impression material
- Soft beading wax
- Indelible marker

Patient interview and information record

- Complaints (including impact, source, and development)
- Dental history
- Medical history

Extraoral examination

Appearance	Jaw Movements	Temporomandibular Joint	Muscles
• Vertical dimension of occlusion (VDO) • Tooth arrangement • Lip support • Color - Skin - Teeth	• Symmetry • Limitations	• Clicks • Crepitation • Pain	• Masseter • Temporalis • Medial pterygoid • Neck

Intraoral examination

Occlusion		Dentition: Quality, Structure, and Support	
• Centric relation • Centric occlusion	• Eccentric protrusion • Eccentric lateral freeway space	• Maxilla - Natural - Artificial	• Mandible - Natural - Artificial
Prosthesis		**Other Oral Conditions**	
• Maxilla - Type - Quality ° Retention ° Stability ° Tooth arrangement ° Composition	• Mandible - Type - Quality ° Retention ° Stability ° Tooth arrangement ° Composition	• Hygiene • Breath • Lips • Mucosa • Palate - Contour - Tori • Soft palate - Contour - Resilience	• Residual ridges - Maxillary ° Height ° Contour - Mandibular ° Height ° Contour • Floor of mouth - Tori - Mylohyoid ridge • Tongue • Glands and lymph nodes • Saliva - Quantity - Quality

Other diagnostic tests

- Radiographs
- Biopsies
- Microbiologic tests

Finish

- Disinfect the impressions.
- Pour impressions and prepare the casts for the articulator.
- Render diagnosis, treatment plan, and prognosis.
- Estimate costs and fees.
- Make acrylic trays.

Appointment Two: Treatment Plan, Impressions, and Selection of Anterior Teeth

Preparation

- Acrylic tray
- Impression compound
- Portable flame and Bunsen burner
- Hot water bath
- Lubricant
- Low-viscosity impression material
- Scalpel handle and no. 11 blade (Bard Parker, Becton-Dickinson)
- Egg-shaped carbide bur (Buffalo Dental)
- Indelible marker
- Mouth mirror
- Shade and mold guides for acrylic resin
- Spatula and rubber bowl

Actions

- Review the treatment plan, prognosis, and fees with the patient.
- Adjust the trays.
- Mold the periphery of the trays with wax compound.
- Make an impression of each residual ridge with low-viscosity impression material.
- Select the anterior denture teeth.

Finish

- Disinfect the impressions.
- Box and pour the impressions.

Appointment Three: Jaw Relations and Arrangement of Anterior Teeth

Preparation

- Record bases with occlusal rims
- Portable flame and Bunsen burner
- Reinforced brittle wax
- Wax spatula
- Wax knife
- Indelible marker
- Six maxillary anterior teeth
- Articulator
- Stone
- Slurry water
- Spatula and rubber bowl

Actions

- Record the resting vertical dimension of the lower third of the face and the VDO with the patient wearing the old dentures.
- Adjust the occlusal rim to the preferred VDO.
- Arrange the maxillary anterior teeth on the occlusal rim with the patient's approval.
- Remove approximately 3 mm of wax bilaterally from the posterior part of the mandibular rim and place notches in the wax.
- Record with the reinforced wax the position of the mandible in centric relation.
- If desired, record the orientation of the maxillary occlusal rim and anterior teeth with a facebow.

Finish

1. Disinfect record bases and occlusal rims.
2. Attach the maxillary cast to the articulator.
3. Mount the mandibular cast on the articulator.
4. Select the posterior teeth.
5. Arrange the mandibular anterior and all of the posterior teeth.

Appointment Four: Clinical Trial of Teeth and Orientation of the Condylar Guides

Preparation

- Teeth arranged in wax on the record bases
- Articulator
- Portable flame and Bunsen burner
- No. 7 spatula
- Wax knife
- Reinforced brittle wax
- Stone
- Slurry water
- Spatula and rubber bowl

Actions

- Assess the tooth arrangement on the articulated casts.
- Insert the teeth into the patient's mouth.
- Remount the mandibular cast if articulator mounting is incorrect.
- Adjust the condyles on the articulator to reproduce the eccentric movements of the patient's mandible.
- Obtain the patient's approval of the tooth arrangement.

