

A PLAN OF ROOT CANAL THERAPY-LABORATORY EXERCISE

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Preliminary selection of extracted teeth

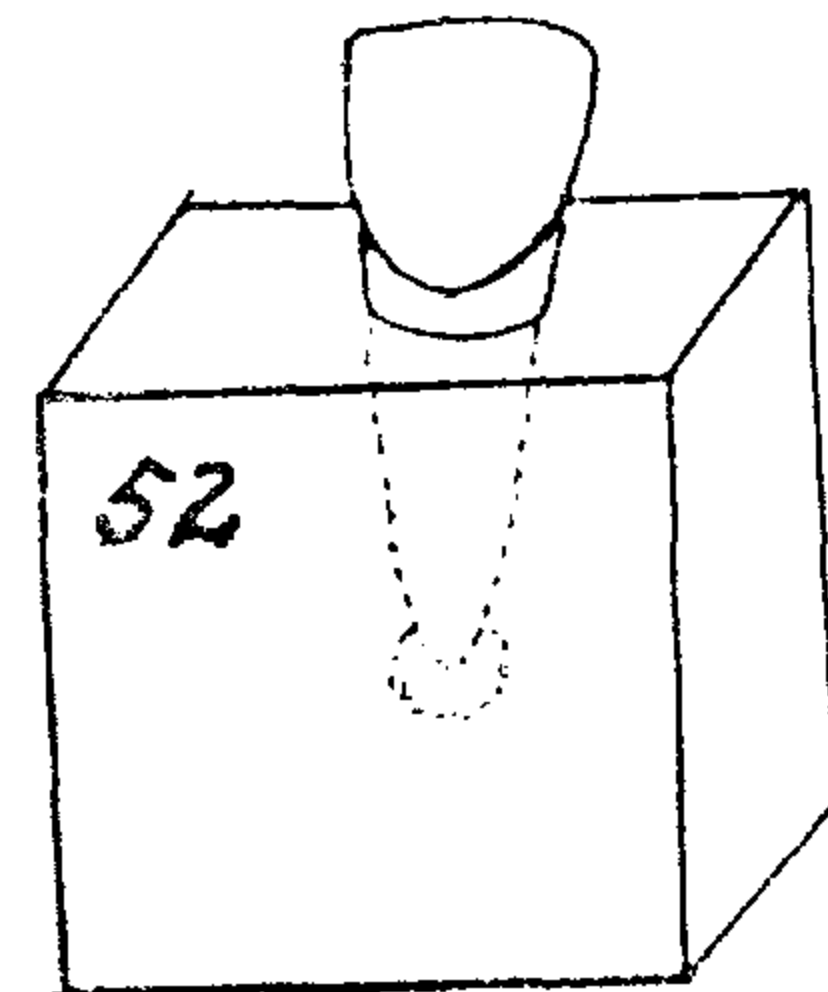
One anterior tooth is to be selected for root filling. This tooth should have a single root canal which should be free of pronounced curvatures.

ANTERIOR TOOTH FOR ROOT CANAL FILLING

When a suitable anterior tooth has been selected, it is envelope, marked with the student's name and chair number, is returned to the Nurses' Station. This tooth will be sent to the X-ray department and will be returned to the student at the next session. Students should not contact the X-ray department directly.

The radiograph of the tooth is checked by staff, to verify that the root canal is free of obstructions or pronounced curvature. A small sphere of wax (approximately 4mm. diameter) is attached to the root apex and the tooth is then mounted in a block made from a plaster and sawdust mixture. The dimensions of the block should be 1'' × 1'' × ½''. A mould made from baseplate wax will facilitate construction of this block.

The tooth is placed so that its labial and lingual surfaces face the 1'' square sides of the block. An identifying number is engraved on the set plaster block and the engraved area filled with amalgam so that the number will show up on future radiographs.



Preparation of the crown

At this stage the crown of the tooth is rendered caries free and any defective restorations are removed. The crown is recontoured by restoring the defects with rapid setting zinc oxide and eugenol cement.

The following steps are then carried out in *the mechanical preparation of the root canal*:

- 1) Access is gained into the root canal.
- 2) A measurement radiograph is taken to establish the length of the tooth.
- 3) Instrumentation of the root canal is performed.

Instruments used in mechanical preparation of the root canal Broaches. Smooth and barbed broaches are employed. The smooth broach may be employed for exploration of the root canal. Barbed broaches are used to remove pulp tissue, debris and dressing materials from root canals. Barbed broaches should never be forced into narrow

canals as they will bind and resist withdrawal. Broaches are available in several different widths, usually designated x-fine, fine, medium, coarse, etc.

