牙體復形學 Operative dentistry

Nomenclature and Instrumentation

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學習目標

- 期許同學在瞭解病患的需求及材料的特性後，能依據所學善加利用，做到不僅是幫病患解決病痛的牙醫師，同時也是個讓病患永遠也忘不了的藝術家．

1. 牙齒的生理，解剖形態
2. 齲齒的生理，診斷及治療計劃
3. 窩洞的修形及材料的選擇
4. 窩洞的充填方式及其修飾
5. 美觀性材料的選擇及其運用
6. 變色牙的修飾

參考資料

1. Sturdevant's art and science of operative dentistry. 4th edition. Theodore M. Roberson.
2. Fundamental of operative dentistry. A contemporary approach 3rd edition, James B. Summitt.

Summary

Operative dentistry is the basic science in clinical dental practices.It included dental physiology,morphology,cariology,tooth preparation for restoration.The purpose of Operative dentistry is to complete the function and create the aethestic outlook.

Nomenclature and Classification of Caries and Cavity Preparations

Systems for Naming and Numbering Teeth

Each tooth may be identified by its location in the mouth and by its individual name. Examples include the maxillary right central incisor and the mandibular left second premolar. Areas of the mouth are referred to by arch (maxillary or upper and mandibular or lower) and by the side of the patient's midline (left and right) (Fig 6-1). Each arch is divided in half at the midline, forming four quadrants (maxillary right and left quadrants and mandibular right and left quadrants). In addition, each tooth is identified as primary or permanent.) the individual name of the tooth, eg, molar or central incisor; completes the identification of the tooth. Examples of complete tooth names are mandibular left permanent first molar and maxillary right primary canine.

Systems for Naming and Numbering Teeth

The tooth-numbering systems primarily used today are the Universal system and the Federation Dentaire Internationale (FDI) system (Fig 6-2). In the Universal system, the numbering begins with the maxillary (upper) right third molar (tooth 1), proceeds around the arch to the maxillary left third molar (tooth 16), then to the mandibular (lower) left third molar (tooth 17) and around the mandibular arch to the mandibular right third molar (tooth 32).

Systems for Naming and Numbering Teeth

In the FDI system, the first digit of the tooth number represents a quadrant (1, maxillary right; 2, maxillary left; 3, mandibular left; and 4, mandibular right). The second digit represents the tooth (1, a central incisor, regardless of the arch or quadrant; 2, lateral incisor; 3, canine; and so on to 8, third molar). The maxillary left first premolar would be identified as tooth 24; the mandibular right second molar would be identified as tooth 47.

Systems for Naming and Numbering Teeth

Incisors and canines are referred to as anterior teeth, regardless of the arch; premolars and molars are posterior teeth. In addition to quadrants, the mouth may also be divided into sextants, or sixths. There are three sextants in each arch, with divisions between the canines and first premolars--the maxillary right, anterior, and left sextants and the mandibular right, anterior, and left sextants.

Nomenclature of Tooth Surfaces And Cavity Preparations

The surfaces of the teeth are identified by their locations. Any surface or movement toward the midline of the arch is referred to as mesial (see Fig 6-1). A surface or movement away from the midline is distal. Surfaces and movements toward the tongue are termed lingual; those that are in the direction of the cheek or lips are termed facial. For the anterior teeth, facial may be referred to as labial (toward the lips); for posterior teeth, facial may be referred to as buccal (toward the cheek).

Nomenclature of Tooth Surfaces And Cavity Preparations

On any tooth, gingival refers to a surface or movement toward the gingiva (Figs 6-3 and 6-4). A distinction is made, however, between the chewing surfaces of posterior teeth, which are called occlusal (Figs 6-4a and 6-4b) and the biting edges of anterior teeth, which are called incisal (Figs 6-3a and 6-3b). A proximal surface is one that faces an adjacent tooth; it may be further identified as mesial or distal.

Nomenclature of Tooth Surfaces And Cavity Preparations

The anatomic contour of anterior teeth is less complicated than that of posterior teeth, in which the occlusal surfaces are characterized by grooves, cusp tips and ridges, marginal ridges, and fossae. Marginal ridges (both mesial and distal) border the lingual surfaces of anterior teeth (see Fig 6-3b) and the occlusal surfaces of posterior teeth (see Fig 6-4b). A groove is a linear channel between enamel elevations, such as cusps and/or ridges. A fissure is a developmental linear cleft usually found at the base of a groove; it is commonly the result of the lack of fusion of the enamel of adjoining dental cusps or lobes. A pit is a small depression in enamel, usually located in a groove and often at the junction of two or more fissures. A fossa is a hollow, rounded, or depressed area in the enamel surface of a tooth. For example, a mesial fossa lies just distal to a mesial marginal ridge (see Fig 6-4b).

