Instrumentation For Operative Dentistry

Introduction

Operative dentistry is the science and art of the prevention, diagnosis, and treatment of a defect in the enamel or dentin of individual teeth. It's concerned with the restoration of defect. The defect is always as a result of trauma, disease, and esthetics. It's the entirely of the clinical practice of dentistry. It includes restoration of carious teeth with metallic and non-metallic restoration. The objectives are restoration of health, restoration of the efficient mastication, restoration of esthetics, and restoration of normal occlusion. 85% of the patient need to conservative treatment due to dental caries. G.V Black is the father of operative dentistry.

Instruments are referred to a tool or device that used for specific work. Instrument is formed from carbon steel or carbide steel and some alloy can used such as nickel, cobalt or chromium. Carbide is the best material due to high hardness, higher strength at higher temperature, and high efficiency, but carbon steel is weak and not preferred as carbide. Instrument are supplied in varies shape and size to reach all places. They use in retraction, transillumination, indirect illumination and direct vision.

Most hand instruments that used in the past were large with heavy handles and inferior metal alloy in the blade. There was no uniformity of manufacture and nomenclature. To be an effective dentist you should know everything about each instruments. There are two types of instrument hand instrument, rotary instrument, and ultrasonic. There are many classification to identify the instruments easily.

The Aim of the research

To discuss the definition of operative dentistry, classification of instruments, hand cutting instrument and its design, grasps instrument, sharpening of hand instruments, and rotary cutting instruments.

Operative dentistry Instruments:

There are many classification that used to identify instruments as:

Marzouk classification: It depend on the producers the done by this instruments. It classified into three categories as instruments that used for exploration, used for restoration, and used for removal of tooth structure.

1. Instruments used for exploration: It classified into
    1. Instrument that dry the area of mouth: It used for dry the tooth as cotton rolls, air syringe, pair of tweezers, and cotton pullet.
    2. Illuminate the area: It's source of light that used to illuminate or supply light to oral cavity such as built in light in the unite, light attached to mirror or hand piece, and light can be introduced direct or indirect by reflecting it by mirror.
    3. Retract the soft tissue such as hand mirror or blunt plastic instrument, and

tongue depressor or retractor.
    4. Probe the lesion: explorer used for probe such as straight explorer, right angle, arch explorer, and interproximal explorer.
2. Used for restoration such as mixing instruments, plastic instruments, condensing instruments, burnishing, knives, files, and finishing and polishing instruments.
3. Used for removal of tooth structure such as hand cutting instruments, rotary cutting, rotary abrasive instruments, and ultrasonic instruments. (1)

G.V Black classification: It's depend on the use of instruments. It classified into

1. Cutting instrument
    1. Rotary: burs, stones, and discs.
    2. Hand instruments: hatchets, excavator, and chisels.
2. Condensing instrument: hand and mechanical.
3. Finishing and polishing
    1. Hand instruments: orange wood sticks, polishing points, finishing strips.
    2. Rotary: mounted stones, rubber cups, mounted brushes, finishing burs, and impregnated wheels.
4. Isolation instruments: rubber Dam, saliva ejector, cotton roll holder, and evacuating tips and equipment.
5. Plastic instruments: spatulas, carvers, burnishes, and packing instruments.
6. Miscellaneous instrument: mouth mirror, explorer, props, scissors, and pliers.(1)

Hand instruments:

In the past, Dentists were used hand instruments only for cavity preparation. They were use sharp cutting instruments, but these process was very slow. The first hand piece was invented in 1871, it increases the process of cavity preparation. Hand instrument still used in finishing and polishing, and some proximal process. (2)

Hand Instrument design: It consist of shaft, shank, and blade.

Shaft: It used as a handle, straight, and available in various sizes and shape (small-medium-large). Serrated handles increase doctor comfort and friction for hand griping. They can be serrated or knurled, and smooth. Most hands now contain knurled to increase friction for hand griping. The standard hand metal with diameter of 6.4 mm.

The large diameter and intermediate are also available. The large diameter (9.8) mm is more comfort for the doctor, but it has disadvantage the large diameter consume large space in the instrument tray. There are two numbers on the handle. One of them is the instrument formula, it describe the dimensional and angulation of the instruments. The other number is manufacture number used for ordering purpose. (2, 3)

Shank: It's the part that connect the handle to the blade. It can be angulated or straight. The angulated form provide stability and make the blade more effective. It may be monoangle or binangle or tripleangle. (4)

Blade: It's primary cutting edge of the instruments. It also called the working. It always be beveled in both sides and called double beveled. It used for cutting in enamel and dentin. It also

called nip when used with non-cutting instruments. It used for condensation of materials. (4, 5)

Figure 1 shows the components of hand instruments.

