Bora Korkut , DDS, PhD

Esthetic Anterior COMPOSITE RESTORATIONS

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PREFACE

I am glad to share my knowledge and my clinical experiences with anterior direct composite restorations through this book. This text includes the clinical application protocols and techniques for anterior direct composite restorations that I have been lecturing on since 2015 at many national and international meetings, at more than 100 hands-on courses, and at my university. Here is a summary of my long-term patient follow-ups, related records, outcomes, knowledge, and experience gained over 3 years of working day and night. All of the application protocols and techniques are my own, performed in my clinic and assessed and previously discussed in various scientific papers. Additionally, all the restorative materials mentioned in the book are the materials I use in my daily clinical practice.

In a sense, this project is more of a visual presentation than a conventional book. The various cases and the material photographs are the meat of the book, which is supported by videos showing the application of the restorative techniques. This format is focused, easier to understand, and more memorable.

I own all the content presented in this book, including 1,197 clinical case photographs, 431 restorative material photographs, 31 application videos, and most of the scientific references. It was a difficult process to eliminate and select materials from a large archive of case photographs and videos, including numerous follow-up records of more than 1,000 patients.

This book is intended to give readers the knowledge needed to perform esthetic and long-lasting composite restorations in both simple and complicated anterior cases. The text will guide readers in understanding correct clinical indications and performing minimally invasive treatment planning. Readers will also find up-to-date information on various restorative materials, with recommendations for how to use these materials properly depending on the case. Isolation techniques for different types of cases, alternative clinical application protocols, and layering techniques are all described. Readers will also learn to analyze surface morphology during finishing and polishing procedures. The clinical tips included throughout the book make it a great resource for both undergraduate and postgraduate students, as well as for clinicians.

There is a special chapter dedicated to complications, reasons for failure, and the outcomes of my own cases. This chapter provides visual references and simple solutions for dentists experiencing similar problems in the clinic. Real gains in life are born from mistakes, and I believe that this chapter will reinforce knowledge gained from earlier chapters.

Knowledge is increased by sharing, not by saving. Through this book, I hope my knowledge and experiences will create a significant positive difference in your clinical work.

I'd like to thank to Dr Ertuğrul Çetinkaya, Quintessence Publishing Türkiye, and Quintessence Publishing Germany and USA for their support and efforts in the production process.

Enjoy reading!
Associate Professor Bora Korkut, DDS, PhD

I dedicate my book to my lovely mother, Prof Dr Aslı Korkut, and father, Prof Dr Kayıhan Z. Korkut. Thank you for your academic teaching, endless support, and unique love.

AUTHOR

Associate Professor Bora Korkut, DDS, PhD

Dr Korkut graduated from Marmara University Faculty of Dentistry in 2008 and completed his doctorate thesis and PhD in Restorative Dentistry at Marmara University Faculty of Dentistry Department of Dental Diseases and Treatments in 2015. He has worked as an academic at Marmara University Faculty of Dentistry Department of Restorative Dentistry since 2015, earning an Assistant Professor title in 2018 and an Associate Professor title in 2022.

Dr Korkut has many national and international scientific publications about direct and indirect restorations, prerestorative clear aligners, tooth bleaching, clinical dental photography, tooth wear, CAD/CAM restorations, magnification in dentistry, and caries diagnosis and management. He has presented many scientific lectures in national and international dental meetings about dental photography, anterior/posterior composite and ceramic restorations, clear aligners, ICON therapy, tooth bleaching, tooth wear, and restoration complications since 2015. He is a certified Invisalign provider. He has participated as an instructor in more than 100 hands-on courses since 2015.

He is a member of the GC Europe Restorative Advisory Board and the Bio-Emulation Group. He is also a key opinion leader and official international speaker of several leading international dental companies such as GC Corp, Hu-Friedy Group Europe, Tokuyama, Dentsply Sirona, Align Technology, Eighteeth, iVeneer, Polydentia, Ivoclar, Busch, and Horico.

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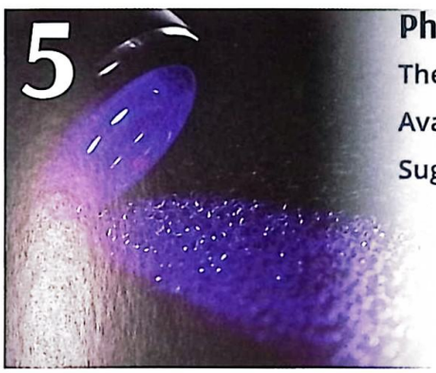

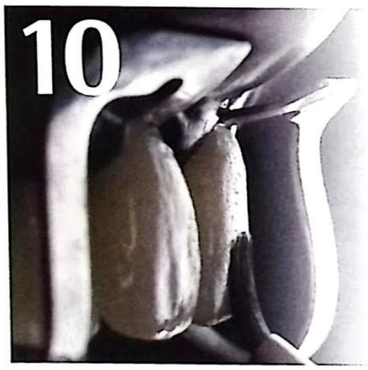

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CHAPTER 1

Diagnosis and Treatment Planning

Proper diagnosis and treatment planning can be achieved by evidence-based clinical decision making

Ideally, the main objectives that should be achieved before performing restorative procedures in the anterior region are evaluating the patient's mouth as a whole and completing the necessary infrastructure treatments first. Failing to address the problems causing the patient's complaints and focusing only on the esthetic result is a major mistake that will adversely influence the long-term success of restorations. Restorative treatment planning should start with a detailed endodontic, periodontal, and orthodontic evaluation of the patient's general oral hygiene, the dental tissues, and the related surrounding tissues. The clinician should either be competent in these disciplines or consult with other dental specialists. Only then can accurate treatment planning be performed.

PERIODONTAL ASSESSMENT

GINGIVAL INFLAMMATION

Good periodontal hygiene is necessary in patients before restorative treatment can begin, especially because the adhesive properties of resin-based dental materials are adversely affected by moisture. A healthy gingiva should be pale pink in color and free of edemas and bleeding (Fig 1-1).

The patient should first undergo initial periodontal treatment if needed, and their hygiene maintenance should be evaluated at the following appointment. If restorations are placed at the same appointment, a fluoride-free polishing paste should be used after the initial periodontal treatment to facilitate strong adhesion.

HIGH LABIAL FRENULUM ATTACHMENT

The labial frenulum is the muscular attachment between the lips and gums, and it can be longer than normal in some patients (Fig 1-2). Major diastemas between the maxillary central incisors are particularly often associated with a high labial frenulum. These abnormal muscle attachments should be examined carefully before the restorative procedures and removed only when necessary.

GINGIVAL RECESSION

Gingival recessions should also be carefully examined before restorative procedures are performed. A high labial frenulum attachment, chronic trauma, an aggressive brushing pattern, or a systemic disease are all potential causes of gingival recession. The pri-

Fig 1-1 Healthy gingiva.

mary goal is to eliminate the cause of recession. If there is no surface cavitation in the areas of recession, periodontal treatment should be considered the priority rather than restoration. In some cases, gingival recession can be treated with orthodontic tooth movement, but a consultation with an orthodontist is recommended. Surface cavitations associated with recessions can generally be observed in cervical areas as shiny, eroded tertiary dentin surfaces, and the root surface may also be involved. In such cases, the cause of recession should be addressed first, and then restoration should be considered.

