Chapter 11

Conservative treatment of carious lesions in pediatric dentistry

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Introduction and etiology of carious lesions

Carious pathology is a chronic degenerative process of multifactorial etiology defined as a transmissible disease. It affects the dental hard tissues and is initially characterized by infection and thereafter by demineralization of the affected tissues, resulting in cavity formation.

The process of the development of carious lesions requires the coexistence of three components that are temporally interrelated:

- presence of cariogenic bacteria with acidifying characteristics in the plaque
- substances promoting bacterial growth and adhesion that act as a metabolic substrate for acid formation (carbohydrates)
- host-related factors.

At the oral cavity level, the presence of saliva causes the enamel surface to be covered with acquired salivary pellicle, which is characterized by the presence of some glycoproteins and mucus. In addition, there are numerous microorganisms that form a mucobacterial plaque, which in turn can adhere to the salivary pellicle. The presence of this substrate is considered to be physiological, and its shift toward disease depends on the duration for which it has been present on the tooth surfaces, which can favor the accumulation of pathogenic bacterial colonies (Fig. 11.1).

The bacteria most commonly found in pathogenic plaque are *Streptococcus mutans* and *Lactobacillus*, which have acid-producing and acid-tolerant features, respectively. Two components are evident within the bacterial plaque: the corpuscular fraction, i.e., bacteria, leukocytes, and epithelial cells, and the amorphous fraction, i.e., salivary glycoproteins and dietary carbohydrates. As can be seen, the crucial factor in the process of caries development is diet and, therefore, the consumption of rapidly fermentable substances such as carbohydrates.

Because carious lesions are the result of enamel demineralization, it is important to consider the pH of the tooth surface itself. The critical pH value is 5.5, and the presence of glucose-6-phosphate hydrolase, a bacterial enzyme, may decrease the pH, initiating the decalcification of the hydroxyapatite in the enamel.

Figure 11.1 Evaluation of plaque on dental surfaces.

Diagnosis

International Caries Detection and Assessment System (ICDAS) method

The diagnosis of caries is based on the history of the lesion present on the tooth surface at the time of clinical examination and does not provide indications on the future course of the disease.

To prepare an adequate treatment plan for dental caries, it is necessary to implement an appropriate diagnostic system because different intervention criteria are set based on the severity of the lesion.

The diagnostic means most widely used to record carious lesions are as follows:

- direct observation
- delicate probing of the tooth surface (WHO-CPI-PSR probe) (Fig. 11.2)
- bitewing radiographs.

Figure 11.2 WHO-CPI-PSR probe.

The use of low-magnification optical systems and alternative techniques such as fiber-optic transillumination and fluorescence laser is useful and desirable.
Physical examination of the hard tissues should be performed under suitable lighting, and the tooth surface should be observed after thorough cleaning, first wet and then after air-drying, because the refraction difference between a portion of healthy and demineralized enamel is greater when saliva is removed from the porous enamel.
In case of uncertainty or to confirm the visual inspection findings, a WHO-CPI-PSR probe should be used gently along the tooth surface to evaluate its roughness (demineralization) or the presence of a minimal cavity limited to the enamel. The spherical end of the probe is slid along the suspect surface; a limited discontinuity is detected if the probe tip "drops" into the enamel surface lesion. The use of a sharp probe (sickle probe) is not advisable: if "pressed" on a sub-surface lesion, it can cause irreversible damage, favoring cavitation.

ICDAS codes

- 0: sound tooth surface (Fig. 11.3)
- 1: initial enamel lesion visible on the tooth surface after drying (Fig. 11.4)
- 2: enamel change visible even when the surface is wet (Fig. 11.5)
- 3: cavitated enamel lesion without dentinal involvement visible through the enamel (Fig. 11.6)
- 4: underlying dentinal shadow visible through the enamel with or without localized enamel damage (undermining caries) (Fig. 11.7)
- 5: frank cavitation with dentin exposure (Fig. 11.8)
- 6: cavity with extensive dentin exposure (Fig. 11.9).

Figure 11.3 ICDAS index 0: sound surface.

Figure 11.4 ICDAS index 1: initial enamel lesion (visible only after prolonged drying of the tooth and confined to furrows and fissures).

Figure 11.5 ICDAS index 2: clear and clearly visible enamel change.

Figure 11.6 ICDAS index 3: localized cavitated enamel lesion without visible signs of dentinal damage.

Figure 11.7 ICDAS index 4: area of underlying dentinal shadow visible through the enamel.

Figure 11.8 ICDAS index 5: frank cavitation with dentin exposure.

Figure 11.9 ICDAS index 6: destructive lesion with dentin exposure.

Sound tooth surface: code 0. Absence of obvious signs of caries and/or altered enamel translucency after prolonged drying (5 seconds). If tooth surfaces exhibit developmental defects, such as enamel hypoplasia, fluorosis, tooth wear (attrition, abrasion, and erosion), or intrinsic or extrinsic stains, they are coded as sound (Fig. 11.3).

Initial enamel lesion visible on the surface after tooth drying: code 1. On wet tooth surfaces, discoloration attributable to carious activity is not evident; however, after prolonged drying, an opacity (white or brown lesion) that is not consistent with the clinical appearance of sound enamel is visible (Fig. 11.4).

Enamel change visible even when the surface is wet: code 2. An opacity (carious lesion) or discoloration (white or brown lesion) not consistent with the clinical appearance of sound enamel is visible on both wet and dry tooth surfaces. When the lesion affects the mesial or distal smooth surfaces, it can be seen directly via either buccal/labial or palatal/lingual observation. In addition, via occlusal observation, this opacity or discoloration may appear as a shadow confined to the enamel seen through the marginal ridge (Fig. 11.5).

Cavitated enamel lesion without dentinal involvement visible through the enamel: code 3. Presence of an intense opacity on wet tooth surfaces caused by the carious lesion (white spot) and/or brown discoloration wider than natural fissures or pits.
After drying, a lack of continuity is seen on the smooth enamel surface, indicating demineralization. Fissures and pits may appear wider than normal, but there is neither dentin exposure on smooth surfaces or at the base of the cavity nor discontinuity.
In case of uncertainty or to confirm the visual inspection findings, a WHO-CPI-PSR probe should be gently slid along the tooth surface to confirm the presence of a cavity apparently confined to the enamel. The spherical end of the probe slides along the junction; a limited discontinuity is detected if the probe tip “drops” into the lesion present on the enamel surface (Fig. 11.6).