Nomenclature of Tooth Surfaces And Cavity Preparations

With the advent of bonding restorative materials to teeth, walls of cavity preparations are less distinct than they are in preparations for restorations that are retained by mechanical undercuts in the preparation walls or by nonadhesive cements. The walls of cavity preparations, however, are generally referred to by the same terms as the surface features of the teeth, for example, the gingival and distal walls (Figs 6-5 to 6-9). Exceptions are the pulpal wall (or floor), which is only in the occlusal portion of a preparation and is the wall adjacent or nearest to the pulp chamber of the tooth (Figs 6-6 and 6-7), and the axial wall, which, in all other areas of a preparation, is the wall adjacent or nearest to the pulp chamber or pulp canal(s) and is approximately parallel to the long axis of the tooth (Figs 6-5, 6-6, and 6-9).

Nomenclature of Tooth Surfaces And Cavity Preparations

The junction of two walls in a cavity preparation is called a line angle. Again, in preparations for bonded restorations, line angles may not be well defined, but the names for line angles may be used to refer to general areas of the preparation. For example, the meeting of the facial and axial walls forms the facioaxial (or axiofacial) line angle (Fig 6-6). Similarly, the junction of three walls is referred to as a point angle. For example, the junction of the facial, axial, and gingival walls creates the facioaxiogingival (or axiofaciogingival or gingivofacioaxial) point angle. Again, the junction of two walls is often rounded, so it does not actually form a line, but it is still referred to as a line angle; likewise, a point angle is usually not a sharp point.

Nomenclature of Tooth Surfaces And Cavity Preparations

The margins (or cavosurface angles) of a preparation, which are formed by the junction of a cavity wall and an external tooth surface, are identified by the names of the adjacent walls (eg, incisal margin, mesial margin, or gingival margin). The anatomic crown of a tooth is the portion that extends from the cementoenamel junction, or cervical line, to the occlusal surface or incisal edge; it is covered by enamel (Figs 6-10 and 6-11). The clinical crown is the portion that is visible in the oral cavity. Depending on the tooth, the clinical crown may include only part of the anatomic crown (Fig 6-10) or it may include all of the anatomic crown and part of the root (Fig 6-11).

Classification of Carious Lesions and Tooth Preparations

Near the beginning of the 20th century, G. V. Black, who is known as the father of operative dentistry, classified carious lesions into groups according to their locations in permanent teeth. The same classification is used to refer to cavity preparations, because the location of carious tooth structure is a major factor in the design of the cavity preparation and the selection of instruments (Fig 6-12).

Classification of Carious Lesions and Tooth Preparations

Class I (I) lesions occur in pits and fissures on the facial, lingual, and occlusal surfaces of molars and premolars and, less often, the lingual surfaces of maxillary anterior teeth*(most frequently lateral incisors, less frequently central incisors, rarely canines) (see Figs 6-7 and 6-8).

Classification of Carious Lesions and Tooth Preparations

Class 2 (II) lesions occur on the proximal surfaces of the posterior teeth (molars and premolars). If a proximal surface of a posterior tooth is involved in a restoration, it is a Class 2 restoration (see Fig 6-6).

Classification of Carious Lesions and Tooth Preparations

Class 3 (III) lesions occur on the proximal surfaces of anterior teeth (central and lateral incisors and canines). Class 3 cavities do not involve an incisal angle (see Fig 6-9).

Classification of Carious Lesions and Tooth Preparations

Class 4 (IV) lesions occur on the proximal surfaces of anterior teeth when the incisal angle requires restoration. The angle may have to be removed because of its fragility or for proper placement of the restoration, or it may have been fractured by trauma (Fig 6-13).

Classification of Carious Lesions and Tooth Preparations

Class 5 (V) lesions occur on smooth facial and lingual surfaces in the gingival third of teeth. Class 5 cavities begin close to the gingiva and may involve a cementum or dentinal surface as well as enamel (see Fig 6-5).

Classification of Carious Lesions and Tooth Preparations

Class 6 (VI) lesions are pit or wear defects on the incisal edges of anterior teeth or the cusp tips of posterior teeth (Fig 6-14).

Classification of Carious Lesions and Tooth Preparations

In addition to being named for their classifications, cavity preparations and restorations are named for the tooth surfaces involved. For example, a restoration involving the mesial and occlusal surfaces of a posterior tooth is called a mesio-occlusal Class 2 restoration; simply saying mesio-occlusal restoration identifies it as a Class 2 restoration because the proximal surface of a posterior tooth is involved. A preparation or restoration involving the mesial, occlusal, distal, and facial surfaces of a posterior tooth is called a mesio-occlusodistofacial preparation or restoration.

Classification of Carious Lesions and Tooth Preparations

For brevity's sake, the names of the surfaces are often abbreviated (distal, D; lingual, L; facial, F; mesial, M; incisal, I; occlusal, O). A mesio-occlusal restoration in a posterior tooth would be abbreviated MO, and a distolingual restoration in an anterior tooth is abbreviated DL.