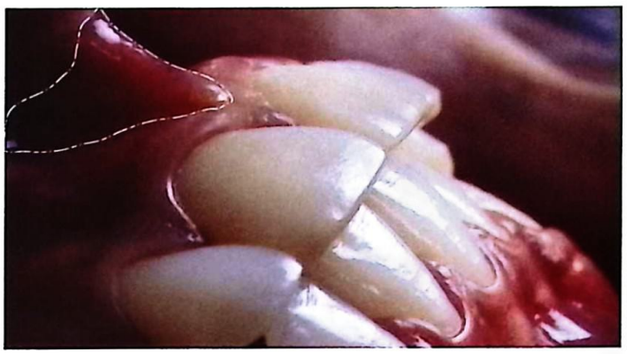

Fig 1-2 Frenulum.

GINGIVAL COLOR, CERVICAL LEVEL, AND ZENITH POSITIONS

Dental esthetics should be considered together with gingival esthetics, also called pink esthetics. The cervical gingival level, zenith points, and gingival color are parameters of pink esthetics that should be evaluated before restorative procedures (Fig 1-3). The visibility of the gingiva in the patient's full smile should also be evaluated. A gingival leveling procedure is not required in patients whose gingiva is not very visible in full smile (Fig 1-4).

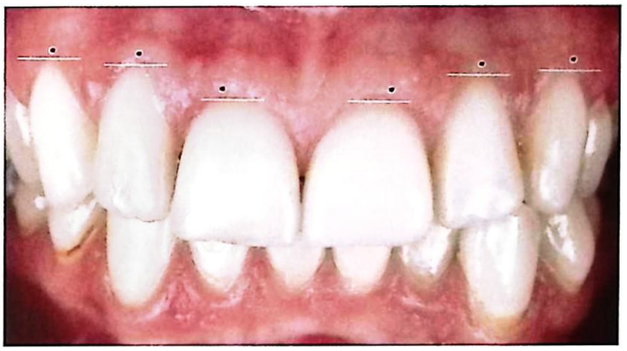

Fig 1-3 Cervical gingival levels and zenith positions.

Ideally, the cervical gingival levels for the maxillary anterior teeth should be at the same level for the central incisors and canines and 1 mm cervical in relation for the lateral incisors. The ideal zenith positions are located at the midpoint of the dental axis of the lateral incisors and canines and an additional 1 mm distal for the central incisors. These reference points are valuable, but it is also important to remember that the esthetic smile of each patient is unique.

The cervical gingival level and zenith positions should be assessed periodontally in cases where orthodontic repositioning or restorative recontouring is necessary due to congenital deficiencies.

Gingival discoloration in the anterior region is also among the factors that adversely affect smile esthetics. Especially heavy smokers usually have dark-colored gingiva due to nicotine discoloration. These discolorations can be corrected with a diode laser in a single visit. The patient should be informed about the discoloration before the restoration, and this invasive procedure can be planned to take place before or after the restorative procedure.

Fig 1-4 **(A)** Irregular cervical gingival levels. **(B)** Gingiva not visible with the patient in full smile.

ENDODONTIC ASSESSMENT

Necessary endodontic treatments are preferably completed before restorative procedures, and the patient should not have any endodontic symptoms prior to restoration. The better the substructure of a tooth, the more lasting the supported restoration will be. Likewise, successful restorations will directly affect the success of endodontic treatment. In teeth that have been endodontically treated, the presence and quality of apical lesions should be examined radiographically, and the findings should be evaluated together with the anamnesis and clinical examinations.

ORTHODONTIC ASSESSMENT

According to a minimally invasive approach, a detailed orthodontic evaluation should be performed before restorative treatment. Patients in need of restorative treatment who have not yet started planned orthodontic treatment and those currently undergoing orthodontic treatment should receive this multidisciplinary evaluation.

ANGULATION, TORQUE, AND POSITIONING OF TEETH

Disturbances in the angulations, torques, and positions of anterior teeth are common indications for restorative treatment (Fig 1-5). Orthodontics should be the first treatment option in such cases. Although the torque and position of a tooth can be corrected via restorative treatment, orthodontic tooth movement is the most conservative approach.

Recently, it became possible to treat less severe disturbances in torque and position easily via pre-restorative, short-term clear aligners. This allows for simpler, safer, and more hygienic pretreatment of the teeth and the surrounding periodontal tissues as compared to treatment with orthodontic braces. Clear aligners are also more comfortable for the patients. Following pre-restorative orthodontic corrections with aligners, high-end esthetic outcomes can be obtained with composite build-up restorations, usually without any dental preparations. The patient should be informed in detail about the pre-restorative treatment options, and the most appropriate treatment plan should be decided from there.

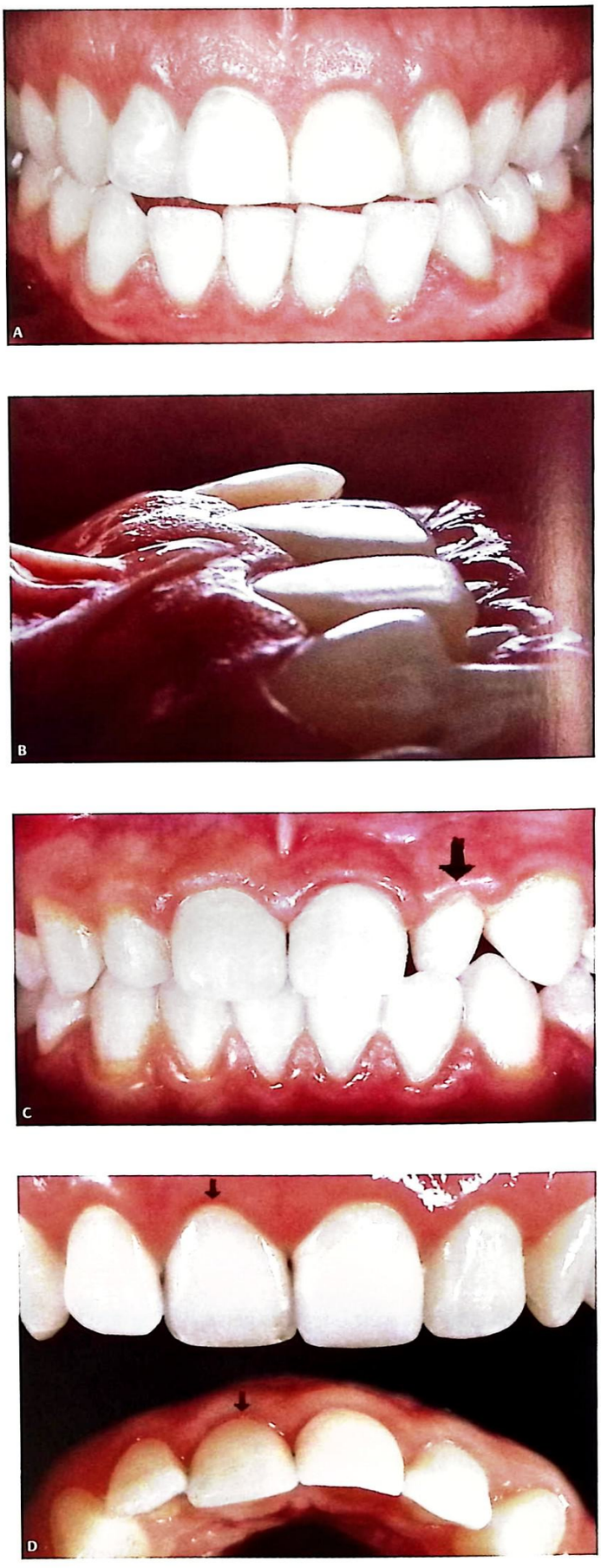

Fig 1-5 **(A,B)** Angulation, torque, and position disorders in anterior teeth. **(C)** Maxillary left lateral incisor in reverse articulation. **(D)** Malpositioned maxillary right central incisor.