Underlying dentinal shadow visible through the enamel with or without localized enamel damage (undermining caries): code 4. A dentinal shadow is present on the wet tooth and is visible through the apparently sound enamel (loss of continuity but without exposure of the underlying dentin). This shadow, which is more visible when the tooth is wet, presents itself as an intrinsic bluish, grayish, or brownish stain that must be clearly associated with a carious lesion of the tooth tissue. If the examiner believes that the carious lesion initially developed on an adjacent surface and no evidence of lesions on the smooth surface of the tooth being examined is found, code “0” will be assigned to this surface (Fig. 11.7).

Frank cavitation with dentin exposure: code 5. Cavitation of the opaque enamel and/or discoloration (white or brown) of the exposed dentin visible at clinical examination. In case of uncertainty, the WHO-CPI-PSR probe is used to confirm the presence of a cavity in the dentin. This is achieved by sliding the round tip of the probe along the surface: any cavity in the dentin is detected when the ball tip of the probe enters into the lesion gap (Fig. 11.8).

Cavity with extensive dentin exposure: code 6. Obvious loss of tooth structure, with a large and deep cavity in which the dentin is clearly visible both on the walls and the bottom. The marginal ridge may not be present. The cavity involves at least half the tooth surface and can possibly reach the pulp (Fig. 11.9).

Isolation of the operative field

In the field of dentistry, many treatment procedures require isolation of the operative field for various reasons (Fig. 11.10). In pediatric dentistry, the importance of isolation is related not only to the use of specific materials but also to the less capacity of children to control swallowing, thereby preventing accidental ingestion of foreign bodies (burs, endodontic instruments, etc.). A well-positioned dam also protects soft tissues from contact with irritating and unpleasant substances (etchants). In addition to protecting the young patient, the use of rubber dams has some advantages for the clinician as well: good visibility of the operative field, absence of saliva and therefore of bacterial contamination during the procedures, and better outcomes.

Figure 11.10 Instruments for operative field isolation.

Unfortunately, the use of rubber dam is sometimes not possible in pediatric dentistry because of incompletely erupted or badly positioned dental elements or the lack of cooperation of the child. In such cases, clinicians should implement all available procedures to make the operative field as suitable as possible for treatment, such as using suction, dental cotton rolls, and liquid dams.
Rubber dam sheets are made of latex and are available in various thicknesses, giving them different elasticity and isolating ability. The most commonly used thicknesses are medium (0.2 mm) and heavy (0.25 mm) depending on whether the procedure involves anterior or posterior regions of the dental arches. Dam positioning entails the use of devices such as the rubber dam punch, which has a tip that makes clear and precise holes when inserted into the holes in a rotating disc on the opposite handle. The holes on the disc have different diameters, allowing the most appropriate adaptation to the dental anatomy. After positioning, a Young frame keeps the sheet stretched. To place clamps on dental elements, clamp forceps are required, and finally, the use of a waxed dental floss is essential for both the insertion of the dam into the interdental spaces and ligation of the dental elements. Clamps or hooks have the essential role of keeping the dam fixed on dental elements; they are selected in accordance with the position of the dental element in the arch and its anatomy and the type of isolation required. Clamps feature different shapes that allow an optimal positioning on all dental elements (molars, premolars, and anterior teeth). When testing the selected clamp on the dental element, especially in the case of a pediatric patient, it is advisable to secure the clamp to a piece of dental floss tied to the buccal hole to allow quick recovery if it were to fall into the oral cavity. It is possible to isolate multiple dental elements by ligating the elements adjacent to the clamped one using dental floss. There are various operative techniques for rubber dam positioning; however, in pediatric dentistry, the use of winged clamps is preferred as it is possible to assemble the clamp and dam outside the oral cavity and apply them simultaneously on the dental element to be treated. When removing the dam after completing the restoration, care should be taken to remove any residue from the interdental spaces.

Operative procedures

Noninvasive dentistry

The treatment of noncavitated carious lesions in both permanent and deciduous dentition involves a noninvasive approach and aims to arrest or reverse the pathological process of caries to avoid the application of conservative restorations with varying degrees of complexity. This result is achieved via methods that can be used in both a professional setting and at home:

- daily brushing (at least twice a day) with a toothpaste promoting enamel remineralization/repair (containing fluoride, hydroxyapatite, or similar substances)

