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CLINICAL UPDATE

# Non-metallic grid for radiographic measurement

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## Abstract

The purpose of this paper is to suggest an easier, non-metallic radiographic grid system for measuring the working length and radiographic size of pathologic areas during endodontic diagnosis and prognosis determination.

## Introduction

Radiographs form a basic and important tool in endodontic practice. They are needed in most steps of clinical treatment from diagnosis and prognosis determination to completion of the case. Measurement of radiographs is especially significant during root canal therapy, where precision is a factor influencing the success of the treatment.

Accurate measurement can be hampered by the presence of distortions on intra-oral periapical radiographs. Distortions can be in the form of elongations or foreshortenings (1). One way of minimizing distortions is the parallel placement of radiographic film with film holders (2,3). Bhakdinaronk and Manson-Hing (4) compared the paralleling and bisecting angle technique with different film-holding techniques. They showed that almost all the radiographs had distortions in the form of elongations, although the paralleling technique could reduce the amount of elongation. They also noted that morphologic variations from patient to patient and even within the same mouth might pose problems in the parallel placement of radiographic films.

To overcome the clinical problems of distortions and to enable an accurate measurement on a radiograph, radiographic grids were introduced. Everett and Fixot were the first to use metallic grids for working length determination (5,6). Schwarz (7) and Baird (8) also proposed techniques for incorporation of the grids in radiographs.

In the grid system, a pre-measured grid with a 1-$mm^2$ framework is placed along with the radiographic film, and the film is exposed. The image obtained has anatomic structures with grid lines over it. Measuring the grid lines helps in accurately measuring the radiographic length, as the distance between the two grid lines on the radiograph is 1 mm, even if the image is foreshortened or elongated.

Initially, metal meshworks were used to produce grid lines on a radiograph. The metal meshwork was rigid and thus placement of the mesh-attached radiographic film in the patient's mouth was difficult. The metal meshwork was highly radiopaque so that it masked important anatomic structures such as root apex and fracture lines.

To overcome this disadvantage, Larheim and Eggen (9) in 1979, introduced a method to produce non-metallic radiolucent grid lines. The advantage of this system was that it did not mask the anatomic landmarks. The disadvantage of this system was the cumbersome procedure for incorporating grid in the film.

The present paper suggests an easier method to produce grids on the radiograph. The advantages of this system include ease of grid identification because of radiolucent lines. Radiolucent lines do not mask the anatomical structures as the radiopaque lines of metallic

grids do. The grid is attached to the film and radiograph is exposed. Thus, if the film is distorted, for example, elongated, the grid lines will also be elongated. This means that we know that the distance between the two grid lines is 1 mm. If the film is elongated, it will show the distance between the two grid lines as greater than 1 mm. The suggested method in this study is still applicable to digital radiography if applied prior to exposure.

Other advantages of this system are easy availability of materials, ease of use and use of safe dyes intra-orally.

## Materials

The system consists of

- A 1 mm × 1 mm canvas meshwork (cut to the size of the radiographic film) (The canvas was made from a local manufacturer of knitting material. The manufacturer was asked to fabricate the canvas according to our specifications of 1 mm equidistance.)
- A radiosensitive iodine-based, water-soluble dye that is biocompatible (Telebrix 35 Guerbet BP, Roissy CdG Cedex, France).

Composition:

Sodium ioxitalamate – 0.0966 g
Meglumine ioxitalamate – 0.6509 g
Corresponding quantities of iodine – 0.35 g

- Double-sided adhesive
- Radiographic film (periapical/occlusal)

## Procedure

The canvas meshwork is stuck onto the film using a double-sided adhesive. Then, 0.3 mL of the dye is loaded in a syringe and spread onto the canvas with gloved fingers. The assembly is placed in a plastic sleeve, and then into a radiographic film holder. Radiographs are taken as usual using the parallel cone technique. The processed film shows normal anatomic and pathologic structures with radiolucent grid lines.

The method was tested with extracted teeth *in vitro*. After these tests, clinical cases were performed with this technique for measuring the working length, size of the pathologic lesion. Pictures of the clinical cases are shown in Figures 1 and 2.

## Discussion

Radiographic grids are helpful in the accurate measurement of radiographs because the grid and the anatomic features are exposed at the same time. Even if the radiograph is distorted, grid lines can be counted as the distance between the two grid lines, which is 1 mm even if it is elongated or shortened.

**Figure 1** Working length determination with grids.

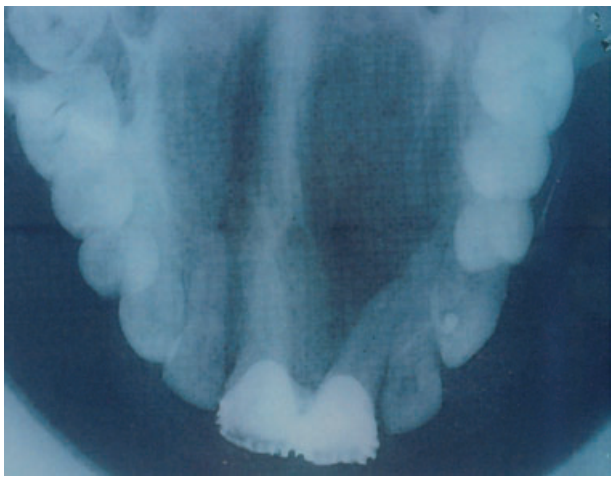

**Figure 2** Determination of size of a periapical lesion in an occlusal radiograph with grids.

In this system, it was expected that the canvas would absorb the dye and produce radiopaque grid lines. But the canvas produced radiolucent lines on a radiograph. This might be because the canvas does not absorb the dye. The dye forms a layer over the canvas in between the mesh framework. This layer makes the radiolucent lines of the canvas more prominent on the radiograph and with good contrast. The radiolucent lines are clearly seen over the bone and teeth, and are easy to count.

Digital radiographic techniques can superimpose radiolucent grid lines with software but such a technique is completely different to this suggested technique.

The main use of grids could be easier working length determination. Although apex locators can serve this

purpose, the apex locators are still considered as adjuncts to radiographs. Accurate measurement of a pathologic lesion is important to allow a follow-up regarding the progression or regression of a lesion. Conventional methods of visually determining the size of a lesion from a radiograph are not accurate and standardized. This non-metallic grid system can also be used for measuring the size of a lesion.

The other uses of this technique include measuring the size of a post space, the amount of dentine remaining around the post space or root canal, the size of a resorptive defect and detecting the exact level of fracture of the root in trauma cases.

This method is a simple, effective and accurate way of measuring objects on a radiograph.

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