In cases of anterior congenital deficiencies, it is recommended to rearrange the positions of the teeth adjacent to the missing tooth via orthodontic treatment before the placement of restorations. The multidisciplinary treatment plan should be developed by an orthodontist and a restorative dentistry specialist. The type of the tooth that is congenitally missing also influences the treatment plan (Fig 1-6). Therefore, provisional restorations may be useful in this regard (see chapter 2).

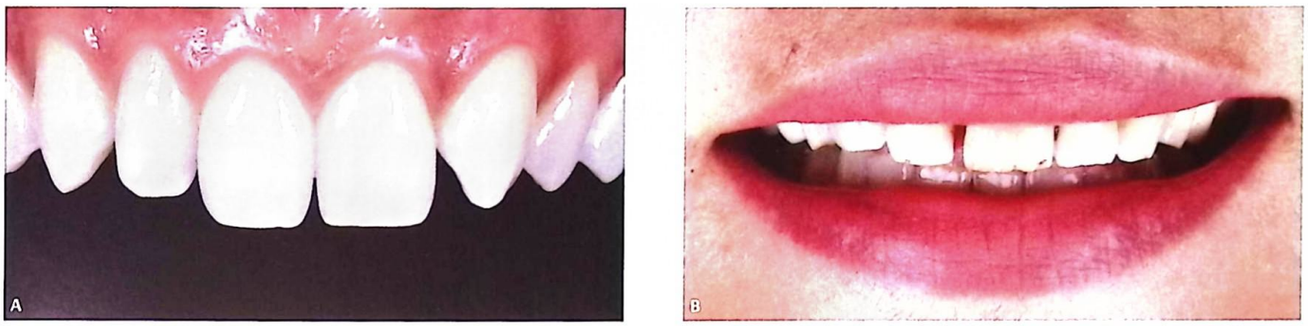

Fig 1-6 **(A)** Congenitally missing maxillary lateral incisor. **(B)** Congenitally missing maxillary central incisor.

UNDESIRABLE SPACES AND TOOTH DISTRIBUTIONS

The evaluation of undesirable spaces and tooth distribution is usually important in polydiastema cases. The distribution of spaces between the anterior teeth directly affects the number of restorations that will be placed, the position of the restoration(s), and how invasive the treatment is. The first important aspect to evaluate is the proportion of the mesiodistal and cervicoincisal dimensions of the anterior teeth on the right and left sides. One by one, the widths and lengths of the right central and lateral incisors and canine are compared to those on the left from a frontal view. If there is no dimensional mismatch and the widths are proportional, the second important aspect to consider is whether the gaps are symmetrically distributed on the right and left sides (Fig 1-7). In cases where the spaces are also symmetrically distributed, the restorations for diastema closure can usually be performed without any additional treatment.

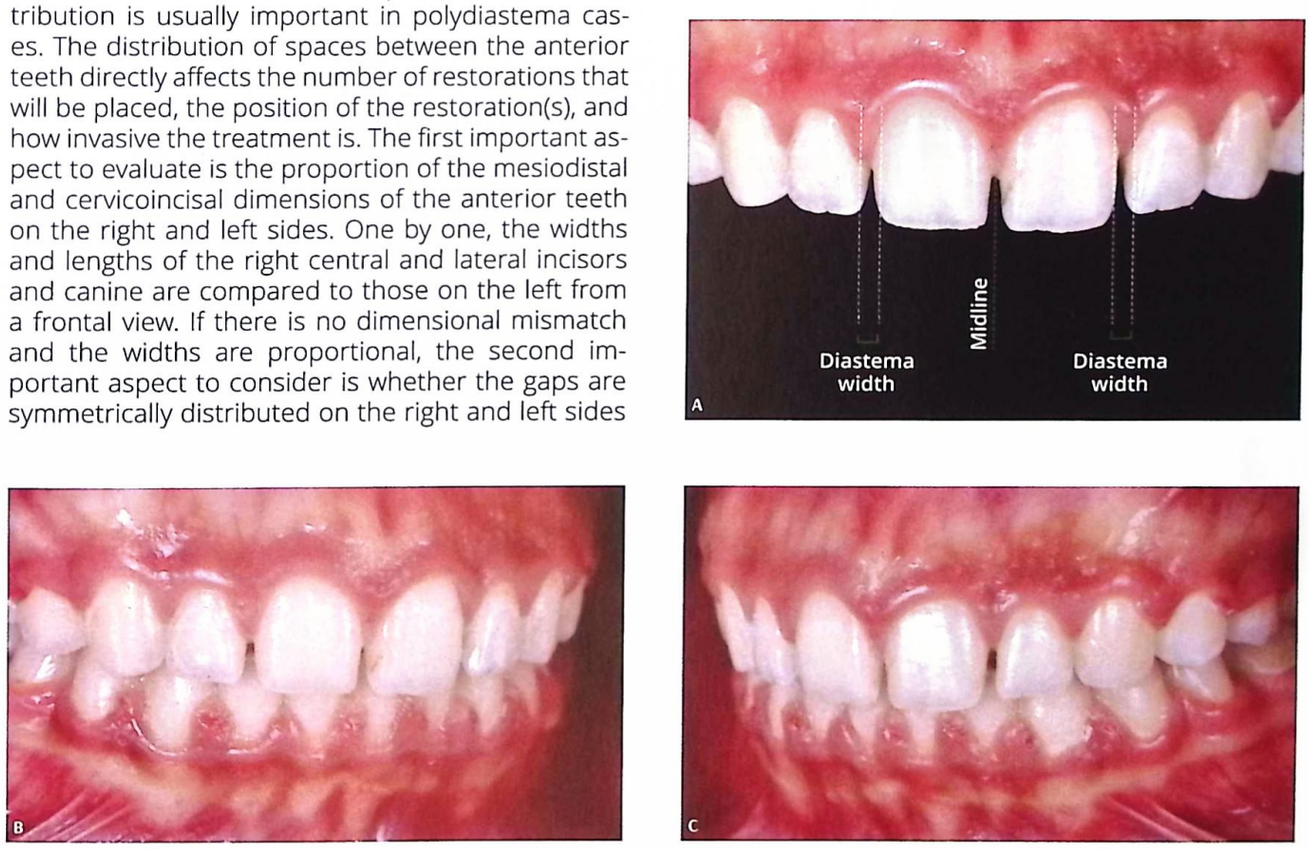

Fig 1-7 **(A)** Diastema distribution and dental midline relation. **(B,C)** Symmetrically distributed diastemas.

Fig 1-8 **(A)** Diastema distributions in a case of poor tooth position and shape. **(B)** Diastema distributions in a case of peg-shaped lateral incisors.

If it is estimated that the widths of the teeth would be too great after a planned restorative build-up procedure and the golden ratio would be exceeded, consideration should be given to closing the diastemas with additional tooth restorations. In situations involving things like microdontia, congenital deficiency, the presence of old restorations, or poor tooth position, shape, and size, the dimensions and distributions of the anterior teeth are not usually proportional. Therefore, the teeth should be moved more mesial or distal via orthodontics prior to restorative treatment (Fig 1-8). Short-term, pre-restorative clear aligners are very use-

ful for this. As a more invasive alternative, additional artificial diastemas can be created via, for example, interproximal reduction (IPR). Mock-up restorations, wax-up restorations, and digital restorative designs are also useful in these cases because the patient can be consulted for their opinion at the provisional stage.

MIDLINE

According to the golden ratio, the dental midline passing between the central incisors should align exactly with the philtrum. Although this is an important criterion, the dental midline is in this ideal position only 70% of the time. From an esthetic perspective, the proportional symmetry of the anterior teeth on the right and left sides is much more important than the correct position of the midline. Scientifically, deviations in the dental midline of up to 4 mm to the right or left are within esthetically acceptable bounds. Therefore, in diastema closure cases, the centrality of the dental midline should be sacrificed if needed to ensure the proportional symmetry of the teeth without preparation.