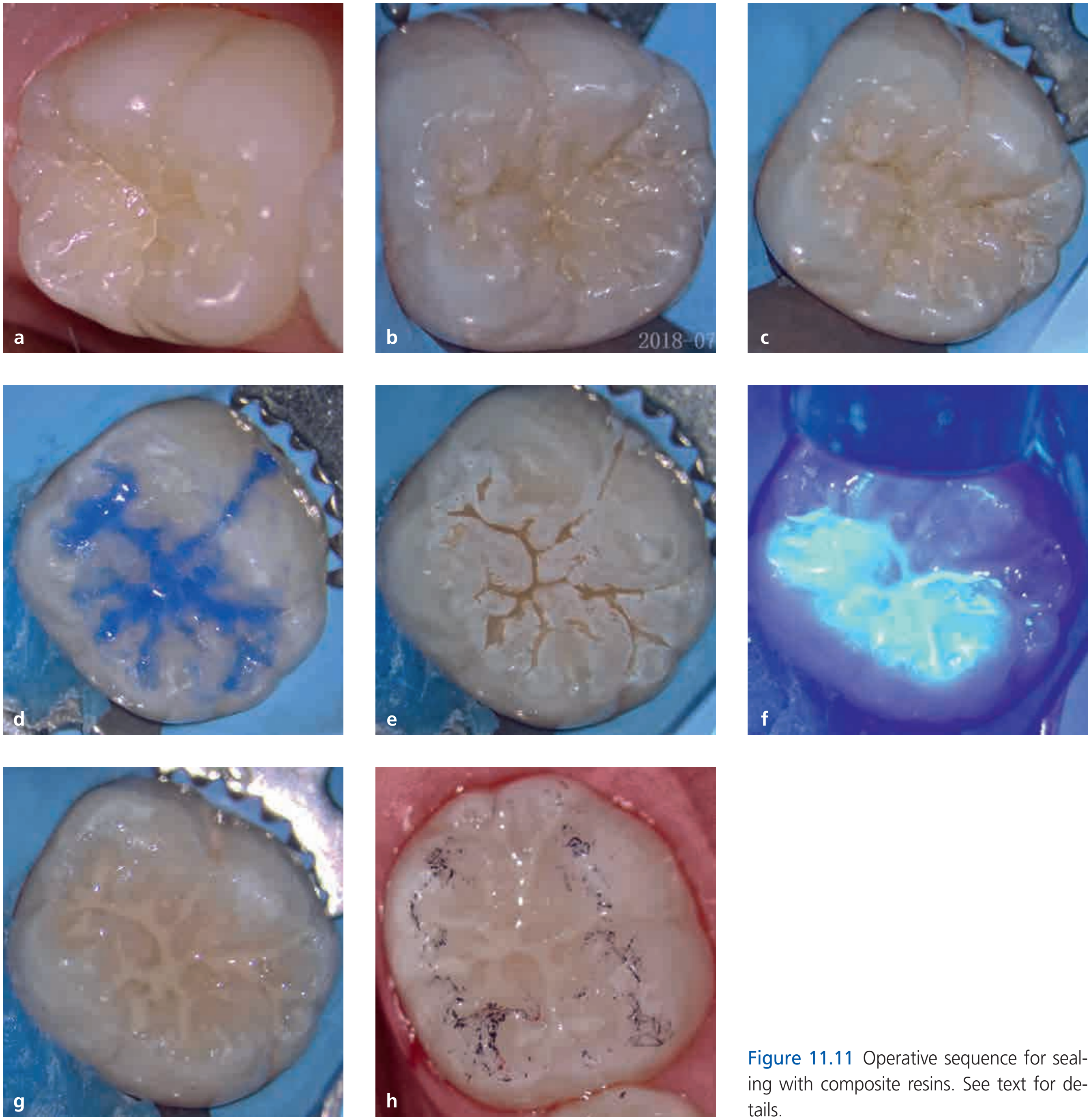

Figure 11.11 Operative sequence for sealing with composite resins. See text for details.

- use of a gel or mousse containing fluoride and/or casein products (casein phosphopeptide–amorphous calcium phosphate [CPP–ACP])
- professional topical application of varnishes and lacquers or gels with high fluoride concentration (see Chapter 6)
- pit and fissure sealing.

Pit and fissure sealing (ICDAS codes 0-1 and 2). Clinical diagnosis of caries is based on the absence of obvious signs or the presence of demineralized enamel (white spots or brown discoloration) at the bottom of occlusal or buccolingual pits, fissures, or fossae, with a clear change in enamel translucency after prolonged drying (5 seconds). Molar pits or fissures, particularly in permanent dentition, are the sites where carious lesions are most frequently found. Caries prevention in these sites is one of the fundamental objectives of pediatric dentistry. A 15-year longitudinal study showed that pit and fissure sealant treatment reduces the onset of caries by 62% (Simonsen, 1991). The Italian national guidelines for the promotion of oral health and the prevention of oral diseases in children and adolescents (Recommendation No. 3 - Update November 2013) state that "sealants are indicated for all children and adolescents, although the greatest benefits are achieved in subjects and dental elements at high risk of caries," and recommend clinical assessment every 6–12 months to verify tooth integrity.

Currently, two types of *sealant* materials are used: composite resins and glass ionomer cements (low- or high-viscosity). Resin *sealants* have a greater retention than low-viscosity glass ionomer cements, but their ability to prevent tooth decay depends on moisture control in the operative field. Therefore, in cases of barely erupted teeth (in patients at high risk of caries) or badly positioned teeth, which are therefore difficult to isolate, the use of low-viscosity glass ionomer cements is recommended.

Sealing with composite resins: operational sequence

- Isolate the operative field using a rubber dam (Fig. 11.11a, b)
- Cleanse the tooth surface thoroughly, avoiding fluoridated and/or oily products.
- Rinse with air and water sprays to remove any material residue (Fig. 11.11c)
- Etch the tooth with 37% orthophosphoric acid for 30 seconds and then rinse the treated surface thoroughly (for at least 30 seconds) (Fig. 11.11d)
- Dry the surgical field and the treated enamel thoroughly to obtain optimal drying of pits and fissures (Fig. 11.11e)
- Apply a thin layer of sealant on the pits and fissures
- Cure and evaluate resin hardening and integrity (Fig. 11.11f)
- Verify that the sealant extends over all pits and fissures, and evaluate its degree of retention (Fig. 11.11g)
- Remove the dam and check the occlusion (Fig. 11.11h).