Black's Steps in Cavity Preparation

Treatment modalities for dental caries other than surgical removal are discussed in Chapter 4. When it has been determined that nonsurgical means of treating caries will not suffice, however, restorative therapy is indicated. This involves the surgical removal of carious tooth structure and restoration of the tooth to its original anatomic form with a suitable restorative material. The design of the cavity preparation is determined first by the location of the caries lesion(s) in the tooth. The shape or outline of the cavity preparation, as it meets the external surface of the tooth, is referred to as outline form. Other factors influencing the design include the need to obtain access for the instruments as the operator is preparing the cavity or placing the restoration (convenience form) and the need to provide retention for the restorative material (retention form). Also required is resistance to stress on the restoration and the tooth to the forces of biting and chewing (resistance form). Because cavity preparation is a surgical procedure in which a mistake can mean injury to living tissue, it is essential that the operator be knowledgeable and highly skilled.

Black's Steps in Cavity Preparation

The sequential steps of cavity preparation were established by Black. Black's steps represent a systematic, scientific procedure for efficiency in cavity preparation. Although the technology of bonding restorative materials to enamel and dentin was not available to Black, his steps of cavity preparation are generally as appropriate today as they were when he formulated them:

Black's Steps in Cavity Preparation

1. Establish outline form. Outline form is based primarily on the location and extent of the carious lesion, tooth fracture, or erosion. In carious teeth, the outline form is established after penetration into carious dentin and removal of the enamel overlying the carious dentin. The extent of carious dentin should be a primary determinant of the outline form of the preparation; the final outline is not established until the carious dentin and its overlying enamel have been removed.

Black's Steps in Cavity Preparation

2. Obtain resistance form. Resistance for the remaining tooth structure and for the restoration must be designed in the preparation, so that the restoration is resistant to displacement and both the tooth and the restoration are resistant to fracture during function.

Black's Steps in Cavity Preparation

3. Obtain retention form. Retention may be obtained through mechanical shaping of the preparation to retain the restoration and/or via bonding procedures that attach the restorative material to tooth structure.

Black's Steps in Cavity Preparation

4. Obtain convenience form. Convenience form allows adequate observation, accessibility, and ease of operation during preparation and restoration of the tooth. Convenience form that involves the removal of sound, strong tooth structure should be limited to that which is necessary.

Black's Steps in Cavity Preparation

5. Remove remaining carious dentin. Removal of remaining carious dentin applies primarily to that in the deepest part (pulpally) of the preparation. Other carious tooth structure was removed when the outline form was established.

Black's Steps in Cavity Preparation

6. Finish enamel walls and cavosurface margins. For indirect restorations (those requiring the making of an impression and fabrication of a stone duplicate of the preparation), finishing involves making the walls relatively smooth. For direct and indirect restorations not utilizing bonding, finishing involves removing any unsupported, weak, or fragile enamel and making the cavosurface margin smooth and continuous to facilitate finishing of restoration margins. For bonded resin composite restorations, enamel that is not supported by dentin and is not going to be exposed to significant occlusal loading is frequently allowed to remain in place and is rein forced by bonding to its internal surface.

Black's Steps in Cavity Preparation

7. Clean the preparation. Black referred to this step as "performing the toilet of the cavity." It includes washing or scrubbing away any debris in the preparation and drying the preparation. Afterward, the cavity is inspected for any remaining debris, fragile enamel, and demineralized tooth structure.

Instrumentation

Hand Instruments

Black organized not only the classification of cavity preparations and their parts, but the naming and numbering of hand instruments. Cutting instruments, which he also called excavators, were to be used in shaping the tooth preparation. All other hand instruments are grouped into the noncutting category.

Metals

For many years, carbon steel was the primary material used in hand instruments for operative dentistry because carbon steels were harder and maintained sharpness better than stainless steels. Stainless steels are now the preferred materials for hand instruments, because all instruments must be sterilized with steam or dry heat between patients and because the properties of stainless steels have improved. There are literally hundreds of formulas for stainless steels, all incorporating a significant amount of chromium, some carbon, and iron. Chromium imparts corrosion resistance and brightness to the metal; carbon imparts hardness.

Cutting Instruments

Before rotating instruments were available, dentists could cut well-shaped cavity preparations using sharp hand instruments alone. The process was slow. The advent of the dental handpiece in 1871,il first attached to a foot-operated engine, allowed increased speed of tooth preparation. Most tooth preparation today is accomplished with rotary instruments, but hand cutting instruments are still important for finishing many tooth preparations. Few preparations involving a proximal surface can be properly completed without the use of hand cutting instruments. It is crucial that hand instruments used for cutting tooth structure or carving restorative materials be sharp. Design. Hand cutting instruments are composed of three parts: handle (or shaft), shank, and blade (Fig 6-15). The primary cutting edge of a cutting instrument is at the end of the blade (called the working end), but the sides of the blade are usually beveled and also may be used for cutting tooth structure (Fig 6-16). The shank joins the blade to the handle of the instrument and is angled to keep the working end of the blade within 2.0 to 3.0 mm of the axis of the handle (Fig 6-17).