RESTORATIVE ASSESSMENT

Periodontal, endodontic, and orthodontic prerestorative preparation procedures should be completed for the restorative evaluation (see chapter 2).

The concept of dental esthetics refers to a healthy and beautiful smile that is unique to a patient and that can change over time. Restorative assessment should be based not only on the teeth but also on other components of an esthetic smile, such as the lips and face. Each case must be evaluated and planned individually. The golden ratio reference values should be determined before the restorative planning. These standards are important for understanding the limits of restorative treatment, performing further planning during the prerestoration evaluation, and performing the clinical restoration procedure according to the correct reference values.

DENTAL PROPORTIONS

According to the golden ratio, there should be symmetry between the widths of the right and left anterior teeth from the frontal view. The incisal edges of the anterior teeth should form a convex curve that follows the curve of the lower lip (although this harmony should not be sought in patients with lip asymmetry). From the frontal view, if the span between each canine is divided into 100 units, each central incisor should ideally account for 25% of the space, each lateral incisor for 15%, and each canine for 10%. In numerical values, the lateral incisor should be 1.0 unit wide, with the central incisor 1.618 times as wide and the canine 0.618 times as wide (Fig 1-9).

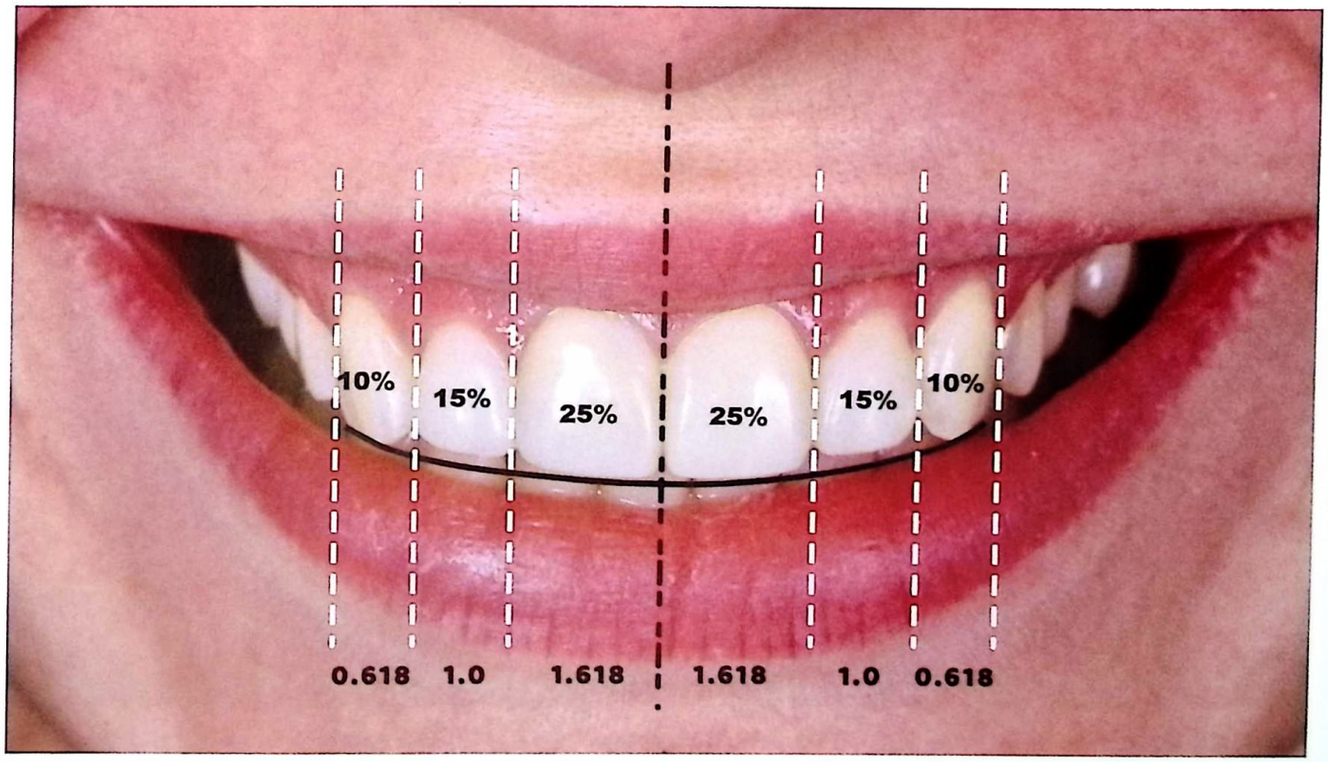

Fig 1-9 Golden ratio regarding the widths of maxillary anterior teeth.

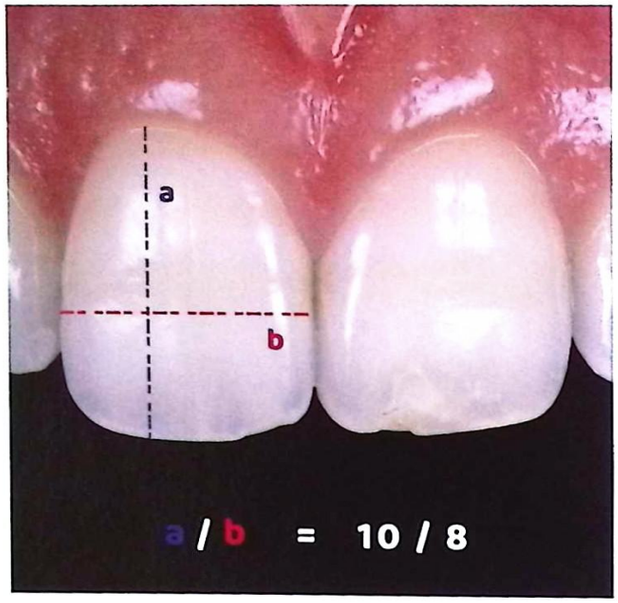

Fig 1-10 Relation between crown length and width.

There is also an ideal width to length ratio for the crowns of the maxillary anterior teeth. Ideally, the ratio of the distance between the marginal contact points (the widest distance) to the distance from the zenith point to the incisal edge (the longest distance) should be 80% (Fig 1-10). A ratio of 65% to 85% is considered clinically esthetic and acceptable. However, ratios outside of these limits may also meet the esthetic demands of some patients. When the ratio is unacceptable, restorative crown lengthening, periodontal crown lengthening, or orthodontic extrusion/intrusion procedures should be considered.

An ideal ratio has also been determined for the marginal contact surfaces of the maxillary anterior teeth. In terms of the distance from the gingival papilla to the contact point, the ratio should be 50% between the central incisors, 40% between the central and lateral incisors, and 30% between the lateral incisor and canine (Fig 1-11). The clinician should keep in mind, however, that less than ideal ratios may be acceptable to patients. From a clinical standpoint, it is most important to create contact surfaces with smooth emergence profiles and well-arranged embrasures.