Clinical case

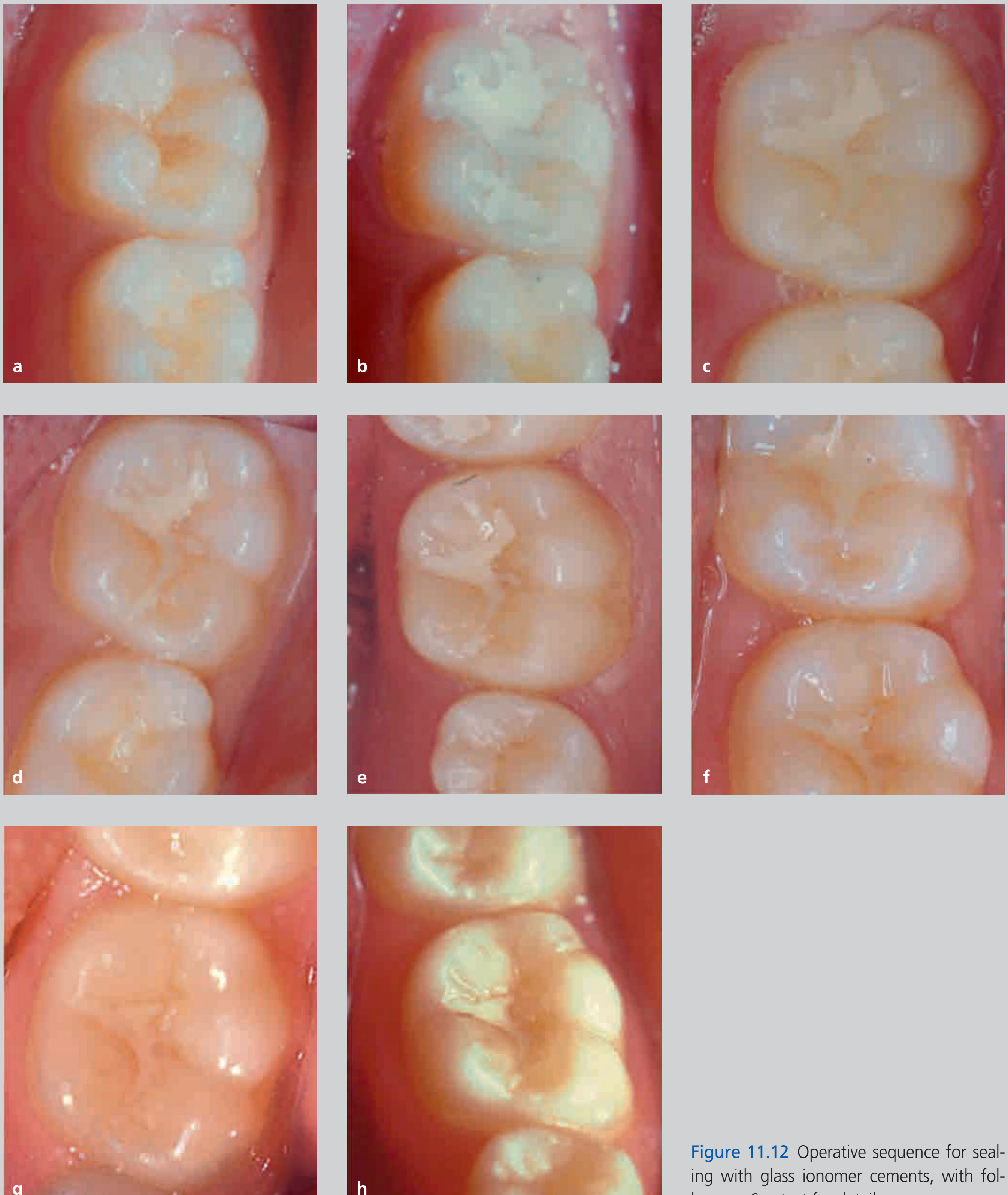

Figure 11.12 Operative sequence for sealing with glass ionomer cements, with follow-up. See text for details.

Sealing with glass ionomer cements: operational sequence

- Isolate the operative field using cotton rolls and surgical suction
- Cleanse the tooth surface thoroughly, avoiding fluoridated and/or oily products
- If required, use a conditioner
- Rinse with air and water sprays to remove any material residue
- Dry the surface without drying it out completely (because cement adhesion is better on moist enamel)
- Apply the cement and cure for the time specified by the manufacturer (approximately 30 seconds)
- Verify that the cement extends over all pits and fissures, and evaluate its degree of retention
- Evaluate the occlusal relationship with the antagonist.

See the clinical case described in Figure 11.12.

Minimally invasive dentistry

Minimally invasive dentistry comprises all treatment protocols involving the removal of carious tissue with the utmost respect for and preservation of healthy dental tissues. When proceeding with the esthetic functional rehabilitation of dental elements affected by the caries process, it is necessary to account for the extension of the carious lesion because operative techniques may vary depending on the anatomical part to be reconstructed. However, there are significant differences regarding the materials used in deciduous dentition compared to permanent dentition. Notably, despite considering glass ionomer cements and compomers to be useful in some restorative situations, many authors use composite resins for restorations in the posterior regions.

Selective enameloplasty plus sealing (PRR-1 by Simonsen, 1977–1980) (ICDAS code 3)

The treatment of small carious lesions on the occlusal surface through selective enameloplasty and fissure sealants (Fig. 11.13) is indicated when there is an intense opacity on the wet tooth, such as white spots, and/or a brownish discoloration wider than natural pits and fissures.

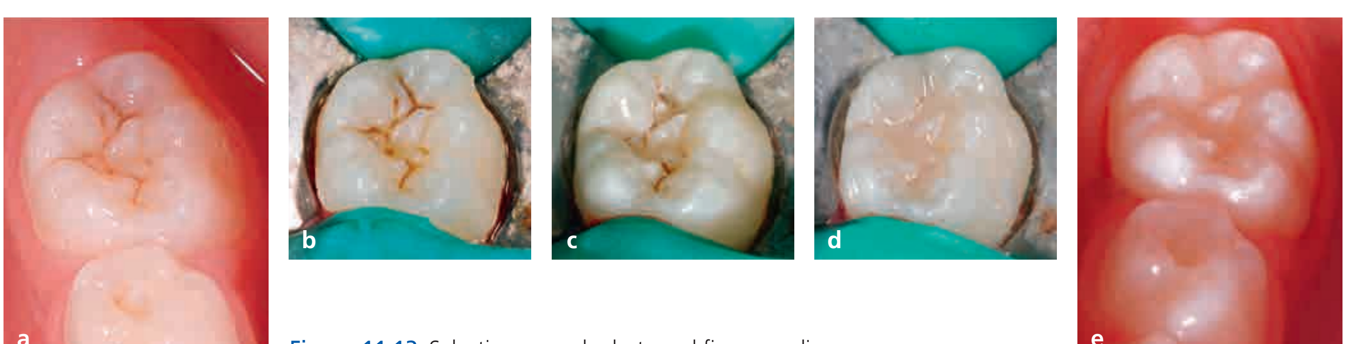

Figure 11.13 Selective enameloplasty and fissure sealing.

After drying, a lack of continuity is seen on the smooth enamel surface, indicating the presence of significant demineralization. Pits and fissures may appear wider and more open than normal, but there is no discontinuity or dentin exposure on the smooth surfaces or at the base of the cavity.

Operative sequence

- Isolation of the operative field using a rubber dam
- Thorough cleansing of the tooth surface using nonoily pumice and a bicarbonate jet
- Rinsing of tooth surfaces with air and water sprays to remove porous residues
- Opening of small cavities on the affected fissures
- Etching with 37% orthophosphoric acid for 30 seconds, followed by copious rinsing of the treated surface for at least 30 seconds
- Drying, followed by the application and polymerization of an appropriate adhesive system
- Application of a thin layer of sealant on pits and fissures
- Polymerization for 20 seconds (evaluation of the complete setting of the resin and its retention)
- Dam removal and occlusal check.

Preventive Resin Restorations (PRR-2 by Simonsen, 1977-1980) (ICDAS code 4)

Preventive resin restoration (PRR) is indicated when the wet tooth shows a dentinal shadow that is visible through the apparently sound enamel, which can appear without signs of localized enamel cavitation (Fig. 11.14).