Smooth broch



Bebad broach

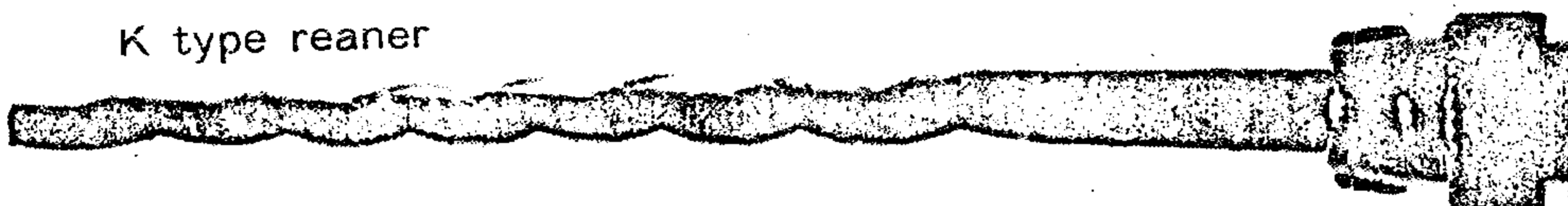


Magnification x9

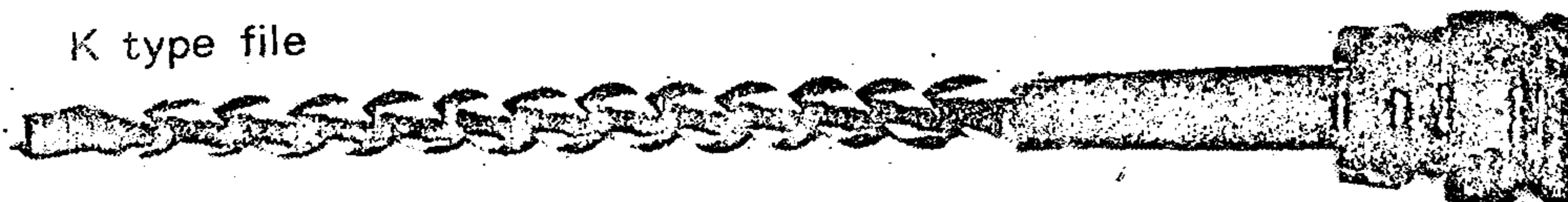
Reamers and files. Reamers are delicate twist drills. They are used to enlarge the apical one-third of the root canal to facilitate root filling. Two patterns of files are available, Hedstroem and K types.

Reamers and files are supplied in lengths of 25mm. and 28mm.

K type reamer



K type file



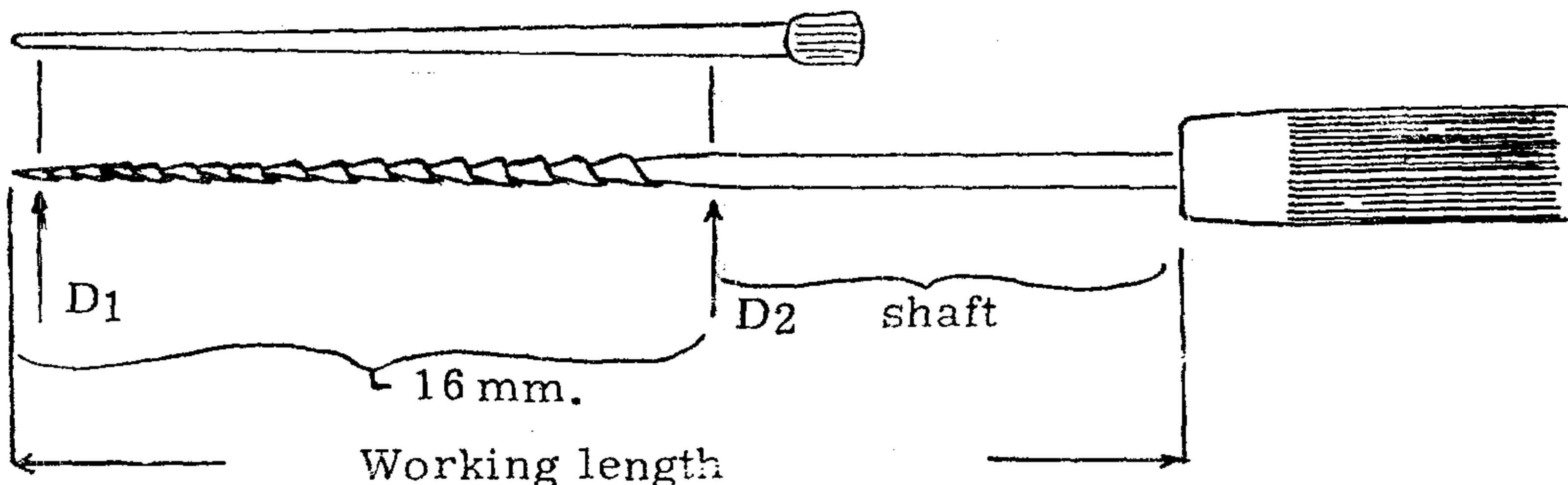
Hedstroem file



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Instrument calibration

In recent years manufacturers have endeavoured to standardise endodontic instruments and root filling points so that there will be (uniformity of size, taper and length.