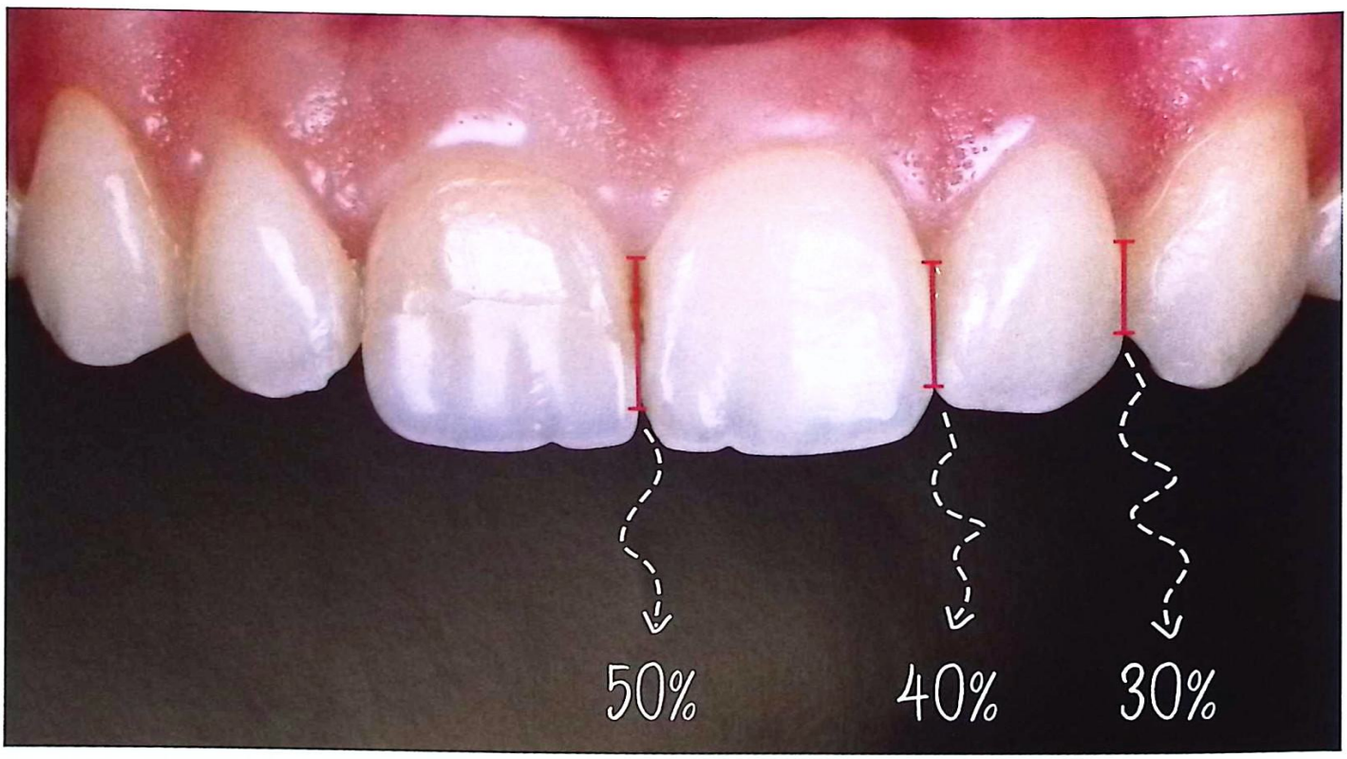

Fig 1-11 Relationship between the marginal contact surfaces of the maxillary anterior teeth.

TOOTH POSITIONING

Orthodontic treatment should be the first line of treatment for correcting tooth malpositioning. A multidisciplinary evaluation including restorative treatment planning should be performed at the very beginning and before the end of the orthodontic treatment. This evaluation should be performed by either a clinician who is competent in both disciplines or in consultation with other dental specialists. Otherwise, the treatment planning might be incomplete or incorrect. More minimally invasive or even noninvasive restorations can be performed following the correction of tooth positioning and diastema distributions with orthodontic treatment planned with a multidisciplinary perspective.

Restorative treatment should be performed at the same appointment as the orthodontic bracket removal/orthodontic attachment removal. Orthodontic retainers should then be applied if necessary. If the restoration cannot be placed during the same appointment, the patient should use transparent removable retainers until the restorative procedure takes place.

Another issue to consider after orthodontic treatment is iatrogenic damages, especially those caused by the removal of orthodontic brackets and residual composite. The clinician should be very careful when removing the remaining resin on the tooth surface so as not to damage the enamel tissue. Specific tungsten-carbide burs with 12-16/16-20 blades or fine-grain aluminum oxide composite polishing disks should be used at low speed to remove the residual resin from the surface of the enamel. LED polymerization devices with specific lenses or composite detection mode can be useful for the removal procedure. Working under loupe or microscope magnification with effective illumination also significantly improves the precision of this work. It should be kept in mind that iatrogenic damage is irreversible and can completely change the restorative treatment plan (Fig 1-12).

Composite restoration is not indicated for every case. Accordingly, the case should be prepared as needed for composite application to be feasible. In cases where orthodontic treatment is not indicated or, as occurs more frequently, when a patient does not accept a long-term treatment plan, tooth malpositioning should be evaluated in terms of restoration and the treatment plan should be adapted accordingly. In some cases, IPR may be necessary when performing restorative treatment to correct tooth positioning. However, radical preparations should be avoided as much as possible.

Fig 1-12 Iatrogenic damage on dental enamel tissue provided during the removal of remaining composite.

OCCLUSION

Occlusal contacts between the opposing teeth should be evaluated carefully both before and after restoration to obtain long-lasting success. Primary occlusal contacts are the most important factor in preventing restoration fractures.

Occlusion should be assessed not only statically but also dynamically (Fig 1-13). Dynamic occlusion refers to the contact between the maxillary and mandibular incisors in protrusive and lateral movements of the mandible. Static and dynamic contacts are very important for determining restorative limits in anterior restorations. The contact surfaces of the anterior and posterior teeth should be examined carefully. Parafunctional movements, the greatest enemies of anterior restorations, should be suspected in the presence of signs of wear in these areas.

The safest occlusal relationship for anterior composite restorations is canine guidance or group function, both of which will provide a protective feature for the anterior restoration to be performed. In the case of performing multiple restorations, especially risky ones, equal contacts of the restorations should be ensured occlusally. If necessary, the canines should be included in the restorative planning to provide canine guidance for functional safety.

PARAFUNCTIONAL MOVEMENTS

The presence of parafunctional jaw movements should be evaluated carefully before performing restorative procedures. Clenching and grinding movements are significant threats to anterior restorations. Clinical signs of clenching and grinding include worn, flat, and shiny surfaces on the cusps of posterior teeth and abrasive lesions on the incisal edges of anterior teeth, especially the mandibular incisors and canines (Fig 1-14).

Advanced malocclusal contacts can be observed in the teeth as abfraction defects in the cervical area and may be characterized by gingival recession (Fig 1-15). In such cases, either canine guidance or group function should be ensured before restoration or the restoration should be designed to be as contact-free as possible during dynamic and static jaw movements. In addition to the restoration procedure, other preventive procedures, such as the application of masseter Botox to limit parafunctional movements or a night guard to limit irreversible damages, may be desirable.