Cutting Instruments

This angulation is intended to provide balance, so that when force is exerted on the instrument it is not as likely to rotate, decreasing the effectiveness of the blade and possibly causing damage to the tooth. Figure 6-17a illustrates an instrument that has a single angle at the junction of the blade and the shank. Because the working end of the blade is not aligned with the handle, the instrument is said to be out of balance. Such an instrument may still be useful in tooth preparation. Its blade will usually be relatively short, and it will usually be used with minimal force. Figure 6-17b shows a shank that has two angles to bring the cutting edge into near alignment with the long axis of the handle to provide balance.

Nomenclature

The terminology organized by Black in the early part of the last century is still used today with minor modifications. Most names Black assigned to cutting instruments were based on the appearance of the instrument, such as hatchet, hoe, spoon, and chisel. For an instrument that did not have the appearance of a commonly used item, Black based the name on the intended use, for example, gingival margin trimmer. Black called all cutting instruments used for tooth preparation excavators, and he referred to instruments as hatchet excavators, spoon excavators, etc. The term excavator is still applicable, but, in the day-to-day language of operative dentistry, it is little used. In catalogs of instruments, however, cutting instruments are often indexed as excavators.

Nomenclature

Black combined the name of each instrument with a designation of the number of angles in the shank of the instrument. Shanks may be straight, monangle (one angle), binangle (two angles), triple-angle (three angles), or quadrangle (four angles) (Fig 6-18). The term contra-angled refers to a shank in which two or more angles are necessary to bring the working end into near alignment with (within 2.0 to 3.0 mm) the axis of the handle (see Fig 6-17b).

Nomenclature

Hatchet. In a hatchet (also called an enamel hatchet), the blade and cutting edge are on a plane with the long axis of the handle; the shank has one or more angles (Figs 6-18e, 6-19a, 6-20, and 6-21). The face (see Fig 6-16) of the blade of the hatchet, will be directed either to the left or the right in relation to the handle, and the instrument is usually supplied in a double-ended form. Therefore, there are left-cutting and right-cutting ends of the double-ended hatchet.

Nomenclature

Chisel. A chisel has a blade that is either aligned with the handle (Figs 6-18a, 6-22, and 6-23d), slightly angled (Figs 6-18b, 6-23a, and 6-23b), or curved (Fig 6-23c) from the long axis of the handle, with the working end at a right angle to the handle.

Nomenclature

Hoe. A hoe has a cutting edge that is at a right angle to the handle, like that of a chisel. However, its blade has a greater angle from the long axis of the handle than does that of the chisel; its shank also has one or more angles (Figs 6-15, 6-18c, and 6-24). A general guideline for distinguishing between a hoe and a chisel will be given later in the chapter.

Nomenclature

Spoon. The blade of a spoon is curved, and the cutting edge at the end of the blade is in the form of a semicircle (Figs 6-19b and 6-25b); this gives the instrument an outer convexity and an inner concavity that make it took somewhat like a spoon. Like the hatchet, the spoon has a cutting edge at the end of its blade that is parallel to the handle of the instrument; therefore, there are left-cutting and right-cutting spoons. The shank of some spoons holds a small circular, or disk-shaped, blade at its end, and the cutting edge extends around the disk except for its junction with the shank; these are called discoid spoons (Figs 6-25a and 6-25c).

Nomenclature

Gingival margin trimmer. (Figs 6-26 and 6-27). Gingival margin trimmers, like hatchets and spoons, come in pairs (left cutting and right cutting) (Fig 6-26), but there are also mesial gingival margin trimmers and distal gingival margin trimmers (Fig 6-27). Thus, a set of gingival margin trimmers is composed of four instruments: left-cutting and right-cutting mesial gingival margin trimmers, and left-cutting and right-cutting distal gingival margin trimmers. Because these are usually double-ended instruments, one instrument is a mesial gingival margin trimmer (with left- and right-cutting ends), and the other is a distal gingival margin trimmer (with left- and right-cutting ends). Figure 6-27a illustrates a mesial left-cutting gingival margin trimmer. Figure 6-27b illustrates a distal left-cutting gingival margin trimmer. Contrasted with these is a right-cutting hatchet (Fig 6-27c). Gingival margin trimmers have many uses in addition to trimming gingival margins (Fig 6-28).

Nomenclature

Off-angle hatchet.

Black's instrument names apply to instruments that have cutting edges that are either parallel or at a right angle to the handle. Instruments have been developed that have blades rotated 45 degrees from the plane of the long axis of the handle; these are called off-angle hatchets.

Usage

Hand cutting instruments are, for the most part, made in pairs, and, as with the gingival margin trimmers, most instruments used today are double-ended and will have one of the pair on each end (see Figs 6-15, 6-20, and 6-26). A cutting instrument may be used' with horizontal strokes, in which the long axis of the blade is directed at between 45 and 90 degrees to the surface being planed or scraped (Fig 6-28a), or with vertical or chopping strokes, in which the blade is nearly parallel to the wall or margin being planed (Fig 6-28b). For horizontal (scraping) or vertical (chopping) strokes, the acute angle of the cutting edge is intended to be used. The acute angle is the junction of the face of the blade with the bevel; in other words, the bevel is on the back of the blade, not the face of the blade. A double-ended hatchet, gingival margin trimmer; or spoon will have one end that is designated as right-cutting and one that is designated as left-cutting. In a double-ended hoe, in addition to allowing vertical or chopping strokes, one end is intended for pushing strokes (beveled end) and the other is intended for pulling strokes (contrabeveled end).

