THE DISCRIMINATION POTENTIAL OF AMALGAM RESTORATIONS FOR IDENTIFICATION: PART 2

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ABSTRACT

The standard dental bitewing radiograph is used to detect interproximal caries but it also provides a specific view of the dental restorations that can be duplicated for identification purposes. The antemortem and postmortem bitewing radiographs are often not at the same angle and result in distorted images of the restorations. The aim of this study was to investigate the progressive increase in angulations of a bitewing radiograph of the same restoration and to determine at what angle the image is distorted sufficiently as not to be recognized. Bitewing radiographs were taken of the same two restorations at 5˚, 10˚, 15˚ and 20˚ superior, inferior, mesial and distal to the original 0˚bitewing radiograph. Twenty examiners were required to determine at what angle the distortion prevented matching of the image with the original bitewing radiograph. The results showed that the image distortion at 15˚became suspect but at 20˚none of the images could be matched to the original bitewing radiograph.

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INTRODUCTION

Dental identification of human remains is dependant on accurate antemortem dental records that should include radiographic images of the teeth and the restorations. These radiographs are usually the so-called bitewing radiographs that are used to detect interproximal caries in the posterior teeth. The technique of taking bitewing radiographs is standardized and relatively easy and these images are intended to be at right angles to the long axis of the posterior teeth and parallel to the occlusal surfaces of the teeth thereby providing an uninterrupted view of the interproximal surfaces of the teeth, but also providing a specific image of the restorations that may be present in these teeth. These radiographic images of the restorations can be compared in antemortem and postmortem records for identification purposes. Borrman & Gröndahl[1] reported that dentally trained personnel were able to accurately match antemortem and postmortem bitewing radiographs; this was also shown in Part 1 of these articles where the two sets of radiographs were exact duplicates.

Most dentists are aware that their bitewing radiographs are not always at right angles to the long axis of the teeth and that the angulation of the cone of the x-ray machine can be either anterior or posterior to the right angle plane resulting in a degree of overlapping of the interproximal enamel surfaces of the posterior teeth; the cone may also be angulated superior or inferior to the occlusal plane. These images will then be distorted to a lesser or greater degree depending on the error in the cone angulation. The comparison of antemortem and postmortem dental radiographs depends on the matching of dental restoration morphology. If the antemortem and postmortem radiographs are taken at the same angle the restoration morphology will be identical. If, however, the angulation of the antemortem radiograph is significantly different to the postmortem radiograph there can be overlapping of two restorations and this can occur with occlusal and palatal restorations on a molar in a tooth, and thereby result in inaccurate interpretation of the dental records.

In Part 1 of this series it was shown that exact duplicates of radiographic images of compound amalgam restorations are easily matched and a single restoration may be used to identify an individual. If there is a significant difference between the angulations of the antemortem and postmortem radiographic images, at what angle is it not possible to accurately

distinguish that two restorations are the same?

Aim

The aim of this study was to investigate the variations of the angulations of bitewing radiographic images of compound amalgam restorations in molar teeth and compare these images with a control bitewing radiograph to determine at what angle the image changed significantly to prevent matching of the radiographic images.

MATERIALS AND METHODS

A pair of molar teeth each with a three surface amalgam filling was radiographed at right angles to the long axis (equivalent to a bitewing radiograph) and this was designated as 0º. This pair of teeth was then radiographed at 5º, 10º, 15º and 20º superior, inferior, mesial and distal to the plane of the bitewing radiograph (Fig. 1). These angulated views were examined and compared to the 0º bitewing radiograph by twelve dentally trained personnel to determine at which angle the images of the restorations were no longer comparable with the 0˚bitewing radiographic image. The examiners were required to match the various angulated radiographs and indicate Y if the image was comparable to the 0˚image and N if unrecognizable. The result of the matching procedure by each examiner was recorded (Table1).

RESULTS

The examination of the angulated views of the radiographs showed that accurate matching of these radiographs with the 0˚ occurred at 5º and 10º, but at 15º the morphology of the amalgam restorations had changed sufficiently as to make confident matching doubtful; at 20º the images were not recognizable (Table 1). The mesial angulation showed that at 5˚ and 10˚ the images were comparable to the bitewing radiograph but at 15˚ six examiners indicated that the image was unrecognizable, at 20˚ the image was unrecognizable by all the examiners. Similarly the distal images were not comparable at 15˚ by seven of the examiners. The superior images showed that at 15˚ eight of the twelve examiners were not able to match the images to the bitewing image and amongst the inferior images six of the twelve examiners were not able to compare the image of 15˚ with that of the 0˚ bitewing radiograph.

Table 1: *The results of the comparison of the images of the mesial, distal, superior and inferior angle variations of the radiographic images.*

	MESIAL				**DISTAL**				**SUPERIOR**				**INFERIOR**			
Examiner	5º	10º	15º	20º	5º	10º	15º	20º	5º	10º	15º	20º	5º	10º	15º	20º
1 (VMP)	Y	Y	Y	N	Y	Y	Y	N	Y	Y	N	N	Y	Y	Y	N
2 (PvZ)	Y	Y	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y	Y	N
3 (CN)	Y	Y	Y	N	Y	Y	Y	N	Y	Y	N	N	Y	Y	Y	N
4 (GN)	Y	Y	Y	N	Y	Y	N	N	Y	Y	N	N	Y	Y	N	N
5 (NP)	Y	Y	N	N	Y	Y	N	N	Y	Y	Y	N	Y	Y	N	N
6 (AR)	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y	N
7 (MS)	Y	Y	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y	N	N
8 (MC)	Y	Y	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y	N	N
9 (OH1)	Y	Y	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y	N	N
10 (OH2)	Y	Y	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y	N	N
11 (CdH)	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y	N
12 (JD)	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y	N

Y = yes recognizable, N = not recognizable

The table shows that the radiographic images of the amalgam restorations were comparable at 5º and at 10º. At 15º the images became inaccurate and not easily recognizable to some examiners; at 20º the images were unrecognizable by all examiners.