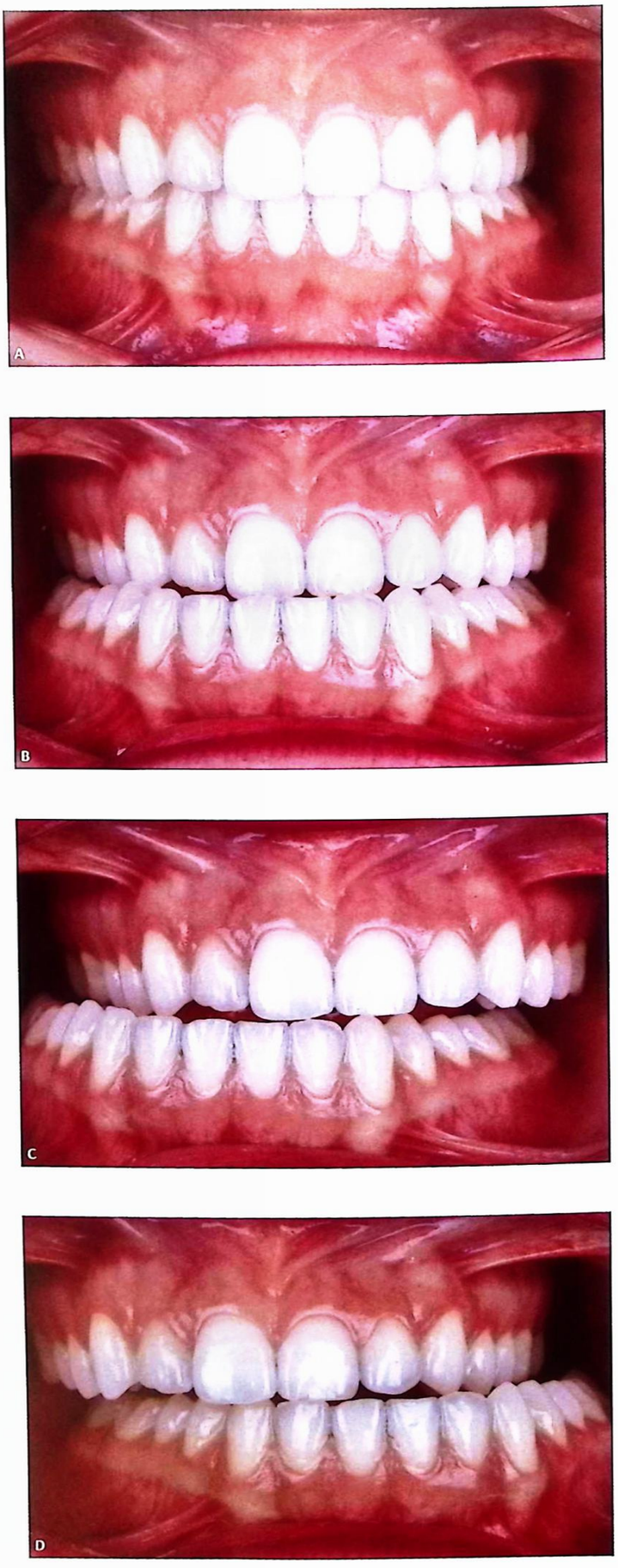

Fig 1-13 **(A)** Static occlusion. **(B)** Mandibular protrusion. **(C,D)** Mandibular lateral jaw movements.

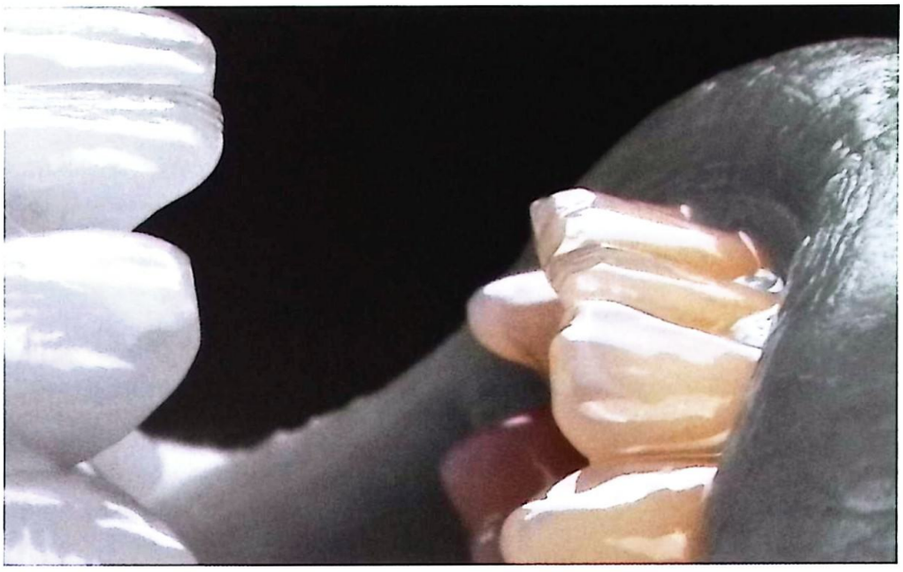

Fig 1-14 Abrasive lesions on incisal edges of mandibular incisors.

Fig 1-15 **(A,B)** Abfraction lesions on cervical area of maxillary incisors and canines due to malocclusion.

CONGENITAL ANOMALIES

Congenital anomalies such as missing teeth, microdontia, and macrodontia result in the most challenging restorative cases to treat (see Fig 1-6). If positional abnormalities are also present, it is best to perform multidisciplinary treatment planning of the case. The positions, torques, and angulations of the anterior teeth, the width of the cervical area of the tooth to be recontoured, the cervical gingival level, the zenith positions, and the occlusion should all be evaluated in detail. The first step in treatment should be correcting the positioning of the teeth via orthodontic tooth movement. Afterward, the gingival levels can be corrected with periodontal treatment if necessary. "Peg-shaped" lateral incisors (a common form of microdontia) can be easily restored without any dental preparation via this approach (see Fig 1-8B).

PREVIOUS RESTORATIONS

Any old restorations should be evaluated before new restorative procedures to determine whether there are any problems that cannot be solved with surface polishing. Fractures, marginal leakage, marginal surface discoloration, initial or secondary caries lesions, and marginal chipping may be observed in the mid- and long-term lifespans of anterior composite restorations. If these conditions are present at the onset of a new restorative plan, the first choice should be to completely replace the old restoration before placing the new one. However, in some cases, the old restorations can be repaired or modified following the minimally invasive removal of caries. The cervical periodontal health of the old restoration and the related emergence profile should be evaluated clinically and radiographically if needed. Restorations with an over-contoured emergence profile should be modified or completely replaced after effective operative field isolation (Fig 1-16).

The size of the old restoration and the presence of secondary caries lesions are also important factors to consider when deciding whether to completely remove or modify a restoration. If a restoration is large and would cover the majority of the crown following preparation, it might be better to plan a direct veneer restoration that covers the entire surface of the tooth rather than a partial restoration (Fig 1-17). That way, the number of restoration margins will be minimized and the danger of marginal chipping and discoloration may be prevented in the long-term.

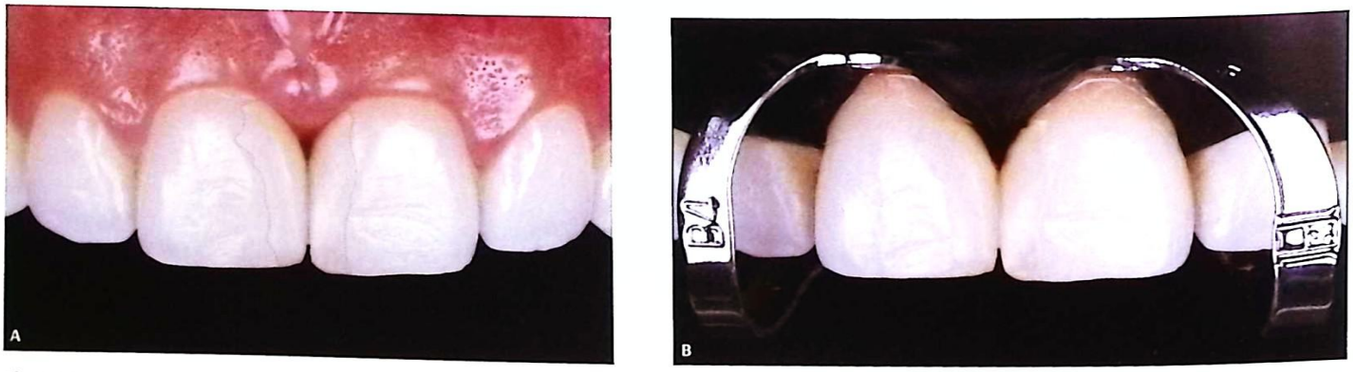

Fig 1-16 **(A)** Old diastema closure restorations with over-contoured emergence profiles between maxillary central incisors. **(B)** Excessive composite margins are visible at the cervical area after rubber dam isolation.