Usage

The cutting edges of most hand cutting instruments used today are single beveled, as are all of those described here (see Fig 6-16). Double-beveled, or bi-beveled, cutting edges are also available but have limited application in contemporary operative dentistry (Fig 6-29). These instruments usually have narrow blades and are used for tasks such as adding mechanical retention points in areas of preparations that cannot be reached by a bur.

Numeric formulas

The configuration of the shanks combined with the appearance of the blade or the use of the instrument produces names such as straight chisel, monangle chisel, binangle hoe, and triple-angle hatchet. These are descriptive terms, but they are imprecise because they do not indicate sizes or angles. For more complete identification of hand cutting instruments, Black developed a system of assigning numeric formulas to instruments (Figs 6-30 and 6-31). The formulas make use of the metric system. For designating the degree of angulation, centigrades are used. Centigrades are based on a circle divided into 100 units (Fig 6-32), as opposed to the 360-degree circle ordinarily used to designate angles. In a centigrade circle, a right angle has 25.0 centigrades.

Three-number formula

For instruments in which the primary cutting edge (at the end of the blade) is at a right angle to the long axis of the blade, Black developed a formula that has three numbers (Fig 6-30). The first number is the width of the blade in tenths of a millimeter; the second is the length of the blade in millimeters, and the third is the angle (in centigrades) made by the long axis of the blade and the long axis of the handle (Fig 6-33).

Four-number formula

For instruments in which the cutting edge at the end of the blade is not at a right angle to the long axis of the blade, such as the gingival margin trimmers, Black designed a four-number formula (Fig 6-31). The first number is the width of the blade in tenths of a millimeter; the second number is the angle (in centigrades) that the primary cutting edge (working end) makes with the axis of the handle (Fig 6-34); the third number is the length of the blade in millimeters; and the fourth number is the angle (in centigrades) that the long axis of the blade makes with the handle. In margin trimmers, a cutting edge angle of greater than 90 centigrades is intended for distal gingival margins (Fig 6-31); an angle of 85 centigrades or less is intended for mesial gingival margins. Chisel versus hoe. Although Black defined a chisel as having a blade that is aligned with the handle or slightly curved from it, terminology has evolved so that a chisel may also have a blade that is angled from the handle up to 12.5 centigrades. A chisel with a blade angled more than 3 or 4 centigrades from the axis of the handle must be binangle for the instrument to be balanced.

Four-number formula

If the blade is angled more than 12.5 centigrades, the instrument is defined as a hoe. In a curved or angled chisel or a hoe, a blade with its primary cutting edge (and its face) on the side of the blade toward the handle is said to be beveled (see Figs 6-23a to 6-23c); a blade with its primary cutting edge (and its face) on the side of the blade away from the handle is said to be contrabeveled (see Fig 6-18c).

Four-number formula

Recommended instrument kit. Black recommended a long set of 96 cutting instruments, a university set of 44 cutting instruments, or a short set of 25 cutting instruments. Because bonding technology and high-speed handpieces were not available, the dental materials of the time were more limited, and a primary restorative material was direct gold; the longevity of restorations depended on the retention and resistance form developed with hand cutting instruments.

Four-number formula

With access to advanced materials and technology, current use of hand cutting instruments is greatly diminished. The kit recommended in this chapter has only 12 hand cutting instruments (six double-ended instruments). Because it is now recognized that there is no need to plane walls and floors of cavity preparations to smoothness with hand instruments for a restoration to perform well, hand cutting instruments play only a small, albeit important, part in cavity preparation. If burs alone were used for shaping proximal preparations, excessive sound tooth structure would have to be removed from the tooth being restored or the bur would damage the adjacent tooth. Hand cutting instruments enable the dentist to shape and refine small proximal boxes without damaging adjacent teeth.

Four-number formula

Hatchets, hoes, chisels, and gingival margin trimmers have straight cutting edges and are designed to plane enamel and dentinal walls and margins in shaping cavity preparations, especially in areas of the preparation that cannot be reached with a bur. Spoons, on the other hand, have rounded cutting edges; their intended use is the removal of carious dentin. Although slowly rotating round burs are most useful in removing carious dentin, a spoon gives more tactile sensation and is preferred by many operators.

Noncutting Instruments

Non-tooth-cutting hand instruments are similar in appearance to cutting instruments, except that the blade used for tooth preparation is replaced with a part that has a totally different use. In noncutting instruments such as burnishers and amalgam condensers, the blade is replaced by a nib or point. The flat end of the nib of a condenser is called the face. Amalgam carvers have carving blades instead of tooth-cutting blades.