Finish

- Disinfect the baseplates with the teeth.
- Adjust the posterior teeth to establish as many simultaneous anterior and posterior occlusal contacts as possible.
- Provide a detailed prescription for the dental technician to process the dentures.

Appointment Five: Remount and Insertion of the Dentures

Prepare

- Processed dentures on casts
- Round bur with a straight handpiece
- Slurry water
- Stone
- Spatula
- Rubber bowl
- Wax knife
- Plaster knife
- Pressure indicator paste (PIP)
- Articulating ribbon
- Carbide burs for trimming acrylic resin

Actions

- Examine the base of the dentures for defects and irritants.
- Evaluate the maxillary denture in the mouth, using PIP if necessary, and adjust the bases.
- Assess the comfort and stability of the mandibular denture and adjust.
- Identify the occlusal contacts, record the jaw relationship in centric relation, and remount the casts on the articulator.
- Adjust the occlusal contacts.
- Polish and insert the dentures.
- Instruct the patient on the management of problems with the dentures.
- Review with the patient the informational pamphlet and add special recommendations.
- Establish further appointments to adjust the dentures until the patient is as comfortable as possible.
- Estimate expected changes to the fit and comfort of the dentures in the future.

Finish

- Establish an appropriote recall schedule.

APPENDIX > 2

What Should You Expect from a New Denture?

Your mouth is soft, and it changes with time, but dentures are relatively hard and stable. Consequently, the new dentures will probably need several adjustments, and you will need time and practice to adapt to them before they feel comfortable. Here are some suggestions to help you adapt to them and keep your mouth healthy.

Eating

Begin by eating small pieces of soft food as you gain confidence to manage your normal diet. Use a knife and fork to prepare the food so that you can chew it in small bites with the dentures, and try to chew on both sides of your mouth.

Cleaning

Keep your mouth and dentures very clean. Wash all of the denture surfaces with soap and a soft hand brush, or a special denture brush, at least once a day. Avoid rough and abrasives cleaners that might scratch the polished surface of the dentures. Soak the dentures in a denture-cleaning for a short time each day. You may use a commercially available denture cleaning solution or a dilute solution of bleach: 1 teaspoon (4.74 mL) of bleach (5% sodium hypochlorite) diluted in 8 oz (227 mL) of water.

Be careful with the bleach, and *do not* soak dentures in the diluted solution for more than 15 minutes. Rinse the dentures under running water before replacing them in your mouth.

Clean and stimulate the lining (mucosa) of your mouth with a medium toothbrush at least once a day, especially the mucosa covered by the denture. The bacteria and fungi in the sticky plaque that collects every day on the surface of the denture can irritate the lining of your mouth.

Resting your mouth

Rest your mouth by removing the denture as often as possible, especially when you are sleeping. You can reduce the growth of germs on the denture when it is not in your mouth by storing it in a dry container. Rinse it in clean water before replacing it in your mouth.

Maintaining the fit

Your mouth must be examined at least once a year to confirm that the lining mucosa remains healthy and that the stress from the denture is spread evenly on the ridges. The shape of your gums will change as the ridges shrink. Consequently, the denture must be adjusted and relined from time to time to keep it fitting accurately. However, do not adjust the denture yourself.

Problems you might notice

Excess saliva

The flow of saliva in your mouth will increase for a short while after you begin to wear new dentures. This is the normal response of the saliva and should settle to the usual flow after a few weeks.

Soreness

Minor irritations or sore spots underneath a new or relined denture are very common. Remove the denture to ease the pain if necessary. However, please try to wear the denture for a few hours, if possible, before attending for an adjustment; this will show where the denture should be adjusted. *Do not* attempt to adjust the denture yourself.

Gagging

This is rarely a problem that lasts long, but the denture might need an adjustment if it persists.

Talking

The new denture might disturb your speech at first. Fortunately, the problem does not usually persist for more than a few days. Reading aloud can help you to adapt your tongue and lips to the shape and position of the new teeth as you talk.