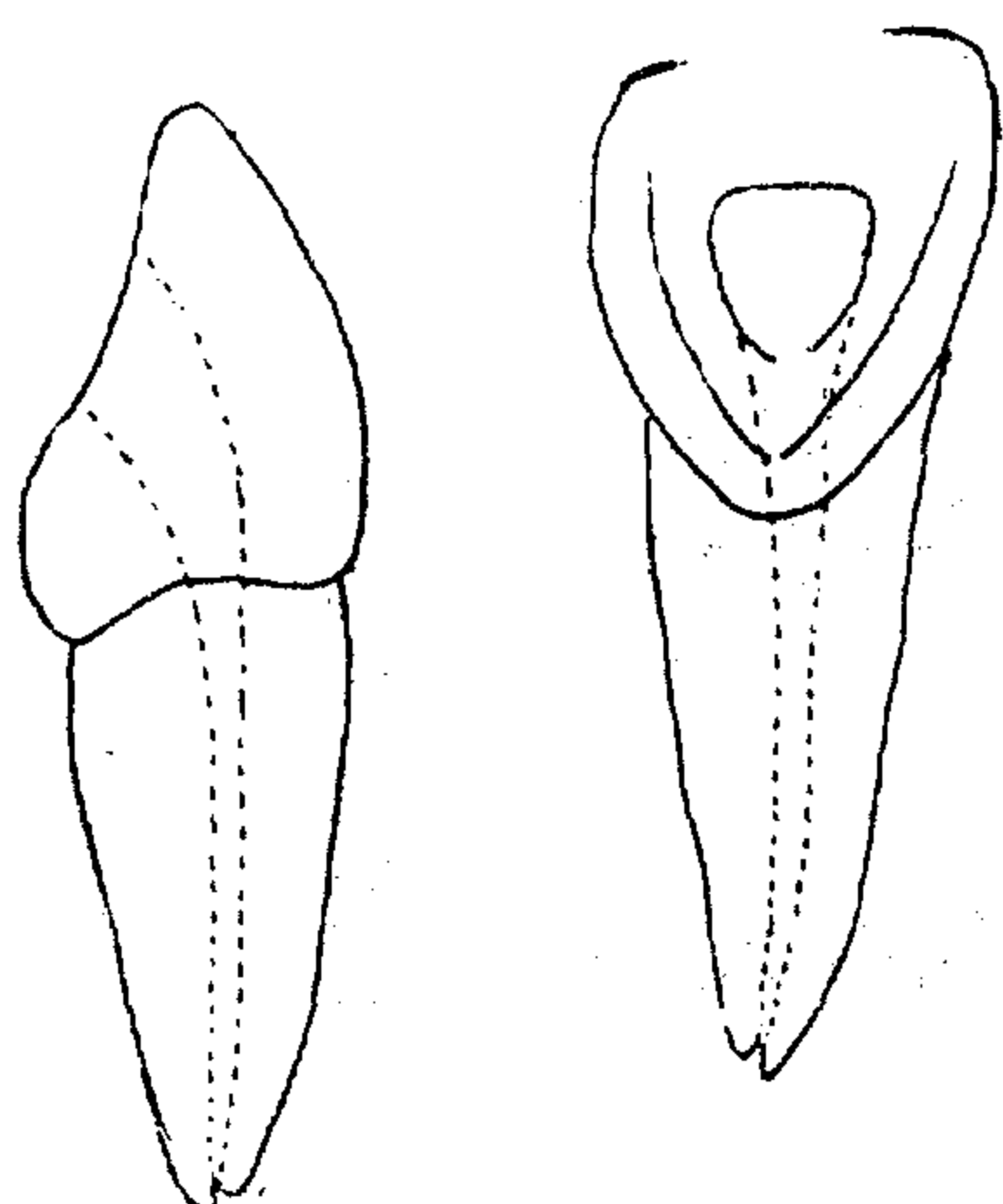


The diameter of the instrument in tenths of a millimeter at point D_1 determines its number in the standardised system. The distance between point D_1 and D_2 is 16mm. The *increase* in diameter between D_1 and D_2 is 0.3mm. Every instrument therefore has a standardised taper. The diameter at point D_1 increases 0.05mm. in successive sizes up to size No.60, thence by 0.1mm. to size 100. Gutta percha root filling points are similarly standardised.

This conversion table shows the relationship between the old numbering system and the new standardised system.

CONVERSION CHART FOR ENDODONTIC INSTRUMENTS AND ROOT FILLING POINTS

Standardised Number e.g. P.D. & Kerr Instruments	Old Number e.g. P.D. Gutta percha point
10	0
15	1
20	2
25	3
30	4
35	
40	5
45	
50	6
55	
60	7
70	8
80	9
90	10
100	11
110	12
130	
140	