Noncutting Instruments

Condensers, carvers, and burnishers are used to place dental amalgam and, to a certain extent, resin composite restorative materials. Plastic filling instruments are used to place resin composite materials, provisional restorative materials, and sometimes cavity-basing materials into tooth preparations. Spatulas are necessary for mixing cavity-lining and cavity-basing materials, provisional restorative materials, and cements for luting inlays, onlays, and crowns.

Noncutting Instruments

Amalgam carriers. For silver amalgam restorations, amalgam is placed into the preparation with an amalgam carrier, an instrument with a hollow cylinder that is filled with amalgam (Fig 6-35). A plunger operated with a finger lever pushes the amalgam out of the carrier into the preparation. For some of the more viscous resin composite materials, carriers have been fitted with plastic cylinders to reduce sticking of the resin material to the internal walls of the cylinder. Condensers. Amalgam condensers are used to compress the amalgam into all areas of the preparation. The working ends, or nibs, of condensers may be any shape, but usually they are round with flat ends (faces).

Noncutting Instruments

Figure 6-36 shows four round condensers of different sizes and configurations. Other commonly used condenser nibs are triangular, rectangular, or diamond shaped. Amalgam is condensed by pushing the condenser directly into the preparation and confining the amalgam between the condenser face and the preparation floor through vertical pressure (vertical condensation). The amalgam is condensed against the vertical walls of the preparation (lateral condensation) by angling the nib and using the end for condensation, or by lateral, or side-to-side, movements of the condenser, using the sides of the nib to condense the amalgam.

Noncutting Instruments

The condensation pressure applied to the amalgam with a condenser depends on the size of the face and the amount of force used by the operator. For small condensers, such as the SA1 condenser (Fig 6-36a), little force is needed. The nibs of the SA1 condenser are 0.5 and 0.6 mm in diameter. For larger condensers, such as the SA3 (Fig 6-36c), with nib diameters of 1.5 and 2.0 mm, a significant amount of force (6 to 8 lbs) gives optimum condensation.

Noncutting Instruments

Amalgam condensers may also be used to place resin composite materials. The resin material is not actually condensed, however, but pushed or patted into all areas of the preparation with the largest condenser face that will fit into the area.

Noncutting Instruments

Carvers. Carvers are used to shape amalgam and resin composite (tooth-colored) materials after they have been placed in tooth preparations. Figures 6-37a and 6-37b show the shapes of the blades of a cleoid-discoid carver. Figure 6-38 illustrates six commonly used carvers. In general, when a convex amalgam contour is being carved, a concave-shaped carver facilitates the shaping or carving. Likewise, a convex carver facilitates carving of a concave shape. A convex carver may be used to carve a convex surface; the surface is carved tangentially, with multiple strokes. Whether a carver is used to carve amalgam or resin composite, it is important that the blade be sharp.

Noncutting Instruments

The cleoid-discoid (or discoid-cleoid) carvers shown in Figs 6-38a and 6-38b are used primarily for occlusal carving in amalgam restorations. The Walls No. 3 carver (Fig 6-38c) is useful for carving occlusal surfaces; the end that is shaped like a hoe is also useful for shaping cusps and for carving facial and lingual surfaces of large amalgam restorations. The Hollenback No. h carver (Fig 6-38d) is useful for occlusal, proximal, and axial (facial and lingual) surfaces; several larger Hollenback carvers, with the same general shape, are also available. The interproximal carver (IPC) (Fig 6-38e) has very thin blades and is extremely valuable for carving proximal amalgam surfaces near the interproximal contact area. The No. 14L carver (Fig 6-38f) can be used for interproximal areas, or it may be used for carving convex facial and lingual surfaces of very large amalgam restorations. The No. 14L carver has a very strong, hollow-ground triangular blade, so it can be used to remove amalgam overhangs from completely set amalgam.

Noncutting Instruments

Although most of the shaping of resin composite restorations should be completed before the material is polymerized, several amalgam carvers are also useful for carving resin composite. The discoid carvers are especially useful for lingual concavities of anterior teeth; cleoid and discoid carvers and the hoe-shaped end of the Walls No. 3 carver are useful for occlusal surfaces of posterior resin composite restorations. Another carver very useful for resin composite restorations is a disposable scalpel blade (No. 12 or No. 12b blade) mounted in a scalpel handle.

Noncutting Instruments

Burnishers. Burnishers are used for several functions. The word burnish is defined as "to make shiny or lustrous, especially by rubbing; to polish"; and "to rub (a material) with a tool for compacting or smoothing or for turning an edge." Burnishing is probably used in all of those ways in dentistry. Two frequently used double-ended burnishers are illustrated in Fig 6-39.

Noncutting Instruments

One use of burnishers is to shape metal matrix bands so that they impart more desirable contours to restorations. Large burnishers are used with considerable force to pinch off freshly condensed amalgam at the margins, or, in other words, to impart some condensation and to begin shaping the occlusal surfaces of amalgam restorations. After the amalgam has been carved, a burnisher may be used with a gentle rubbing motion to smooth the surface. The PKT3 (P. K. Thomas No. 3) burnisher (Fig 6-39a) is also useful for sculpting occlusal anatomy in posterior resin composite restorations prior to polymerization of the resin.