The first operative step is selection of the color to be used for the restoration (Fig. 11.14a), followed by the isolation of the operative field using a rubber dam, which is always necessary when using composite resins (see Fig. 11.14b). The next step is a thorough cleansing of the tooth using a brush, water and pumice, or a bicarbonate jet. Access to the carious lesion involves the use of coarse-grained (100 μm) diamond-coated micro burs under copious irrigation, and care should be taken not to engage enamel tissue that is not affected by the caries process. Selectivity is also necessary when removing the underlying demineralized dentin, and a rosette burr should be used, preferably a tungsten carbide one. Once the complete removal of the decayed tissues has been achieved, the finishing of the resulting cavity is carried out using a fine-grained (40 μm) diamond-coated burr, preferably mounted on a multiplier handpiece, always with copious irrigation (Fig. 11.14c). The following steps describe the preparation of the substrate that will receive the adhesive system and filling material. The conditioning of the surface varies according to the tissue to be treated. Enamel consists of a mineral phase that contains large hexagonal crystals of hydroxyapatite comprising calcium phosphate salts. These crystals form enamel prisms; in 1955, Buonocore understood the need to treat this surface with acids (etching) to transform a smooth and polished surface into an irregular one, increasing its free energy and facilitating capillary infiltration of liquid acrylic resins. The material of choice for enamel etching is 37% orthophosphoric acid, applied for 30 seconds (Fig. 11.14d). The second tissue to be conditioned is the dentin, the preparation of which, performed using rotating instruments, leads to the formation of a *smear layer* on the surface and *smear plugs* at a deeper level (organic and inorganic debris). The presence of debris reduces the permeability of the dentin; etching with 37% orthophosphoric acid for 15 seconds allows its demineralization as well as debris removal (Fig. 11.14e). After 30 seconds, etched surfaces are rinsed, taking care to remove the acid completely, using air and water sprays for at least 30 seconds (Fig. 11.14f). Following cavity cleansing, any excess liquid in the operative field should be removed and the tooth should be dried using suction to avoid the complete dehydration of the dentinal substrate and the collapse of collagen fibers within the tubules (Fig. 11.14g). Such cavity treatment allows the subsequent adhesive procedures to be performed using the *wet technique*, involving application of the primer for 30 seconds (Fig. 11.14h). Once the tissue is primed, the primer is spread with light air blow (see Fig. 11.14i) and then polymerized using halogen light for 40 seconds at

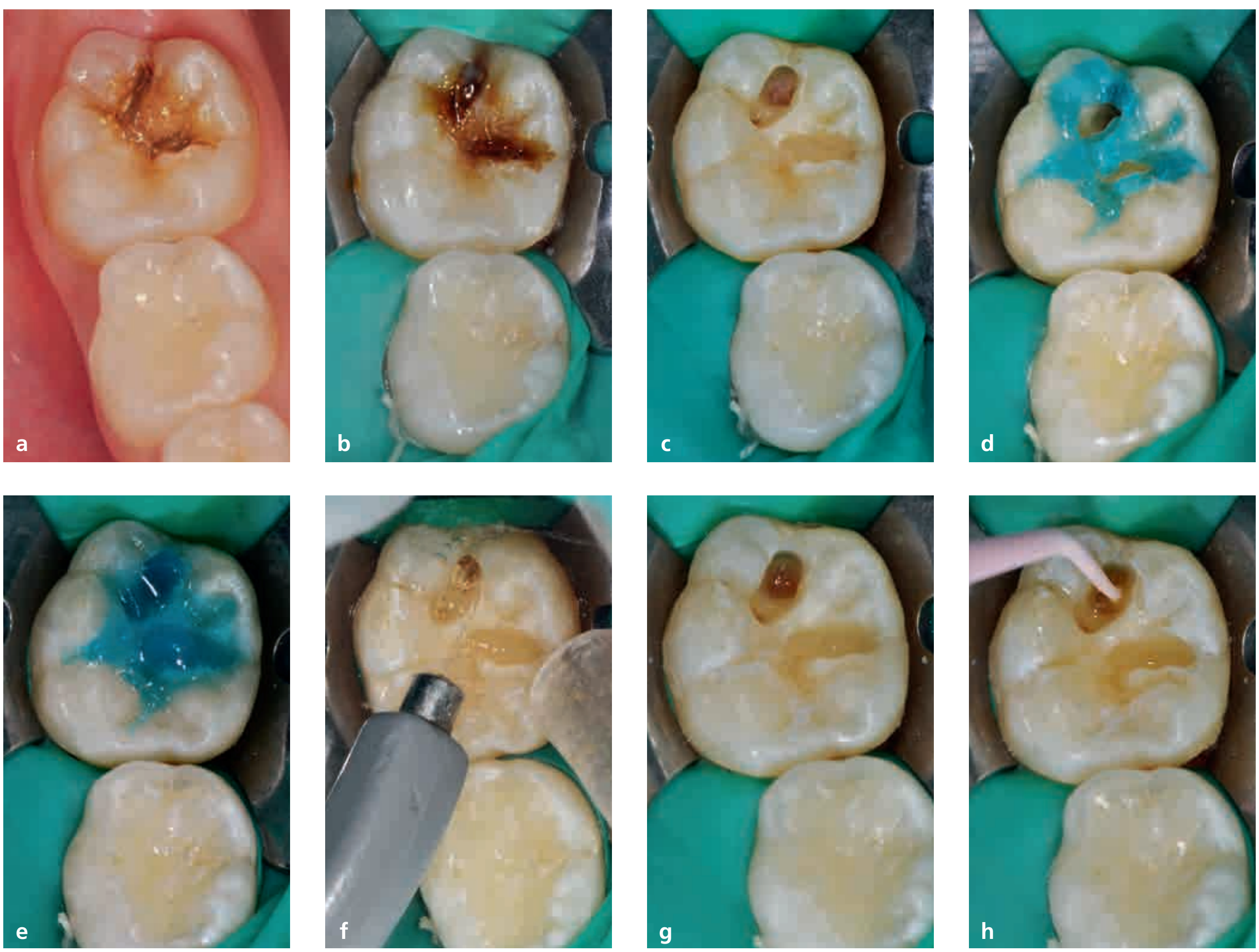

Figure 11.14 (**a–u**) Preventive resin restoration. See text for details.