1) Access to the canal

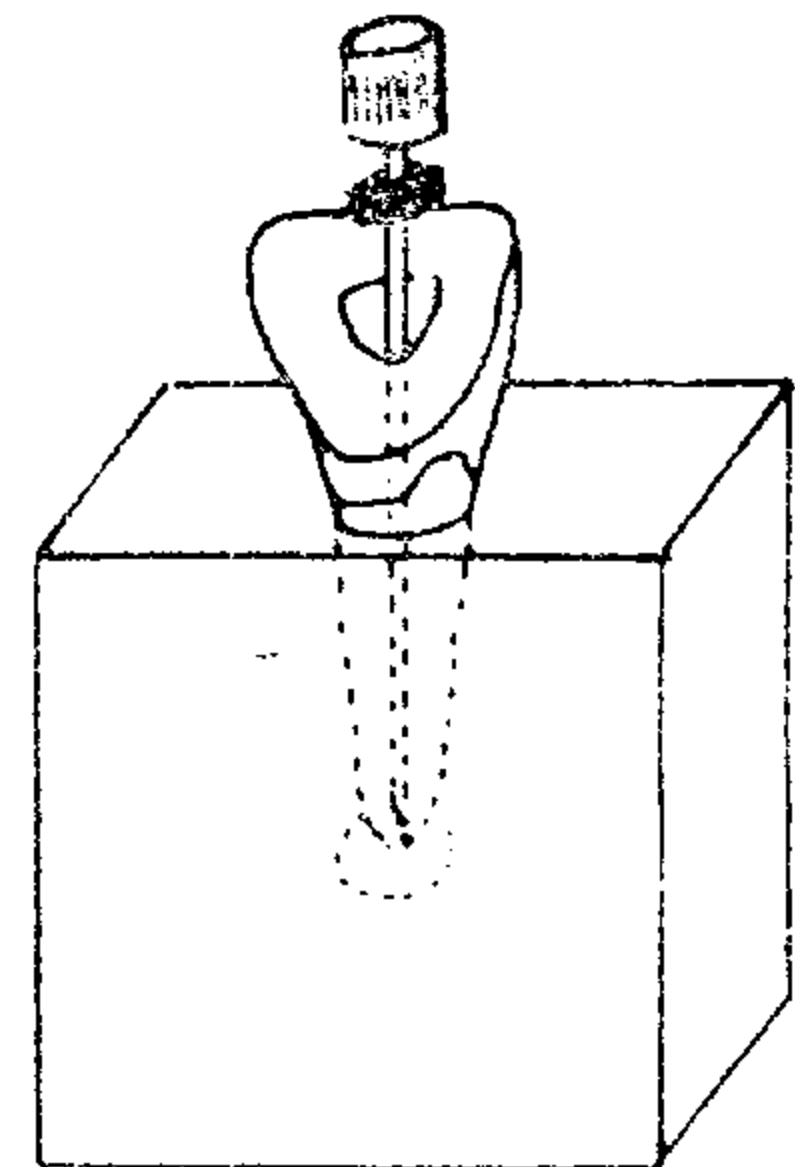
Direct access to the root canal should be obtained a long straight lines. In gaining access to the root canal from the lingual surface of the anterior tooth the approach should be so planned that it will become a direct continuation of the root canal.

The access cavity should not weaken the incisal edge nor be too close to the gingival margin. The initial opening into the pulp is made using a small round bur (No.2) in a slow speed handpiece. The opening is then enlarged using a large round bur (No.4). After the initial penetration into the pulp chamber, the opening is enlarged by cutting from within the tooth outwards. The prepared opening must permit complete removal of pulp tissue from the pulp chamber (including the pulp horns) and the root canal.

2) Measurement radiograph

The approximate length of the tooth may be ascertained by measurement from the

initial radiograph. A reamer or file (No. 15) is then measured and the required length of the instrument is marked by using a sliding rubber stop. This instrument is then *inserted the known length* into the root canal. The rubber stop will rest on the incisal edge of the tooth. The instrument may be held in the tooth by introducing a pellet of cotton wool into the coronal chamber. A radiograph* is obtained and by comparing the known measured length of the instrument and the length of its radiographic image, the correct length of the tooth may be calculated. (See Nicholls, 1st ed., pp. 109—116.)



Example of calculation employing the proportion method of assessing the canal length

Real length of tooth	= x mm.
Real length of instrument	= 21.5 mm.
''X-ray'' length of tooth	= 22.0 mm.
''X-ray'' length of instrument	= 21.0 mm.
Real length of tooth	= $\frac{\text{''X-ray'' length of tooth}}{\text{''X-ray'' length of instrument}}$
Real length of instrument	= $\frac{22.0}{21.0}$
x	= $\frac{22.0}{21.0} \times 21.5$
21.5	= 22.52
Real length of tooth	= 22.5 mm. (nearest 0.5mm.)
Length to be reamed to the apical ''stop''	= 22.5 - 1mm.
	= 21.5mm.

*N.B. This radiograph and subsequent radiographs for this exercise are exposed and developed on the fifth floor.

3) Mechanical preparation

The aim of mechanical preparation of the root canal

1. To cleanse the pulp chamber and root canal.
2. To enlarge the root canal and smooth its walls.
3. To prepare the apical third of the root canal so that it is tapered, round in cross section and precisely shaped to accept a pre-formed gutta percha root point. An apical ''stop'' is prepared 1 mm. short of the apical foramen.