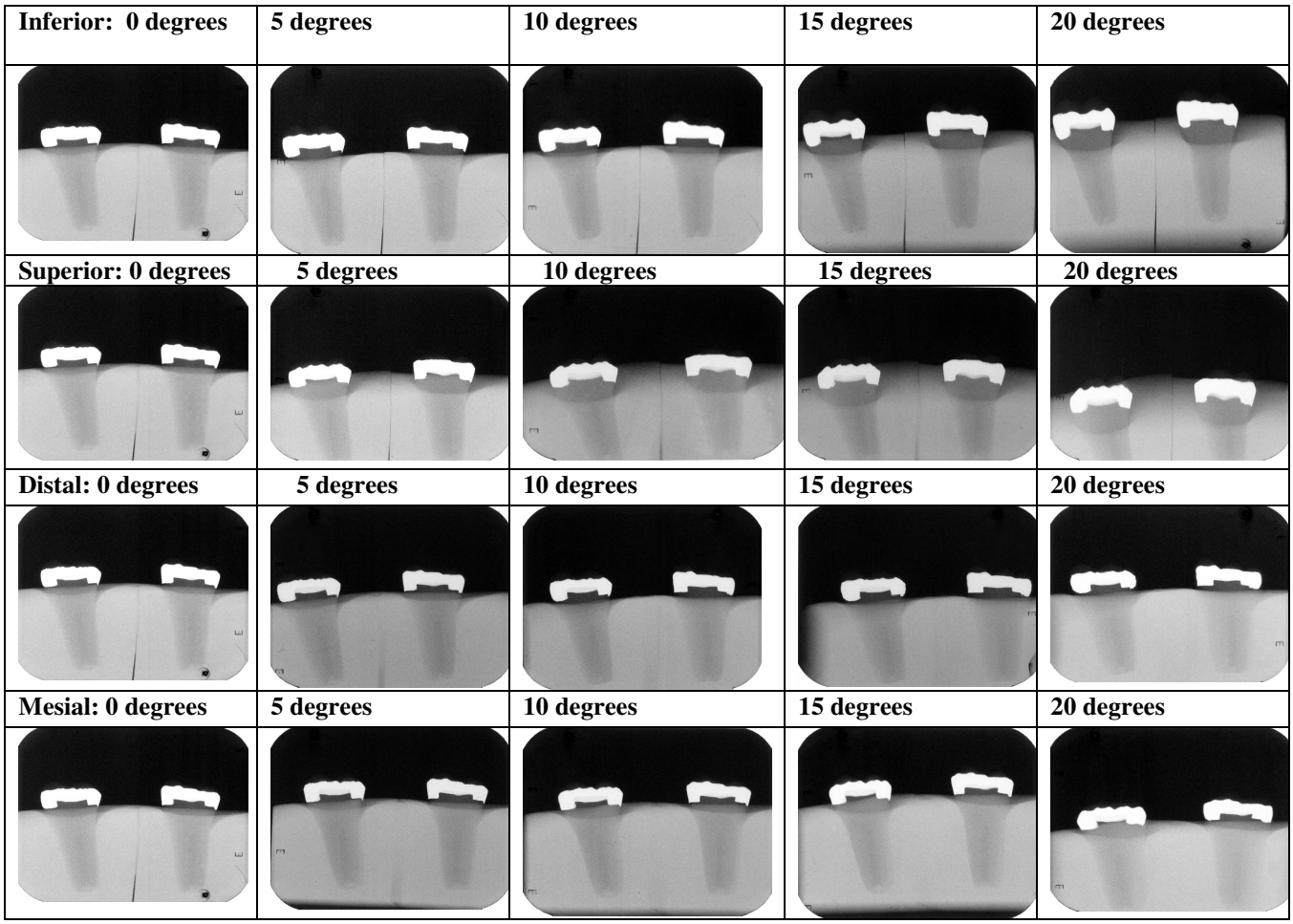

Fig.1: *Two amalgam restorations radiographed at 5 to 20 degrees from the right angle of the 'bitewing' radiograph 0-Degrees.*

DISCUSSION

The process of matching antemortem and postmortem dental radiographic images is a very accurate method of assessing identification of human remains especially if there are dental restorations present. The previous concept regarding dental identification was to obtain 12 concordant features between the antemortem and postmortem dental records to obtain positive identification.[2] If the antemortem and postmortem radiographic images are exactly the same then less than 12 concordant features are necessary for identification; in fact one unique feature can suffice. In Part 1 of this series of articles it was shown that one exact replica of a dental image of a compound amalgam restoration was extraordinary enough to be used for identification of an individual.

This study surmised that very few postmortem radiographic images are exact replicas of the antemortem radiographs and that the degree of distortion of the postmortem image when compared to the antemortem one needed to be tested to determine at what stage the images were no longer comparable. The results of this study showed that at 5˚ and 10˚ the distortion of the image was small enough to allow matching of the radiographic images of the amalgam restorations with the original 0˚ bitewing radiograph. However, at 15˚ and greater the image was sufficiently distorted to prevent positive matching by the examiners.

CONCLUSION

In the comparison of antemortem and postmortem bitewing dental radiographic images of compound amalgam restorations in posterior teeth, the dentally trained person is able to recognize and match images that are within a discrepancy of 15˚ of each other. This recognition of radiographic morphologies

of amalgam restorations obviates the need for 12 concordant dental features for a positive identification.

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