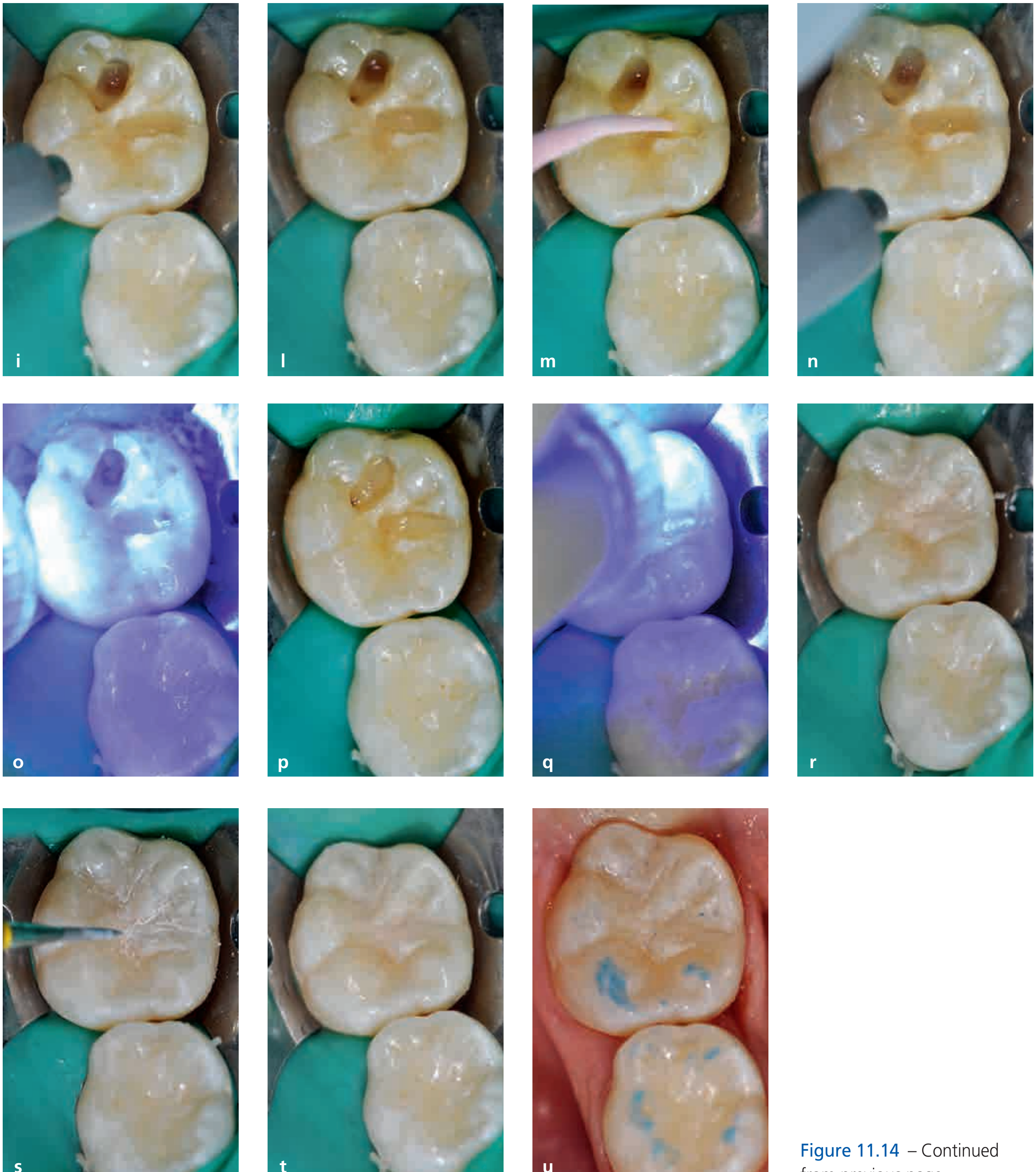

Figure 11.14 – Continued from previous page.

standard power (Fig. 11.14l). The steps for application of a bonding agent are the same (Fig. 11.14m–o). Occlusal anatomy restoration requires anatomical stratification (Fig. 11.14p). The application should be incremental, with each increment polymerized for 40 seconds (Fig. 11.14q). Once the restorative phase is completed (Fig. 11.14r), any excess material can be removed using a fine-grained (20 μm) diamond-coated burr (Fig. 11.14s). After removal of the rubber dam and evaluation of the occlusal contact (Fig. 11.14t), the last steps are smoothening with the silicone rubber, polishing with the brush and diamond paste, and final finishing with the felt pad and aluminum oxide paste.

Atraumatic restorative treatment (ICDAS codes 5-6)

Atraumatic restorative treatment (ART) is an interim therapy preceding definitive restoration (Fig. 11.15). The fundamental principle of this type of intervention is identification of an "affected" dentin layer below the "infected" and discolored dentin, which is often soft and pigmented but not infected (Fusayama, 1979). This technique allows the stabilization of active carious lesions using manual tools to remove the severely weakened enamel and infected dentin.

The "affected" dentin can be remineralized using fluoride-releasing glass ionomer cements (indirect pulp capping), thereby allowing a minimal amount of tissue to be removed (owing to limited enamel and dentin thickness of deciduous molars) and reducing intervention times (in noncooperative patients). This method is widely used in developing countries, where it is even performed by dental auxiliary personnel or in situations with poor availability of dental equipment.

It is important to remember that the child should be checked regularly to prevent any occurrence of complications and to schedule the placement of final restoration as soon as possible.

Indications:

- caries extended to dentin
- no pulp involvement
- access to the lesion possible using manual instruments.

Contraindications:

- carious lesion with pulp exposure
- access difficult using manual instruments.

Operative sequence

- Plexus or nerve block anesthesia (Fig. 11.15a)
- Isolation of operative field using cotton rolls and suction or using a rubber dam if possible (Fig. 11.15b)
- Tooth surface cleansing using sterile cotton pellets
- Removal of infected dentin using manual instruments, starting from the cavity walls and taking care to remove all the caries from the enamel–dentin junction to prevent the progression of the lesion and ensure a good marginal seal (Fig. 11.15c)

- Subsequent removal of dentin from the cavity floor to reduce the patient's sensitivity and discomfort during excavation
- Cleansing of the residual dentin surface and occlusal and lateral cavity surfaces following completion of the excavation phase by rubbing a brush soaked in a weak acid (conditioner) for 10–15 seconds (Fig. 11.15d)
- Rinsing with saline solution and drying of all treated surfaces using a sterile cotton pellet

Figure 11.15 (**a–g**) Atraumatic restorative treatment.

- Preparation of glass ionomer cement and application in the cavity in large amounts, exerting slight pressure to allow the best possible adaptation to cavity walls (Fig. 11.15e, f)
- Removal of any excess cement, evaluation of occlusal contact, and application of a varnish on the surface to prevent water uptake or loss (Fig. 11.15g).

Restorative dentistry

Restorative treatment aims to restore the anatomical features of teeth that are altered by caries or trauma. Dental tissue restoration must reproduce the original shape and size of the tooth while maintaining the healthy tissues and reducing the risk of secondary caries. With regard to materials currently used in pediatric dentistry, the authors' choice tends toward the use of composite resins, whereas glass ionomer cements or compomers are used in certain situations only. Amalgam usage, because of the controversy concerning the presence of mercury, is contraindicated in patients aged less than 6 years (Italian Ministry of Health Decree of October 10, 2001) and is not recommended by the authors in light of the principle of "bioeconomy" of healthy tissue, which is the basis of modern adhesive dental techniques.

Direct restorations

In pediatric dentistry, the direct restoration technique is definitely the most commonly used dental restoration method. It is used in the conservation of deciduous and permanent elements as it proves to be the most simple and least invasive, allowing minimal cavity preparation and requiring shorter intervention times (single session).