In the mechanical preparation of the root canal, the following rules should be observed:

- 1) direct access should be obtained along straight lines;
- 2) smooth instruments should precede barbed or rough instruments;
- 3) narrow instruments should precede wide ones in sequence of size;

- 4) reamers should precede files and should be given only 1/4 to 1/2 turn at a time;
- 5) files should be used with a pull stroke with lateral pressure;
- 6) no root canal instrument should be forced when it binds;
- 7) apical tissues should not be traumatised;
- 8) debris should not be forced through the apical foramen.

Root canal cutting instruments should be examined frequently and if the cutting edges appear to be dull or the shaft bent, the instrument should be discarded.

Reamers are delicate twist drills which cut by being rotated. The very nature of their design predisposes them to breakage. Should the end of the reamer bind while the instrument is being rotated, breakage may occur. They should be used with great care.

With each turn of the reamer, the cutting blades are advanced along the root canal, and so dig into and cut away some dentine. A reamer may be used to facilitate removal of debris from the root canal without running much risk of forcing the debris through the apical foramen, since it will be caught between the blades of the instrument. If a file were used in such cases, there is a possibility of pushing debris ahead of the instrument and into the periapical tissue. A reamer should not be advanced more than a quarter or half turn at a time. The instrument should then be moved back a trifle, re-inserted and given another or half turn to the right. Repeated removal and re-insertion of the instrument, and care not to give it more than half a turn at a time, will prevent binding and hence prevent breakage. From time to time, dentinal debris clinging to the instrument should be removed by mechanical cleansing with gauze.

Files should be used with a pull stroke. They are relatively safe instruments to use from the standpoint of breakage, provided they are not rotated; if used improperly files may force debris through the apical foramen. A loosely fitting file should be inserted into a root canal and be withdrawn laterally against the wall in such a manner as to file one surface of the canal at a time. The file may be cleaned mechanically with gauze.

Under no circumstances should a root canal instrument be forced when it binds. Root canal instruments are delicate and should be discarded at the first indication of wear.

Technique of instrumentation of the root canal

The initial reamer may be selected by judging the width of the canal as it appears in the radiograph and then choosing a reamer of the same width.

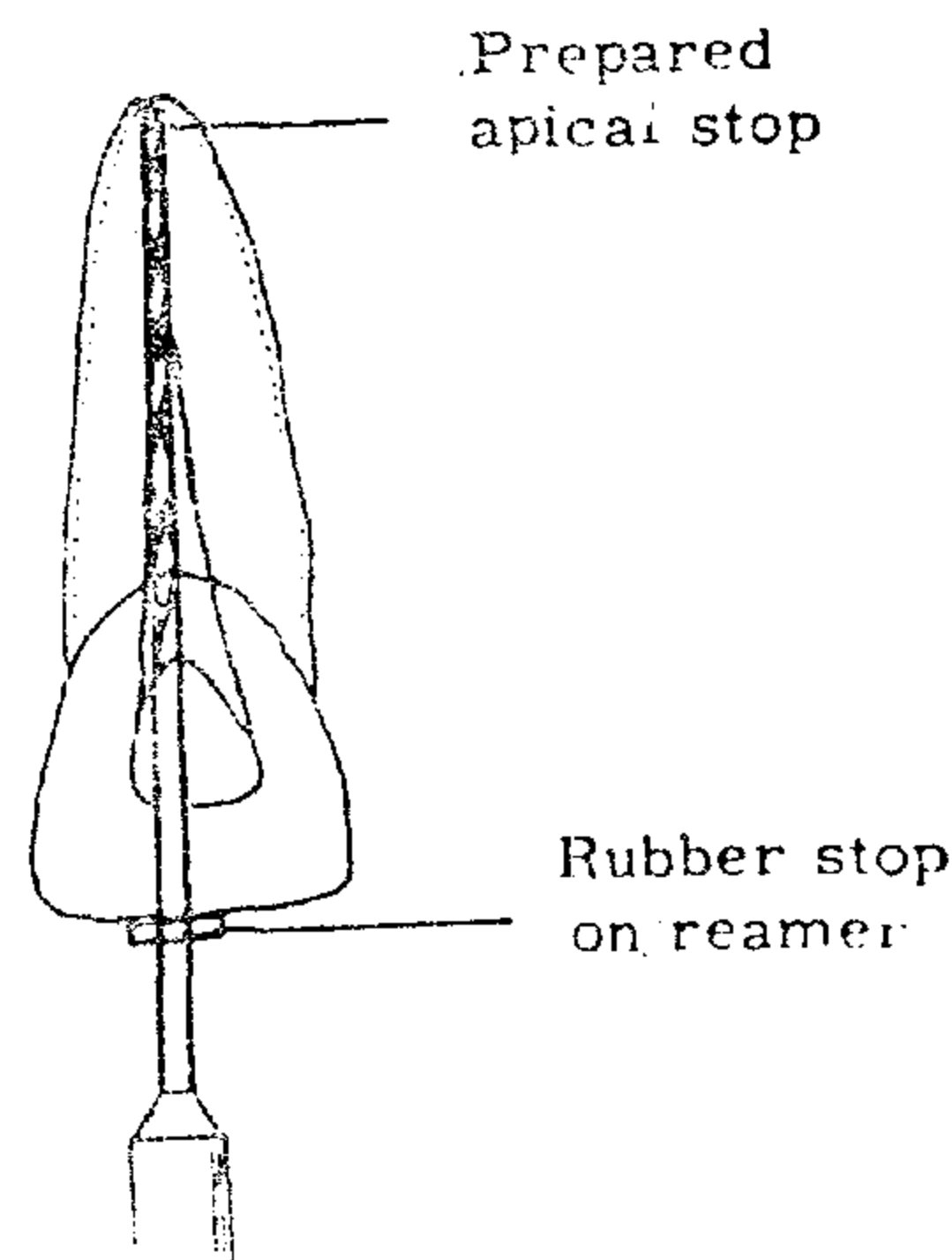
This instrument and all instruments to be used in the root canal are marked to known (calculated) length prior to use. A small rubber disc is pierced by the instrument, slid to the required position and used as a marker. Limiting the reaming of the canal to the apical "stop" (1 mm. short of the apical foramen) will ensure minimal apical opening and reduce the possibility of traumatising the periapical tissues in vivo.