Black's formula:

G.V Black play a great role in operative dentistry. These formula indicates the dimension and angulation of the blade. If the instruments have three number formula, the first number indicates the width of the blade, second number indicates the length of the blade with mm, and third number indicates the blade angle. If the instruments have four number formula, the first number indicates the width of the blade, the second umber indicates the cutting edge angle, the third number indicates the length of the blade, and fourth number indicates the blade angle in centigrade. (5)

Different instruments design:

Hold the instruments in such a way the primary cutting edge forcing downward and the pointing away from the operator. Single beveled provide bevel in one side. Most of the instruments have single bevel that form the cutting edge. They available in right and left or mesial and distal beveled. Enamel hatched is an example of right and left single beveled. Mesial and distal single beveled such as wedelstaedet bevel or bin angle chisel. Bibeveled instruments have primary and secondary cutting edge. Ordinary hatchets and hoes are examples for bibeveled. Triple-beveled have three distinct cutting edges, so they increase the cutting efficiency. Circumferential beveled are beveled in all peripheries such as spoon excavator. (6)

Hand instruments: It classified into chisels and excavator.

Excavator:

They are used for removal and excavator of caries and sharpening the internal parts. They divided into ordinary hatchets, hoes, spoons, and angle former. Ordinary hatchets excavator are equally bi-beveled. The cutting edge is parallel to the long axis. These instruments are used mainly for the anterior teeth in sharpening the line angles and especially for direct gold restoration. Hoes have blade angle more than12.5 angle, the cutting edge is perpendicular for the long axis. Hoes are used for class III, V preparation and removing of the undermined enamel with amalgam and composite restoration. Hoes also useful for direct gold restoration and for planning tooth preparation walls and line angles. Spoon excavator can be bin-angle or triple-angle. They are used for removal of soft caries, carving amalgam, and direct wax pattern. The angle former is a combination of gingival marginal trimmers and chisels, and a special type of excavator. It's a single planed instruments with right and left bevel. It used for creating bevel in enamel margin, sharpening line angles and creating retentive means for dentin in preparation of gold restoration.(7)

Chisel family:

It's used for cleaving, removal of undermined enamel, and smoothening of the walls preparation. Chisels are used with push motion. They are classified into groups as chisels, enamel hatchets, and gingival marginal trimmers. In the straight chisels the cutting edge make a 90 degree angle with the blade of the instruments. They have bevel in one side and have

straight shank and blade. Monoangle chisels are used for smoothness proximal and gingival walls. They used with push or pull motion. In monoangle chisels, if the cutting edge present on distal side (direct bevel) or it present in mesial aspect (reverse bevel). Binangle has two angle between the shank and the blade. It also can be mesial or distal beveled. Binangle allows the access to different area of tooth structure. The triple angle chisels have three angles, and used to flatten the pulpal floor. The wedelstaedt likes straight chisels except it has slightly curvature. (8)

Enamel hatchet: It's similar in design to ordinary hatched, and beveled in one side. It's available in three figure-formula. The cutting edge is parallel with the axis of the handle and perpendicular with long axis of the blade. It used to remove undermined enamel and smooth of the walls of cavity preparation. (9)

Gingival marginal trimmer: It's similar to enamel hatched, but there's two difference between enamel hatched and gingival marginal trimmer. Their cutting edge make an angle with the blade other than 90 degree which make it four-figure formula and the blades are curved to right or left that make them double bladed instruments. It used with pull and push motion, roundation of axio-pulpal line angle to avoid stress concentration, and they are used for creating the proper bevel of the gingival floor and forming sharp angle in internal parts of the cavity preparation. (9)

Other hand cutting instruments:

They are other hand cutting instruments as knife, file, discoid-cleiod that used to trimming the restorative materials. Knives are used to trim excess material on the proximal margins and for contouring the surface of class V restoration. Knives are known as finishing knives. Files also used for trimming restorative material at the gingival margin. Files available in different sizes and angle to access various restoration surface. The discoid-cleiod are used for carving the occlusal anatomy of amalgam restoration. They also used for burnish inlay margin. (7)