Direct or semi-direct restoration technique in anterior regions

The selection of the technique and materials to be used in anterior restorations is not always easy and cannot be based solely on technical considerations. The selection criteria available to the clinician are the child's age and ability to cooperate, the extent of injury, the number of teeth involved, and the possibility of a morphological and functional restoration of the damaged tooth. Usage of glass ionomer cements in the management of caries in an anterior deciduous tooth can be an excellent method to rehabilitate a 2-year-old child esthetically and functionally, whose behavior does not allow the placement of a composite resin restoration, because it does not require rubber dam placement and local anesthesia administration. At a subsequent age, from the esthetic and functional perspectives, the child will be able to undergo a more suitable treatment using composite resins.

Semi-direct restoration of a permanent central incisor fractured following a trauma requires impression taking and preparation of a diagnostic wax-up that is used to make a rigid silicone matrix to be used as a guide for composite layering. After selecting the color and isolating the field with a rubber dam and cervical ligations, the next step is the preparation and finishing of the margins.

After tooth cleansing, the enamel and dentin undergo etching, followed by treatment with traditional adhesive systems. The first application of composite material involves the positioning of a thin layer of enamel (0.5 mm) on the matrix to recreate the entire palatal and interproximal portions of the restoration, slightly increasing the thickness at the contact point between the restoration and the tooth.
Once the material has been adapted using a thin spatula, it is polymerized using halogen light for 40 seconds at standard power.
Before removing the matrix, a mass of dentin is applied in the cervical and central areas that consolidates the fragment. The modeling subsequently proceeds without the silicone support to improve visibility and range of movement.
The application of masses of dentin continues until the enamel–dentin junction is reached, polymerizing each material increment for 40 seconds and taking care to recreate the anatomical and chromatic features of the adjacent dental element. The final increment of enamel composite is applied on the entire dentin mass surface as a single layer to avoid the formation of seams and microporosities. Polymerization occurs as described above, and any excess is removed using very fine-grained diamond burs. After removing the rubber dam, it is necessary to pay careful attention to the finishing and polishing phases of the restoration (Fig. 11.16).

Figure 11.16 (**a–c**) Direct or semi-direct reconstruction technique in anterior regions. See text for details.

Direct reconstruction technique in posterior regions

Black's class I restoration. To perform a Black's class I composite resin direct restoration in a deciduous or permanent tooth, the first step of conservative treatment involves the administration of anesthesia, if needed; selection of the material and its color; and isolation of the field (Fig. 11.17a, b).
The operative sequence is as follows:

- Cavity design follows the carious lesion extent; access through the enamel requires the use of a cylindrical or truncated-cone coarse-grained (100 μm) diamond bur with a flat tip and rounded corners
- For a more selective intervention, the soft dentin should be removed using a tungsten carbide rosette bur mounted on a low-speed handpiece and/or manual instruments (Fig. 11.17c)
- The cavity walls are finished using fine-grain (40 μm) diamond burs, and the edges are subsequently smoothened using an abrasive rubber
- It is recommended to disinfect the exposed dentin by applying sterile cotton pellets soaked in 0.2% chlorhexidine for 1 minute
- Currently, it is believed appropriate to apply a thin layer of glass ionomer cement at the bottom of deep cavities to increase restoration elasticity and reduce dental pulp shock injury. The material should be spread uniformly in the deepest part of the cavity; this is followed by polymerization for 40 seconds or, in the case of self-curing materials, the setting time (sandwich technique) (Fig. 11.17d, s)
- Hard tissue etching requires 37% phosphoric acid, which should act on enamel for 30 seconds and on dentin for 15 seconds (Fig. 11.17f)
- After copious rinsing with air and water sprays to completely remove the gel, the cavity is dried via suction to avoid excessive dehydration of the exposed dentin.
- Application of the adhesive system for enamel and dentin conditioning is performed. The authors recommend using small brushes that, when rubbed on dentin, allow the fluids to penetrate perfectly into dentinal tubules. In such cases, the primer is applied first (Fig. 11.17g), followed by the bonding agent (Fig. 11.17h), which is spread with a light air blow and then polymerized using halogen light for 40 seconds at standard power (Fig. 11.17i)
- When the adhesive seal photopolymerization is completed, the authors perform tooth restoration using an anatomical multilayering technique with single composite increments of 2 mm, followed by polymerization for 40 seconds (Fig. 11.17l). Once the reconstruction of the triangular cusp ridges with masses of dentin is completed, tooth modeling is performed via the application of masses of enamel on marginal ridges and the more superficial occlusal layers (Fig. 11.17m)
- Any excess is removed with very fine-grained (20 μm) diamond burs, and the complete restoration should be finished and polished using a silicone or impregnated brush
- After removing the rubber dam, occlusal check is performed (Fig. 11.17n).