Reamers are used in strict numerical order and each reamer is used as outlined previously until it penetrates into the canal the calculated length. Reaming is continued until clean white apical part of the canal. On completion, a "stop" conforming in shape to the tip of the largest reamer used will have been formed at the apical limit of the canal. Filing is now carried out in those parts of the root canal where reaming will have been ineffective.

A loosely fitting file is introduced and all aspects of the root canal are filed. Care should be taken not to interfere with the reamed apical portion of the canal. Filing is continued until shavings of clean dentine are removed from all walls of the canal.

When mechanical preparation is carried out in vivo the canal is irrigated frequently and debris created by mechanical preparation and other contaminants are washed from the canal.

In this technique exercise irrigations are not employed but debris from mechanical preparation may be removed by inverting the tooth and tapping.



ROOT CANAL FILLING

The technical object of root canal filling is to obliterate the prepared root canal space by placing an inert, hermetic filling.

REQUIREMENTS FOR AN IDEAL ROOT FILLING MATERIAL

- 1) It should be biologically acceptable.
- 2) It should be easily introduced into a root canal.
- 3) It should be liquid or semi-solid upon insertion and solidify later.
- 4) It should seal the canal laterally as well as apically.
- 5) It should not shrink.
- 6) It should be impervious to moisture.
- 7) It is desirable that it should be bacteriostatic, or at least it must not encourage bacterial growth.
- 8) It should be radiopaque.
- 9) It should not stain tooth structure.
- 10) It should allow quick and easy sterilization immediately before insertion.
- 11) It should allow easy removal from the root canal if necessary.

Gutta percha is the nearest an ideal substance for this purpose and is used to technique exercises.

Powder:	Zinc Oxide Bismuth Subnitrate
Liquid:	Eugenol

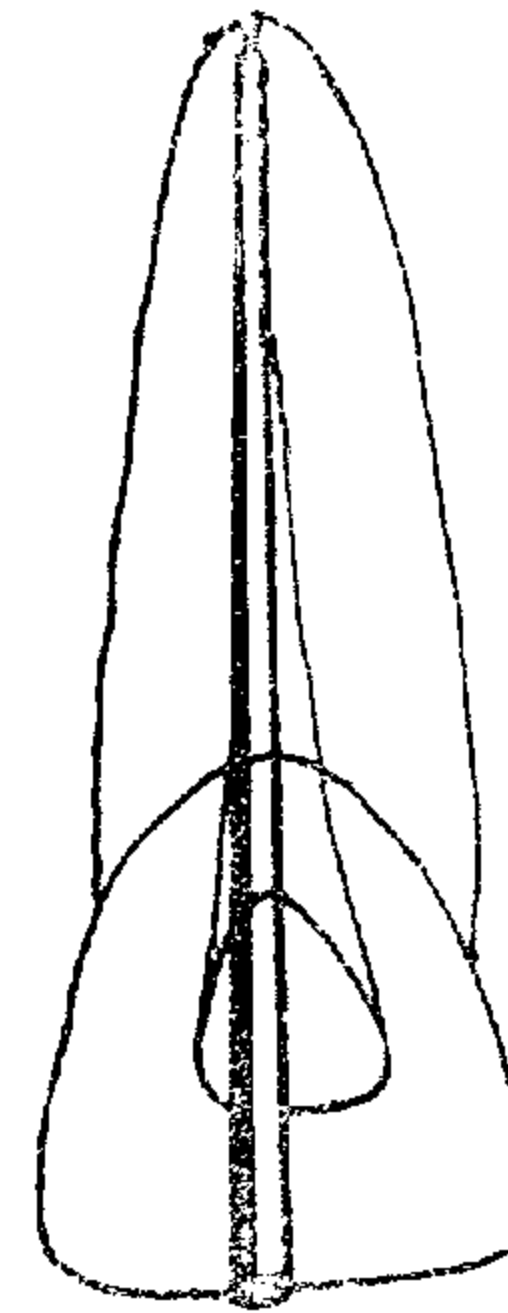
ROOT CANAL FILLING WITH GUTTA PERCHA POINTS

Selection of a gutta percha point (the Master point)

A gutta percha point is selected which corresponds to the size of the largest reamer used in preparing the apical "stop". The point is then measured and cut to correspond with the prepared length of the tooth. On insertion into the canal the point should be advanced the measured distance. The point should fit snugly and exhibit slight resistance to removal ("tugback").

