The application of the buccal object rule for the determination of calcified root canals

M. G. KHABBAZ & M. H. SEREFOGLOU
Department of Endodontics, University of Athens Dental School, Athens, Greece

Summary
Root canal calcification represents a serious problem which often occurs in clinical practice. Calcified root canals are difficult or even impossible to find and treat conservatively. In this paper, a technique is proposed which may be helpful in detecting and locating calcified root canal(s) and properly treating them. The proposed technique is simple and easy to perform in posterior and anterior teeth, and it may be useful in everyday clinical practice.

Keywords: calcification, pulpal obliteration, root canal therapy.

Introduction
Root canal calcification is the deposition of hard tissue to the root canal wall in response to trauma, caries, periodontal disease and also as a consequence of age changes (Sundell et al. 1968, Cohen & Burns 1984, Salentijn & Hendricks-Klyvert 1988). This results in a progressive reduction in the lumen of the canal as secondary dentine is laid down. In these cases, the pulp chamber and the root canal usually become narrow or almost closed. Therefore, conservative root canal treatment may become extremely difficult or sometimes impossible. The failure rate in these teeth after root canal treatment ranges between 20 and 70% (Cvek et al. 1982). In an effort to locate the residual root canal, the dentist removes large amounts of dentine and there is a possibility of perforating or fracturing the root. When surgery is performed in these cases, it is not always successful (Cvek et al. 1982).

The use of radiography has been proposed to solve this clinical problem. However, it is not always helpful because the information provided is seen in only two dimensions, compared with the three-dimensional structure of the tooth (Goerig & Neaverth 1987, O'Connor et al. 1994).

The buccal object rule, which is also referred as Stanley's rule, relates to how the relative position of the radiographic images of two separate objects changes when the projection angle at which the images are made is changed. The object (e.g. root or canal) furthest from the film (the buccal) moves a greater distance on an X-ray projection taken with the cone angled in the horizontal plane than does the object closer to the film (the lingual) (Richards 1980, Cohen & Burns 1984).

The purpose of this paper is to examine the application of the buccal object rule (BOR) to facilitate detection of calcified root canals when root canal therapy is indicated.

Materials and method
A pre-operative radiograph is taken to provide information about the pulp chamber and the canal(s), the amount of calcification and the possible location of the root canal (Fig. 1). Direct access to the pulp chamber is then created until the initial location of the orifice, prior to calcification, is reached. At this stage, the procedure is based completely on the theoretical knowledge of the anatomy of the tooth and the root canal is considered to be situated at the centre of the root (Cohen & Burns 1984, Walton 1989, Marshall et al. 1991). The change in colour of the dentine, if it can be seen, is an additional feature which can be helpful. Opening is continued with a small round bur with a thin stem 30 mm in length (Meisinger, Germany). This bur is left in place in the dentine and three radiographs are taken (Fig. 2). The first, straight-on to the bucco–lingual dimension, is used to determine the position of the head of the bur in the root canal in the mesio–distal dimension. The second radiograph is taken with a 20° horizontal angle and the cone is shifted distally, whilst with the third radiograph the horizontal angle is also 20° and the cone is directed...
The buccal object rule and calcified orifices

Pig. 1 Pre-operative radiograph. Tooth 11 in a 67-year-old patient suffering from irreversible pulpitis. Full calcification of the cervical third of the root canal makes access difficult.

mesially. The last two radiographs give information concerning the relation of the bur to the canal lumen in the bucco-lingual dimension. After this estimation, the bur is moved apically and the procedure (three radiographs) is repeated according to the BOR until the head of the bur and the orifice of the root canal investigated come together (Fig. 3).

After the detection of the root canal(s), root canal treatment will be continued with the working length determination, instrumentation and obturation of the canal(s) (Fig. 4).

To eliminate the amount of radiation, the patient must be protected with a lead apron. Furthermore, the radiographic apparatus must have a voltage of at least 70 kV. Fast films must be used and the minimum exposure time employed (Ennis et al. 1967).

Discussion

Finding a calcified root canal is sometimes a very difficult process (Kvinnsland et al. 1989) and can create serious problems such as severe loss of dentine and perforation (Burns & Buchanan 1991). Some nonsur-

Fig. 2 (A) Straight-on radiograph. The course of the bur seems appropriate for the location of the canal. (B) Second radiograph. The cone is shifted distally. The course of the bur (arrow) still seems appropriate. (C) Third radiograph. The cone is shifted mesially. The bur (arrow) moves a greater distance than the canal on the radiograph, which means that the bur is located more buccally to the canal (farthest from the film). Therefore, the deeper penetration will lead to a perforation. The course of the bur should be adjusted lingually.

Fig. 3 After the adjustment of the course of the bur. Its head is now coincident with the root canal in all projections.
Fig. 4 (A) Working length determination. (B) Immediately after obturation of the root canal.

Fig. 5 (A) A referred case of tooth 16. The loss of dentine near the distal root canal is clear (arrow). (B) Working length determination. The perforation is evident. (C) Detection of the root canal after the application of the buccal object rule.

gical methods have been described to resolve this clinical problem (Goerig & Neaverth 1987, O'Connor et al. 1994). So far, there has not been a safe method to locate these canals. The use of two working radiographs was proposed (Walton 1989) to indicate the angulation of the bur in the root – one straight-on and the other from either the mesial or the distal projection. This method is based on the hypothesis that the information provided by both distally or mesially shifted projections are identical. However, this is not always the case. As can be seen in the case illustrated (Fig. 2b and c), when the cone was shifted distally the course of the bur seemed to be appropriate, whilst when the cone was shifted mesially the bur moved away from the canal. Consequently, deeper penetration of the bur on the course based on the distally shifted projection would have lead to a root perforation.

However, it would be possible to diminish the number of radiographs needed if the first two radiographs taken (one straight-on and one mesially or distally projected) give clear information about the relative position of the bur and the root canal. This can be done successfully only in cases where the head of the bur and the canal have enough distance between them. When they are close together, as in most cases, a third radiograph is obligatory.

In conclusion, the method described in this article, can give the third dimension of the root. It can therefore be very helpful in clinical practice because it can help to satisfactorily find difficult or calcified canals in posterior (Fig. 5) or anterior teeth. It is also possible, using this method, to control and adjust the course of the bur during the access procedure and avoid gross cutting of dentine and perforation. The only disadvantage of this method could be the large quantity of radiation exposed to the patient. The use of fast films and the elimination of the exposure time can reduce this problem (Ennis et al. 1967).
References


This document is a scanned copy of a printed document. No warranty is given about the accuracy of the copy. Users should refer to the original published version of the material.
学霸图书馆（www.xuebalib.com）是一个“整合众多图书馆数据库资源，提供一站式文献检索和下载服务”的24小时在线不限IP图书馆。

图书馆致力于便利、促进学习与科研，提供最强文献下载服务。