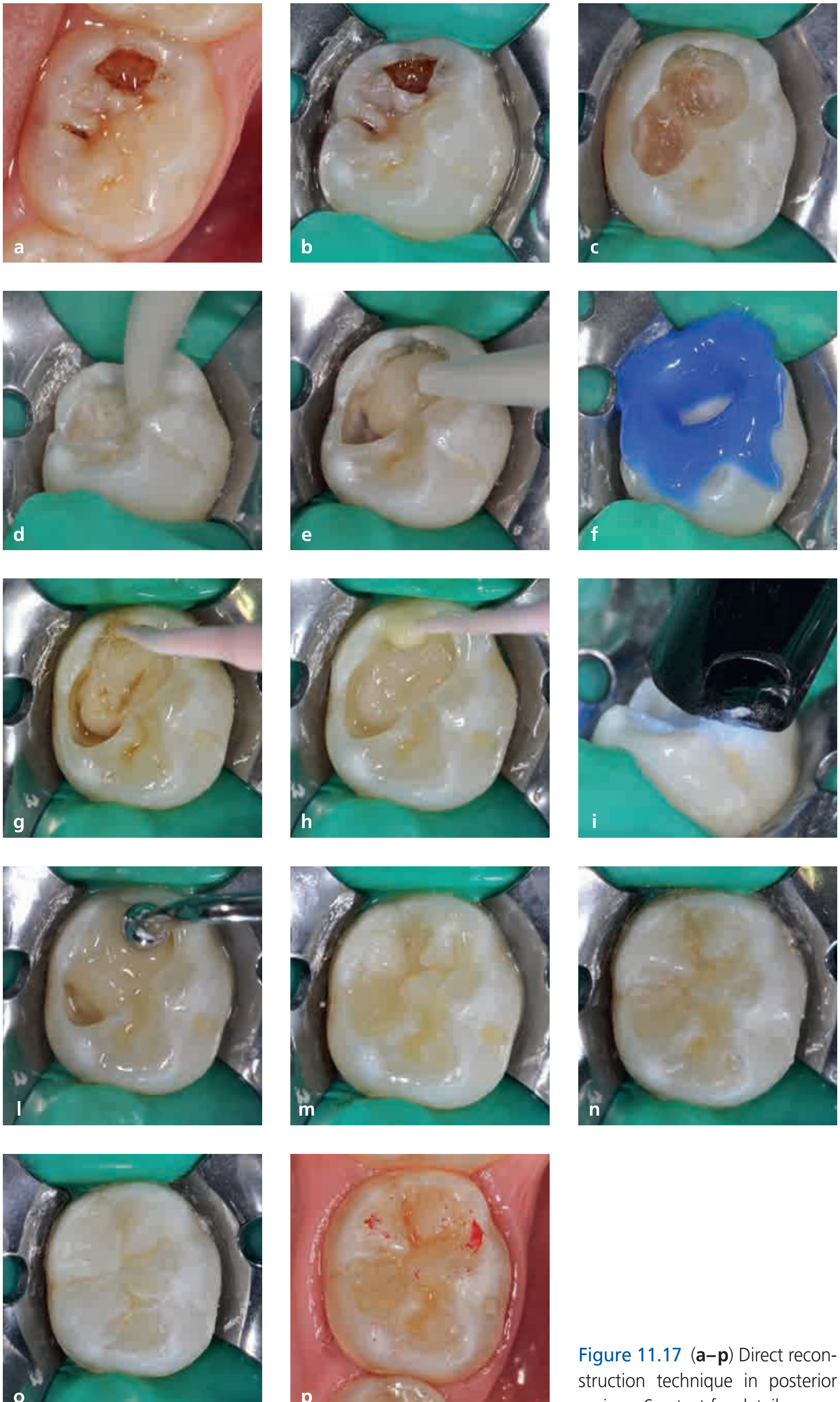

Figure 11.17 (**a–p**) Direct reconstruction technique in posterior regions. See text for details.

Black's class II restoration. Direct restorative treatment of interproximal cavities should be limited to small- or medium-sized carious lesions with a suitable amount of cervical enamel (Fig. 11.18). The principle of maximum conservation of healthy hard tissues entails preserving the proximal ridges, enamel bridges, and occlusal surfaces, even if not completely supported by dentin, when possible. In the presence of interproximal caries, which require the placement of a direct restoration with adhesive technique, cavity preparation should respect the topography of the carious lesion and comprise a round-shaped interproximal box with the smoothening of enamel margins without creating an actual chamfer finish line. The marginal ridge is accessed using a coarse-grained (100 µm) cylindrical diamond bur with rounded head angles. After removing the carious lesion using a tungsten carbide rosette bur mounted on a contra-angle handpiece with a 1:1 ratio, the axial edges are finished with diamond burs of the same design as that of the previous one but with a finer grain (40 µm) or using a long or short flame burr. The smoothing of the cervical step is performed using a dental chisel. After careful cavity preparation, the matrix and wooden wedge are positioned. Next, "adhesive restoration" is performed: etching of hard tooth tissues using 37% orthophosphoric acid (15 seconds for the dentin and 30 seconds for the enamel); rinsing with air and water sprays to remove the acid; and cavity drying via suction, followed by the application of primer and bonding agent. The first step in the morphological and functional restoration of a dental element involves restoration of the proximal wall. Application of a thin vertical layer of enamel material that recreates the interproximal wall contours and transforms the class II cavity into a class I cavity. After removal of the matrix, the marginal ridge undergoes further polymerization and evaluation for the presence of an adequate contact surface using dental floss. At this point, a thin layer of *flowable* composite is placed at the bottom of the cavity, and the composite masses are stratified using the technique described for class I restorations. The technique

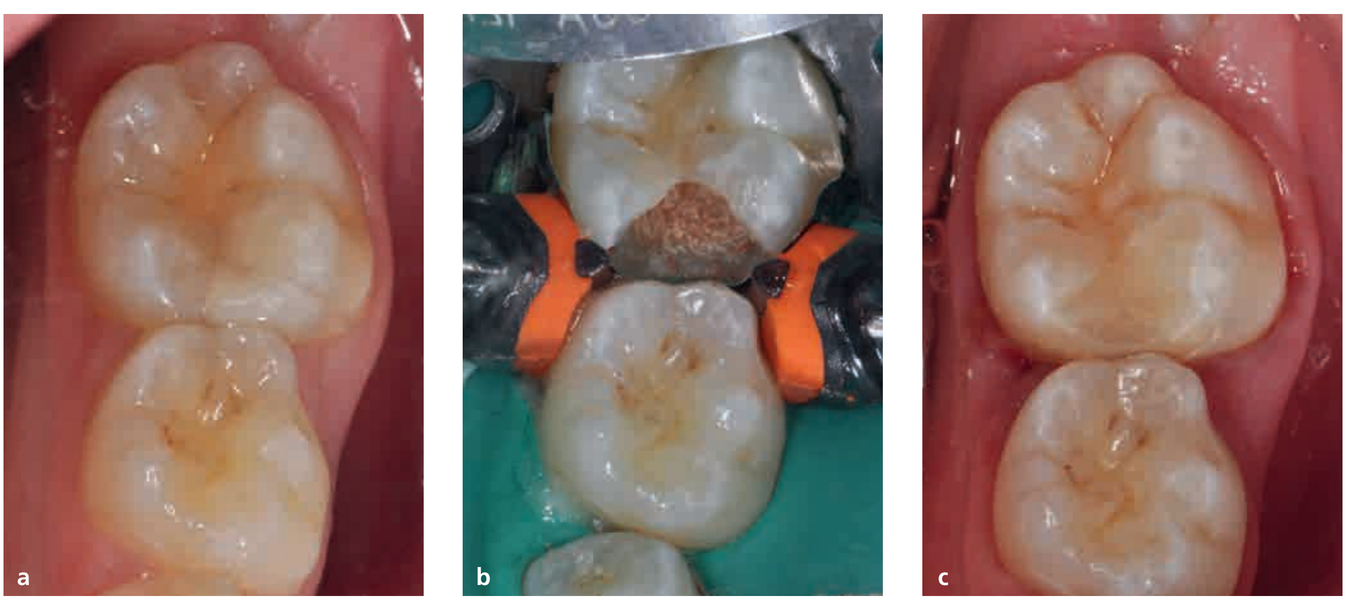

Figure 11.18 Direct reconstruction technique in posterior regions in the permanent dentition.

used by the authors for occlusal surface restoration involves anatomical multilayering, with the application, modeling, and polymerization of various layers of composite resin for dentin and enamel. When reconstruction is completed, the entire restoration is polymerized for 60 seconds, and after dam removal, the occlusal check is performed, along with the finishing and polishing of the definitive tooth surfaces.

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