TRIAL POINT X-RAY

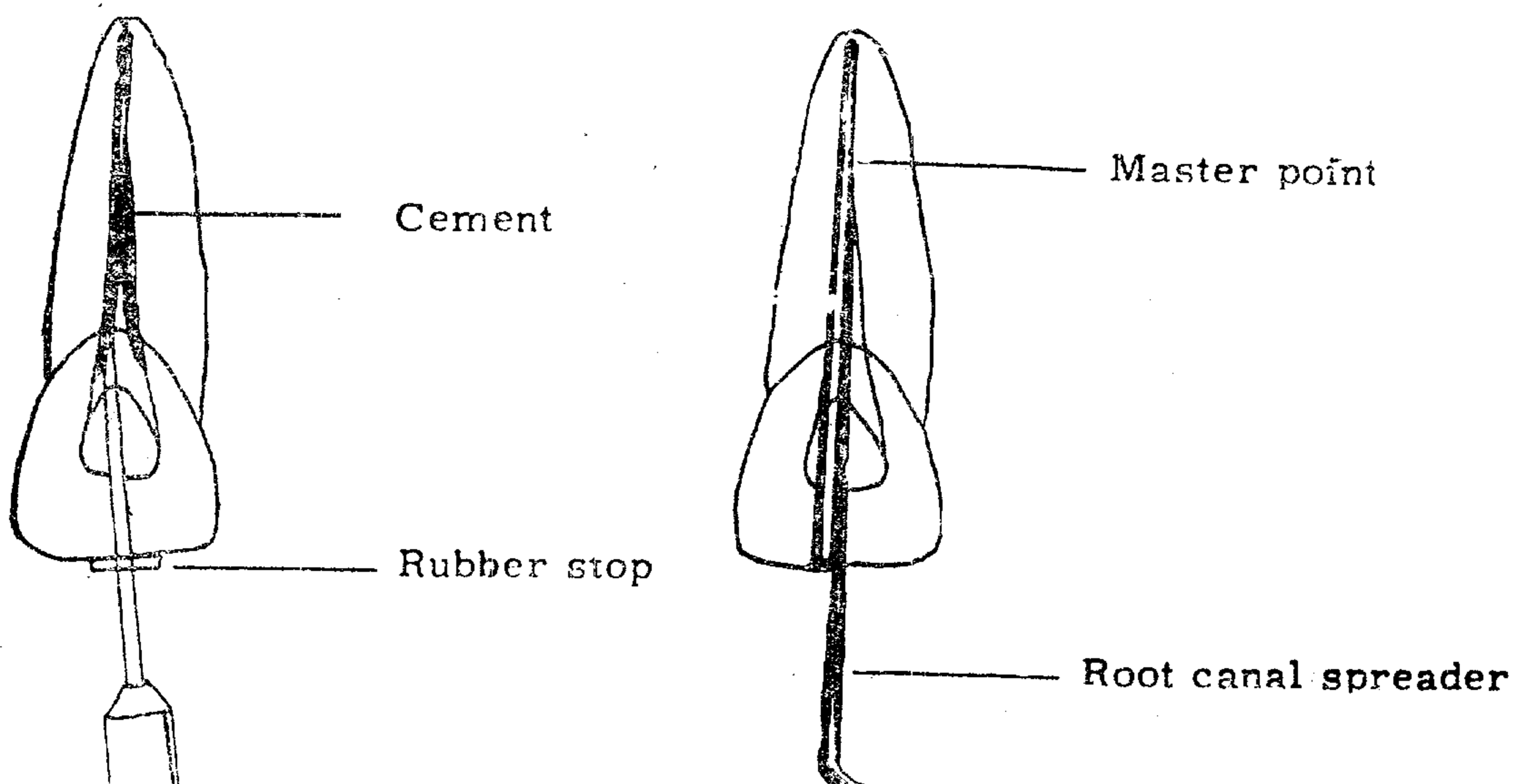
When a point has been fitted, a radiograph is taken to check that all procedures have been carried out correctly. This radiograph must show that the root canal has been prepared correctly and that the point adequately fills the prepared apical region. This gutta percha point is referred to as the Master point.