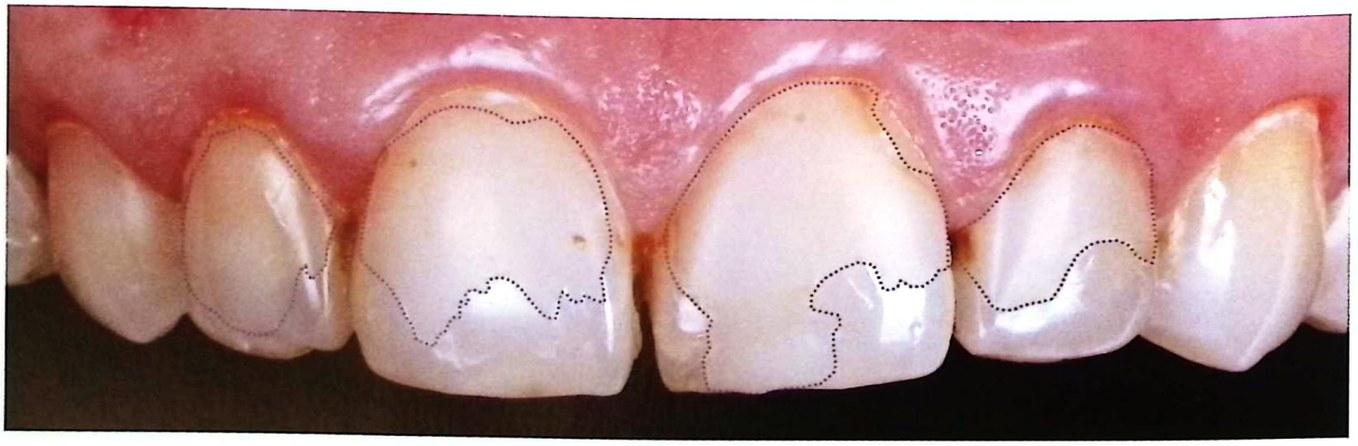

Fig 1-17 Surfaces of the old composite restorations.

Fractures smaller than half the size of the restoration are considered repairable fractures (score 5.4) according to FDI (Federation Dentaire Internationale) criteria, and repair of the restoration should be performed in such cases. The composite repair protocol must be followed (see chapter 9). If the fracture is larger than half of the restoration (FDI score 5.5), the restoration must be replaced.

CARIOUS LESIONS AND WHITE LESIONS

All primary and secondary caries lesions should be included in the preparation for the restoration procedure. However, tertiary dentin lesions and white lesions may or may not be included in the preparation depending on the case. Tertiary dentin is a dark, shiny, and hard surface of repaired dentin tissue. It is often characterized by abrasions in the cervical area and does not need to be removed unless detected with the caries detector. The colored surface of these lesions is also very difficult to mask during restorative layering procedures, so usually the depth of the preparation should be increased for the application of a resin-based masking agent.

White lesions are hypomineralized areas in enamel tissue or initial caries lesions (white spot lesions) that may also be associated with brown caries lesions in more advanced stages (Fig 1-18). Resin infiltration (see chapter 2) should be the first choice for the treatment of these lesions. Alternatively, a direct restoration can be performed by completely removing the lesion by preparation and beveling the surrounding enamel tissue. However, it should be kept in mind that this option may require a very deep and wide dental preparation, which is not in keeping with conservative treatment.

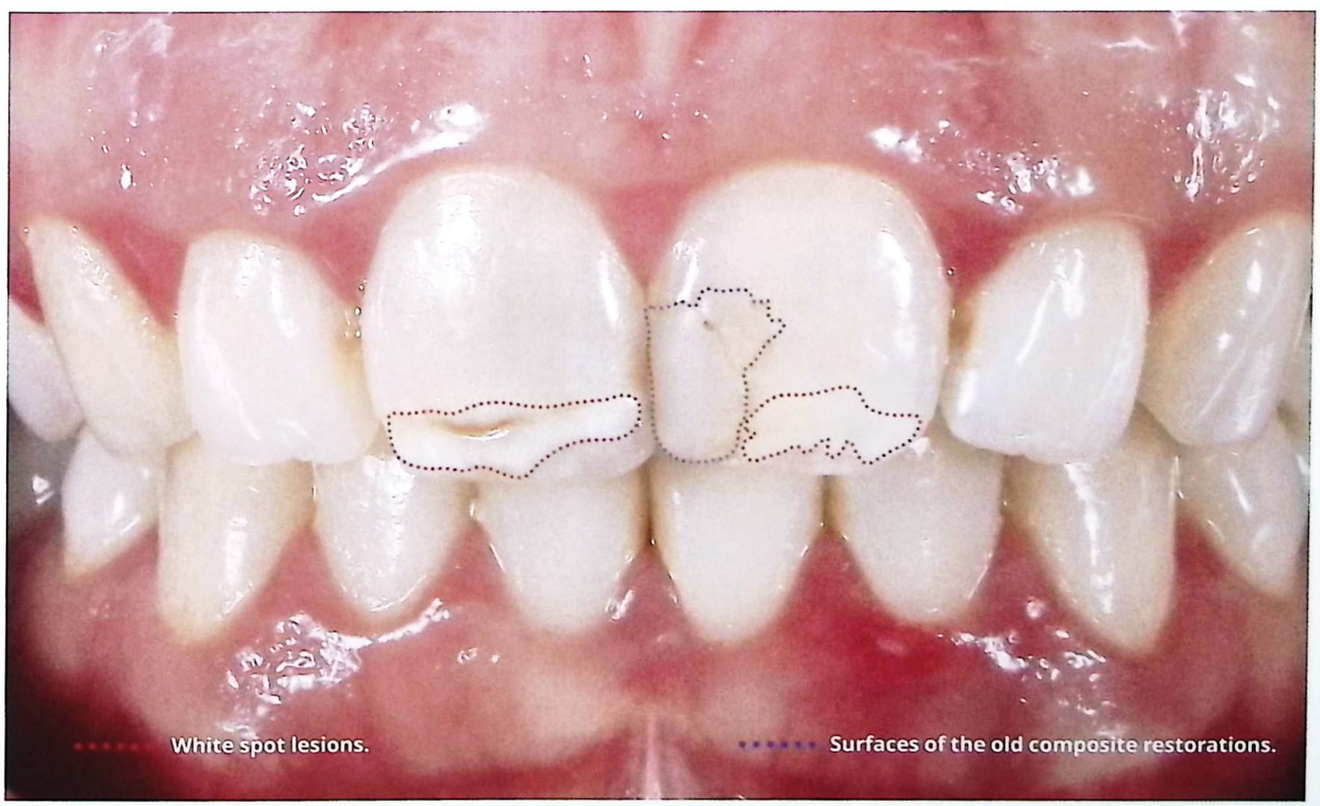

Fig 1-18 White spot lesions and old composite restorations located on the labial surfaces of maxillary central incisors.

DISCOLORATIONS

The restoration of discolored teeth is challenging. First, the type of discoloration, whether internal or external, should be considered.