Noncutting Instruments

Burnishers are used to "bend" cast gold near the margin to narrow the gap between the gold and the tooth. This closing of a marginal gap is best accomplished with a narrow burnisher, such as the side of a beavertail burnisher, used with heavy force in strokes parallel to the margin but about 1.0 or 1.5 mm away from it. If burnishing is accomplished directly on a thin gold margin, the gold can be bent severely and may break. Plastic instruments. Plastic instruments (or plastic filling instruments) are so named because they were originally designed to use with plastic restorative materials, such as the silicates and acrylic resins used in the middle of the 20th century. They are currently used to carry and shape tooth-colored restorative materials such as resin composites and glass-ionomer restorative materials.

Noncutting Instruments

A commonly used plastic instrument is the No. 1-2 (Fig 6-40a). The double-ended instrument has a nib or blade on each end, one at a 90-degree angle to the other. Other double-ended plastic instruments have a blade-type nib on one end and a condenser nib on the other. The bladed plastic instruments have many uses in operative dentistry in addition to carrying and contouring restorative materials. The interproximal carver (Fig 6-38e), for instance, is preferred by some operators for packing knitted cord and placing and shaping resin composite.

Noncutting Instruments

These instruments are now available in both hard plastic and metal; the original rationale for using an instrument made of plastic (Fig 6-40b) was to eliminate abrasion of metal by the quartz in resin composites, which caused grayness in the tooth-colored material. Because of changes in the inorganic fillers used in today's resin composites, the problem of metal abrasion and graying has been eliminated; thus, a metal instrument functions well to carry and shape resin composite.

Noncutting Instruments

Cement spatulas. A variety of materials in operative dentistry require mixing, some on a glass slab, others on a paper pad. Several spatulas are available, and they vary in size and thickness (Fig 6-41). The larger cement spatulas were originally designed for mixing luting cements and the smaller spatulas for cavity liners, but with the advent of resin luting cements, the smaller spatulas are frequently used for mixing small amounts of those materials. The thinner spatulas are flexible; the thicker ones are rigid. Selection of a rigid or flexible cement spatula is dependent on the desired viscosity of the cement and personal preference.

Sharpening of Hand Instruments

To assess sharpness, the user of the instrument should look at the cutting edge in bright light; the presence of a "glint" indicates that the edge is dull or rounded (Figs 6-42a and 6-42b). Alternatively, the dentist can pull the instrument across hard plastic, such as the handle of a plastic mouth mirror or an evacuator tip. A dull blade will slide across the plastic; a sharp blade will cut into the surface, stopping movement. A specially made, sterilizable, sharpness-testing stick is also available (Figs 6-43a and 6-43b) (Dalron Test Stick, Thompson Dental).

Sharpening of Hand Instruments

Sharpening is performed in different ways for different hand instruments. When chisels, hatchets, hoes, and margin trimmers are sharpened, the cutting-edge bevel is placed flat against a flat stone, which is on a stable surface, and the instrument is pushed or pulled so that the acute cutting angle is moved forward, with fairly heavy force on the forward stroke, and with little or no force on the back stroke (Figs 6-44 and 6-45). Usually, unless the instrument has been badly neglected, only two or three forward strokes are required. Because the bevels of these instruments should usually make a 45-degree angle with the face of the blade, the blade should make a 45-degree angle with the surface of the sharpening stone (Figs 6-45 and 6-46).

Sharpening of Hand Instruments

When spoons, discoid carvers, and cleoid carvers are sharpened, the instrument is rotated as the blade is advanced on the flat stone (Fig 6-47). The bevel is at 45 degrees, or slightly more or less, to the face, and the instrument is advanced on the stone with the bevel against the surface of the stone and the cutting edge of the instrument perpendicular to the path of advancement. When a blade with a rounded edge is being sharpened, the handle cannot be simply twirled to achieve the desired rotation, but must actually be swung in an arc to keep the cutting edge of the blade perpendicular to the direction of the stroke.

Sharpening of Hand Instruments

The discoid carver and spoon may be sharpened with a continuous rotation of the blade; the shank moves clockwise from the 9 o'clock position to the 3 o'clock position in one motion. For the cleoid carver, however, the rotation begins with the shank in the 9 o'clock position and continues clockwise only until the bevel just next to the point is ground (see Fig 6-47); to sharpen the other side of the cleoid, the rotation begins with the shank at the 3 o'clock position and continues counterclockwise to the point.

Sharpening of Hand Instruments

The blade of a discoid spoon may be sharpened by grinding the face of the blade with a rotating stone (Fig 6-48). This method of sharpening also thins the blade, and care must be taken to avoid rendering the blade so thin that it could easily break. Sharpening machines are available. A slowly rotating sharpening wheel is employed by one type of machine; an oscillating flat stone, or hone, is used by another. These machines are useful for sharpening instruments between patients and before sterilization.