Sharpening of hand instruments:

It's very important step to increase the efficiency of hand cutting instruments. Dull instruments require high force of the operator that lead to discomfort of the patient and painful. Dull instruments increase the working time and reduce the quality of cavity preparation. The presence of shiny edge indicates that the edge is dull. The sharpening can be made manually with an abrasive stone or mechanically with rotary sharpening stone. The sharpening instruments require less pressure and force, improve the efficiency of cutting and tactile sensation, more control of the instruments and more comfort for the patient. (10)

Advantages of Hand cutting instruments:

Hand cutting produce no vibration or noisy and no heat generation. It has efficient cutting and cut in large area as one stroke. It ensure that cutting in the direction of enamel rods and the cavo-surface margin is formed of full length of sound enamel rod. It also produce better and smoother surface. It can't cut into sound tooth structure so it lead to conservative cutting procedures. Hand cutting instruments have long life span and economical. (8)

Grasps:

They are four types are used with hand instruments as modified pen, inverted pin, palm and thump, and modified palm and thump. Conventional pen grasp in not an acceptable instruments grasp.

Modified pen Grasp: It’s similar to holding a pen. The grasp allows the greatest control. The pads of the thump and of the index and middle finger contact the instruments, while the tip of the finger and the little finger are placed on the nearby tooth surface of the same arch as support. The palm of the hand generally is facing away from the operator which provides great power and wide range of movement. (7)

Palm-and-thump Grasp: It’s similar to that used for holding a knife while cutting an apple. The handle is placed on the palm of the hand and grasped by all the fingers. These grasp need to careful using during cutting. (7)

Modified palm-and-thump Grasp: It used when the palm can easily rest on the preparing tooth or the adjacent. The instruments are held by the four fingers, these grasp provide stabilization and full control of the instruments. It’s usually used with the area of maxillary arch and when the dentist is set in the rear-chair position. (7)

Inverted pen Grasp: It’s the same as modified pin grasp, the palm is being toward the operator. It’s used mostly for preparation of tooth in the lingual aspect on the anterior tooth. (7)

Rests and guards:

Any grasp should include a firm that support the hand during operator producers. When the modified pin grasp and inverted pin grasp are used, rest are support by placing the ring finger on the tooth of the same arch. When used palm-and-thump the tip of the thumb on the prepared tooth on the same arch. The closer the rest area to the operating, the more reliable they are. Guard are hand instruments or other items that used to protect soft tissue from abrasives as cotton rolls. (7)

Rotary instruments:

They represents great develop in the operative dentistry. There are variety in shapes and sizes of rotary cutting instruments and the engine that power them. Rotary cutting instruments include hand piece the power source and the tools that attached to it as the burs. They are used for condensation of material, finishing and polishing, removal of the defective tooth structure (10)

Handpiece:

There are two basic hand piece that used now straight handpiece and contra angle handpiece. In straight handpiece, the long axis of the bur the same as the long axis of the handpiece. It’s more used in the laboratory. Contra angle handpiece are classified into micromotor contra angle handpiece or air-rotor. Air rotor is supplied by compressed air, it has high speed and low torque. It attached to frication grip only and used for removal of tooth caries. It supplied by air with rotational speed 200,000 rpm. Micromotor contrangle gets the power from electric source, it has high torque and low speed. (2)

Burs:

They consist of head, neck, and shank. It classified latch type handpiece, frication grip handpiece, and for straight handpiece. They are formed of carbide due to high hardness and high strength. Carbide burs are expensive and brittle. They classified according to its use into cutting, finishing, and polishing burs. They also classified according to the shape into round bur, inverted bur, pear-shaped bur, end cutting bur, straight fissures, and wheel shaped. They have advantage as tactile preparation, easy to control, and debris can easily remove by water. They also have disadvantage as pain, vibration, noisy, and dull burs produce high heat. (2)

Conclusion:

In conclusion there are many instruments such as hand instruments, rotary, ultrasonic, laser that used in operative dentistry. Many hand instruments are still used now for many purposes. Hand instruments are made from carbide due to high hardness and strength. Rotary instruments are a great revolution in operative dentistry. Rotary instruments include Handpiece and burs. Burs have advantage as easy to control, debris can remove by water, and precision is obtained. Every dentist should know everything about the instruments to do best work with high quality.