Master point in place

METHOD OF ROOT CANAL FILLING

After selecting the gutta percha point, the root canal cement is mixed to stringy consistency using a slab and spatula. The wall of the root canal is then coated with cement. This is done by applying cement to a reamer, introducing the instru-

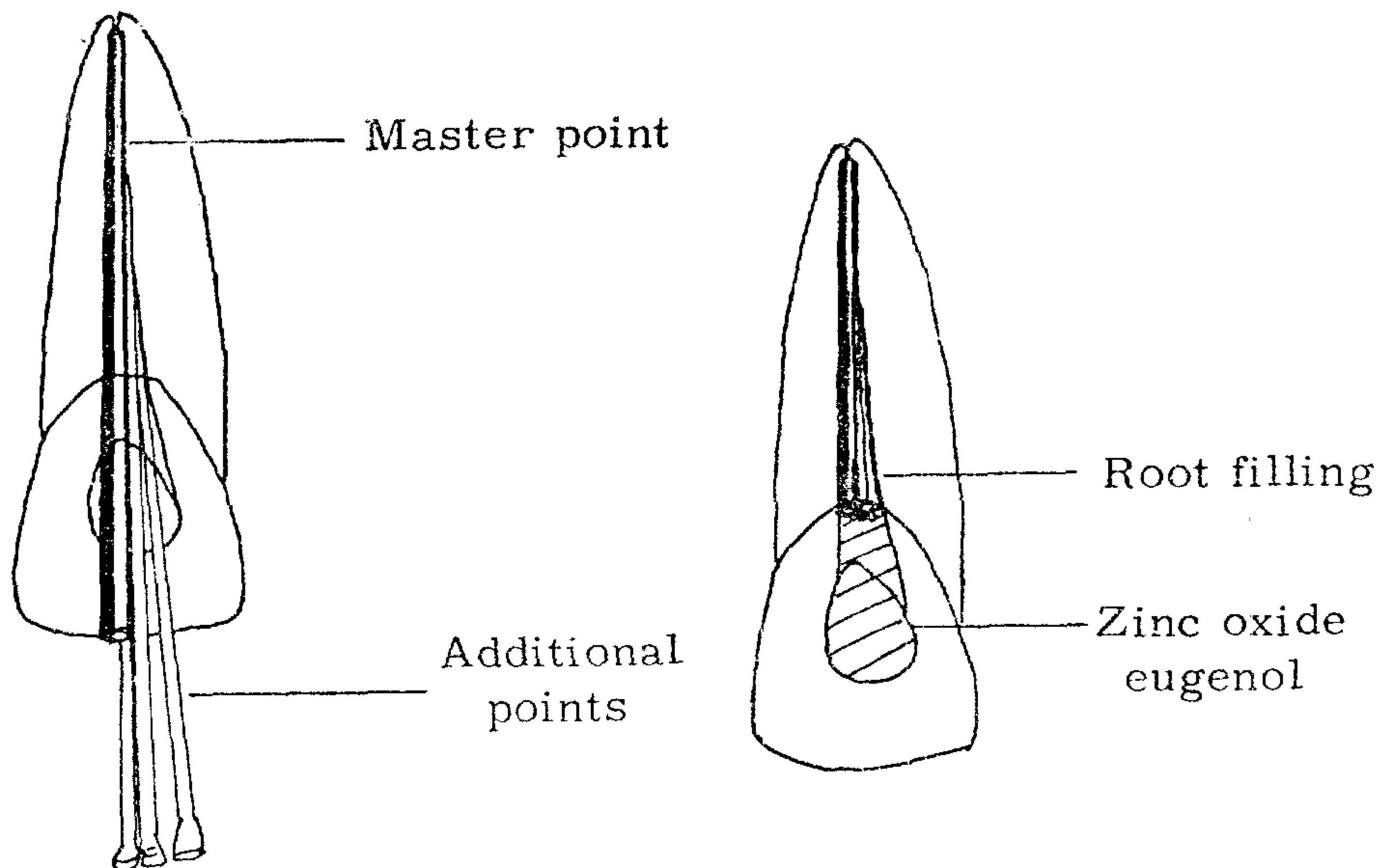


ment a known distance into the root canal and rotating the reamer counter-clockwise. This procedure is repeated three or four times until the canal wall is well coated with cement.

The selected G.P. point is then rolled in cement so that the apical half is coated. It is carried into the root canal by means of tweezers and *slowly* advanced apically until the butt end is level with the allow air and cement to be displaced in a coronal direction.

In most cases the canal is wide coronally and cannot be filled with a single gutta percha point. Several gutta percha points are used and compressed against each other and against the canal wall by the lateral condensation method. After insertion, the master point is forced against a wall of the canal using a "Root Canal Spreader" (Kerr No. 3). On removal of the spreader, a No. 25 or 30 point is inserted into the space created. This procedure is repeated until the root canal is completely filled. The canal wall and initial point are coated with cement but additional points inserted in the canal are not covered with cement.

A radiograph is then taken to determine whether the canal is satisfactorily filled. If the root filling is satisfactory, excess gutta percha *coronal* to the level of the cemento-enamel junction is removed with a hot instrument. The coronal pulp chamber is cleansed of root filling paste and the crown sealed with rapid setting zinc oxide/eugenol cement.



B. SECTIONING OF TEETH

The four multi-rooted teeth selected earlier are to be sectioned longitudinally using large stones, to show details of the root canals and pulp chamber. The rem-



aining teeth are sectioned transversely at different levels.

After sectioning, the exposed pulp chamber and root canals are to be filled with blue inlay wax and the six teeth mounted in a single plaster block. (Examples of sectioned teeth will be available as guide.)