Sharpening of Hand Instruments

When instruments are sharpened during an operative procedure, they should be sharpened with a sterile stone. When a stone is sterilized, it should not have oil in or on it, because the oil may thicken during sterilization and form a shellaclike coating that will prevent the abrasion needed for sharpening. A good substitute for oil is water. Stones lubricated with water should be washed well or cleaned in an ultrasonic cleaner after use to remove the metal filings prior to sterilization. A flat, white Arkansas stone or fine synthetic sharpening stone should be made a part of the operative dentistry instrument kit so that it is available during each procedure.

Mirrors, Explorers, Periodontal Probes, and Forceps

Mirrors, explorers, periodontal probes, and forceps are basic instruments that will be needed during each appointment for diagnosis or treatment. Mirrors. For every procedure performed in the mouth, the dentist must have clear and distinct vision of the field. Wherever possible, the field should be viewed with direct vision. When needed, the mouth mirror allows the operator to visualize areas of the mouth that he or she would not otherwise be able to see. It also allows the operator to maintain a body position that will reduce health problems associated with poor posture.

Mirrors, Explorers, Periodontal Probes, and Forceps

Almost as important as its allowing indirect visualization of obscure areas of the mouth is the mirror's function as a reflector of light into the area being examined or treated. A mirror that is positioned properly allows the operator to visualize the field of operation in the mirror and, at the same time, reflects the operating light into that area. To accomplish this, the light should be positioned behind and just to the side of the operator's head. The mouth mirror can also serve as a retractor of soft tissue (tongue, cheeks, or lips) to aid access and visualization.

Mirrors, Explorers, Periodontal Probes, and Forceps

For clarity of vision, the reflective surface of the mirror should be on the surface of the glass. This type of mirror is called a front-surface mirror (Fig 6-49a). Mouth mirrors are usually round and come in a variety of sizes (Fig 6-49b). The most widely used sizes for adults are the No. 4 and No. 5. For constricted areas in posterior regions of the mouth, when a rubber dam is in place, a smaller mirror, such as a No. 2, is helpful. Explorers. Explorers are pointed instruments used to feel tooth surfaces for irregularities and to determine the hardness of exposed dentin. The explorer that is used most often is the shepherd's hook, or No. 23, explorer (Fig 6-50a). Another useful shape is a cowhorn explorer, which provides improved access for exploring proximal surfaces (Fig 6-50b). The No. 17 explorer is also useful in proximal areas (Fig 6-50c).

Mirrors, Explorers, Periodontal Probes, and Forceps

Periodontal probes. Periodontal probes are designed to detect and measure the depth of periodontal pockets. In operative dentistry, they are also used to determine dimensions of instruments and of various features of preparations or restorations. There are many periodontal probe designs; the differences are in the diameters, the position of the millimeter markings, the configuration of the markings (eg, whether they are notched or painted), and the design of the tip. Three commonly used probes are illustrated in Fig 6-51.

Mirrors, Explorers, Periodontal Probes, and Forceps

Forceps. Forceps of various kinds are useful in operative dentistry. Cotton forceps are used for picking up small items, such as cotton pellets (small cotton balls), and carrying them to the mouth (Fig 6-52). Other forceps useful in operative dentistry are hemostats (Fig 6-53). A hemostat locks tightly, so it is often helpful in placing or removing items used to confine amalgam for condensation. Articulating paper forceps are designed to carry an inked tape to the mouth to mark the contacts of teeth in opposing arches during closure (Fig 6-54).

Instrument Grasps

The operator should master two basic instrument grasps, the pen grasp, which provides more flexibility of movement, and the palm or palm-thumb grasp, which provides limited movement but controlled power. Usually only one-handed grasps are used, but occasionally two-handed instrumentation is needed to make refinement of a preparation more precise (Fig 6-55).

Instrument Grasps

Pen grasp. This is the most frequently used instrument grasp in operative dentistry. The pen grasp is actually different from the way one would grasp a pen (Fig 6-56); the shaft of the instrument is engaged by the end, not the side, of the middle finger; this provides more finger power. The pen grasp is initiated by placement of the instrument between the thumb and index finger; the middle finger engages the handle or shank of the instrument. The ring finger is braced against the teeth to stabilize instrument movement (Figs 6-57a and 6-57b).

Instrument Grasps

Palm or palm-thumb grasp. In this grasp, the thumb serves as a brace (Fig 6-58). Side-to-side, rotation, or thrusting movements of the instrument by the wrist and fingers are controlled by the thumb, which is firmly in contact with the teeth (Fig 6-59).

Instrument Motions

The following are some of the many motions used with hand instruments:

~ Chopping (in the direction of the working end of the instrument, or parallel to the long axis of the blade)

~ Pulling (toward the operator's hand)

~ Pushing (away from the hand)

~ Rotating

~ Scraping (with the blade directed at an angle between 45 and 90 degrees to the surface being scraped and moved side to side or back and forth on the surface)

~ Thrusting (forcibly pushing against a surface)