External discolorations are found on the surfaces of teeth and are usually treatable with vital bleaching (Fig 1-19). The diagnosis must be accurate, and if bleaching is required, it should be performed before restorative treatment. Resin-based restorative materials can't be bleached like natural dental tissues after restorative procedures, and this should be considered during the treatment planning phase. Recently, it was claimed that some monoshade universal composite materials can be used to adjust the color of the surrounding dental tissues even after the bleaching. However, there is no published long-term clinical study regarding this topic yet. Therefore, it is best to recommend vital tooth bleaching to the patient before the restorative procedure, even if the patient does not request it. Likewise, patients who request bleaching following anterior direct restoration should be informed that existing restorations may need to be replaced after the procedure for the sake of color matching.

Intrinsic discolorations are discolorations in the structure of teeth. These discolorations are often present in teeth that have undergone root canal treatment and can usually be treated via nonvital bleaching procedures. Effective nonvital bleaching is crucial in cases of intrinsic discoloration, both for color matching and for the clinical success of the restoration. Cases in which nonvital bleaching is unsuccessful or contraindicated are among the most challenging restorative cases to perform. This is because it is very difficult to achieve shade matching in a single visit, even with the most advanced materials and techniques. The patient should be informed about this in detail during the restorative planning phase, and they should understand that multiple visits may be required to successfully achieve color matching of the restoration (Fig 1-20).

Restorative procedures should not be performed right away in patients who have undergone vital and/or nonvital bleaching. The minimum time to wait is 2 weeks after the last bleaching appointment. There are two reasons for this: (1) The pH of the tooth surface decreases following the bleaching procedure, which will impact effective adhesion, and (2) the whiteness of a tooth directly after bleaching may darken slightly, resulting in an inappropriate composite shade if selected in the early period. As a result, it is necessary to wait at least 2 weeks before restoration for better dental adhesion and more accurate composite shade selection.

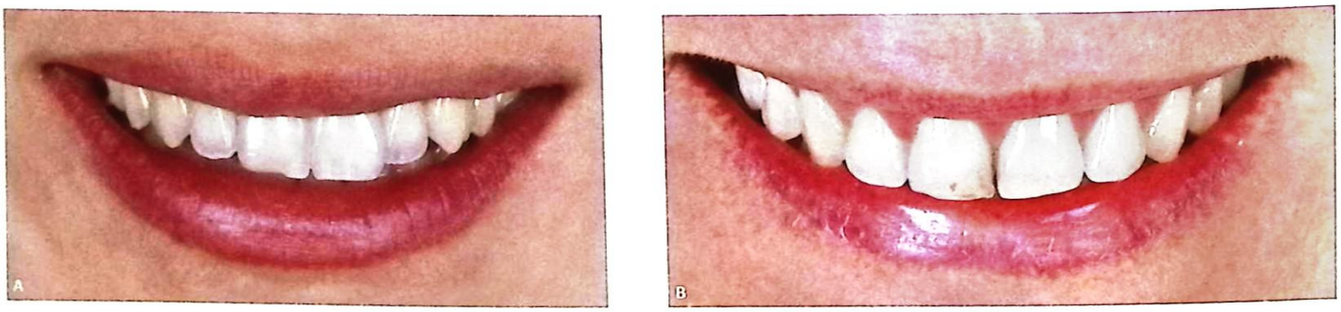

Fig 1-19 **(A,B)** Extrinsic discolorations on maxillary anterior teeth.

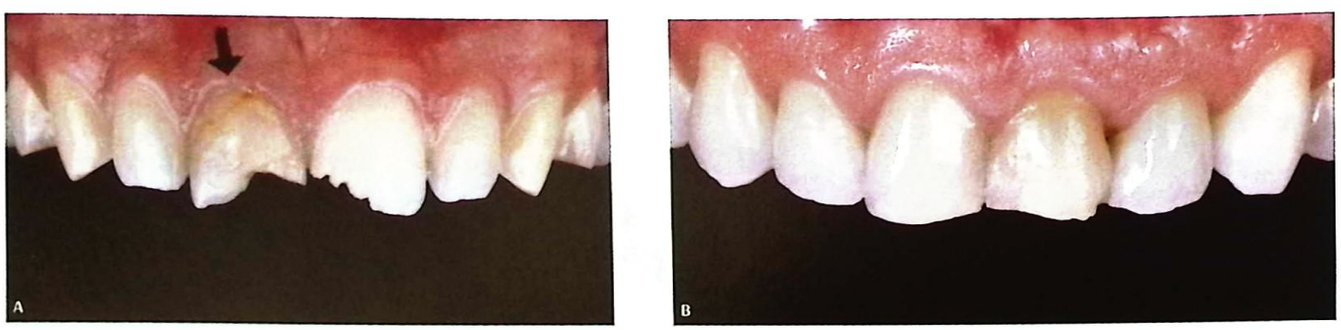

Fig 1-20 **(A,B)** Intrinsic discolorations on maxillary central incisors.

INCISAL OPTICAL CHARACTERISTICS

Light is reflected differently depending on the type, thickness, and optical properties of the dental tissues (enamel and dentin) in anterior teeth. Variations in the opacity/translucency of teeth is visible mainly at the incisal edges. These variations at the incisal edges are called incisal optical characteristics, or mamelon and halo effects. (Fig 1-21). The shape and prominence of the mamelons varies depending on the patient and even on the tooth. Dehydration of dental tissues during procedures may also significantly affect the prominence of these optical characteristics. Dehydration occurs with every dental procedure that causes the dental tissues to dry, and the results of dehydration are perceptible after only 2 minutes. The level of dehydration in dental tissues is directly proportional to the level of opacity in the shade of a tooth. As a result of dehydration, tooth color is perceived as whiter and the mamelons are temporarily less obvious.

Dental tissues that have been dehydrated for less than 30 minutes require approximately 30 minutes to rehydrate. Teeth that have been dehydrated for a longer period require 24 hours to completely return to their original color. Failure to determine the color of a tooth accurately after the first 2 minutes may result in a wasted appointment or, even worse, total failure of the restoration. Therefore, selecting the tooth shade and recording the incisal optical characteristics should be the first things done at a restoration appointment. Incisal optical characteristics can be noted visually, by pencil drawing, or with dental photography using a dental contraster on the tooth to be restored or on the adjacent/symmetrical tooth within the first 2 minutes of treatment (Fig 1-22).

Fig 1-21 Incisal optical characteristics (mamelon and halo effects) on incisal edges of maxillary incisors.

SELECTION OF DIRECT/INDIRECT RESTORATION TYPE

With recent developments in resin-based composite materials, polishing materials, and restoration techniques, the long-term clinical survival of anterior direct restorations is similar to that of indirect restorations. Direct composite restorations have become a much more minimally invasive and durable treatment option, especially when appropriately indicated following pre-restorative short-term treatment with clear aligners. Composite repair and repolishing procedures are one of the main advantages of direct composite restorations, and the mid-term clinical success rate of these restorations is 90% to 100% when not considering the need for these repairs as restoration failure. Performing these restorations when appropriately indicated and selecting the proper materials and techniques can minimize potential complications, such as fracture of the restoration and discoloration of the restorative material.

The clinical success rates and advantages of indirect composite and ceramic restorations, however, should not be ignored. The most appropriate treatment for the patient should be planned individually with the proper material and an effective technique according to the indications. In cases where both direct and indirect restorations are indicated, the patient should be informed of the details of each alternative treatment plan, and their expectations should be considered. Anterior direct composite restorations are minimally invasive or noninvasive treatment options that require regular follow-ups. Generally, the placement of a direct anterior restoration takes an average of 1 hour per tooth. All components of the restoration procedure (material and shade selection, consideration of the adhesion and surface morphology, and surface polishing and occlusion) are performed by a single clinician. Because this is such a complicated procedure, it is more realistic to consider indirect restoration as the first choice for cases where multiple restorations with invasive preparations are indicated or when patient follow-up is not possible.

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