The aim of this work was to measure the danger zone in mandibular molars, relating to strip perforations that might affect the mesial root during canal instrumentation. One hundred mesial roots were sectioned 2mm below the furcation and the distal concavities were measured with a microscope from the border of the canals to the outer dentin of the root. The average thickness of the danger zone of the mesial roots was 0.789 +/- 0.182mm. No significant statistical differences were observed comparing the danger zone of mesiobuccal and mesiolingual canals.

UNITERMS: Danger zone; Safety zone; Mandibular molars.

INTRODUCTION

Danger zone refers to the distal area in the mesial root in mandibular molars. Usually a straight layer of dentin, it becomes a preferable site for strip perforation during instrumentation (Figure 1). Safety zone, on the other hand, is described as the mesial area of the root, with a thicker layer of dentin, slightly touched by the endodontic instruments.

Recent instrumentation techniques emphasize a progressive crown-down preparation of the root canal using NiTi rotary instruments, enhancing cleaning, improving identification of the foramen and facilitating the obturation process. Preenlargement of the coronal and mid-third aspect of the root canal system increases tactile control when directing small, precurved negotiating files into the delicate apical third microanatomy.

Abou-Rass, Frank, Glick first described the danger zone and safety zone of the mandibular molars, showing their importance during cleaning and shaping procedures. Sinai observed that strip perforations in the cervical third of the root canal lead to inflammatory problems and subsequent breakdown of the supporting structures.

Dental literature studying the thickness of the dentin present in the danger and safety zones of mandibular molars is scarce, and most agree that canal instrumentation becomes somewhat difficult since transportation of the canal always occurs towards those areas during preparation of the cervical third of the canal.

MATERIAL AND METHODS

Two hundred mesial canals from one-hundred mandibular molars extracted for several reasons were used in this study. All teeth should have complete root formation and diverging roots. Sex and age of the patients were not regarded as relevant. Carborundum disks were used to
remove the dental crowns and distal roots. The circumferences around the mesial roots were marked at 2mm from the furcation. Mesial roots were marked at 2mm below the furcation, embedded in clear casting resin and horizontally cut. An optical microscope at 10X magnification and precision to the nearest 0.001mm (1u) was used to measure the danger zone of the mesial roots as follows: a point A₁ was chosen on the border of the mesiobuccal canal (MB) and another point B₁ on the border of the mesiolingual canal (ML). Two other points A₂ and B₂ were chosen in a straight line at the outer side of the root (Figure 2).

The distances between A₁ and A₂ and B₁ and B₂ were recorded as the danger zone of the mesiobuccal and mesiolingual canals, respectively.

RESULTS

The average thickness for the danger zones of the mesial roots was 0.789 +/- 0.182mm.

Statistical analysis (ANOVA and Tukey-Kramer) was conducted and showed no significant differences regarding the danger zone in the mesial root of mandibular molars.

DISCUSSION

Cleaning and shaping procedures must disinfect the root canal system and provide an adequate form to fit the obturation material⁵. Most instrumentation techniques adopt a flare preparation of the cervical third. However, excessive flaring might lead to undesirable episodes as transportation of the preparation into the danger zone, or even strip perforations of the root.

Kesseler, Peters, Lorton⁶, reported a mean value of 1.119 +/- 0.273mm for the danger zone of 20 mandibular molars.

Lim, Stock⁷, studied the risks of perforation in mandibular molars and found danger zones with an average size of 1.05 +/- 0.33mm in the MB canal and 1.05 +/- 0.24mm in the ML canal, with a mean size of 1.05 +/- 0.28mm.

Berutti, Feldon⁸ used 15 mandibular molars and found an average of 1.19mm for the MB danger zone and 1.25mm for the ML.

Montgomery⁹ studied the danger zones of mandibular molars after biomechanical preparation, finding an approximate value of 0.976 +/- 0.24mm.

Meister, et al.⁴ have found the creation of danger zones and perforations (5%) using Profile rotary instruments in simulated canals.

This study used 200 mesial canals of mandibular molars with an average size of 0.791 +/- 0.187mm and 0.88 +/- 0.78mm for each mesiobuccal and mesiolingual canals. The mean size for the 200 canals used was 0.789 +/- 0.182mm.

A similar study by McCann, Keller, La Bounty⁴, found an average 0.8 +/- 0.2mm as the size of the danger zone in 20 molars and 0.7 +/- 0.1mm for another 20 molars. The mean size was 0.75 +/- 0.15mm. These same authors reported an average dentin loss of 0.448 +/- 0.04mm in the distal concavity after instrumentation. From this point of view, the distal walls of the roots used in this study, with 89.5% measuring 0.5 to 1mm, would be reduced to a critical point after canal instrumentation.

Lim, Stock⁴ reported the relationship between the size of the distal walls and vertical root fracture. The smaller the size, the greater the susceptibility for root fractures. Our study showed 13% distal concavities measuring 0.5 - 0.59mm, 2% measuring 0.4 – 0.49mm and 0.5% measuring 0.3 – 0.39mm, which, according to these authors, would be more susceptible to vertical fractures.

FIGURE 1: Danger zone in the mesial roots of mandibular molars

FIGURE 2: Reference points to measure the danger zone of each mesial canal
CONCLUSIONS

There was no significant statistical difference between the danger zone in MB and ML canals of mandibular molars. However, professionals must be acquainted with the sizes of the mesial roots of mandibular molars, in order to use appropriate instruments and avoid procedural accidents as strip perforations.

RESUMO

O objetivo deste estudo foi medir as zonas de risco de raízes mesiais de molares inferiores, demonstrando porque perfurações radiculares podem ocorrer durante o preparo do sistema de canais radiculares. Cem raízes mesiais de molares inferiores foram seccionadas horizontalmente 2mm abaixo da bifurcação e as concavidades distais foram medidas com o auxílio de um microscópio, desde a borda dos canais até a superfície externa da raiz. A espessura média para as zonas de risco das raízes mesiais foi 0,789 +/- 0,182 mm. Não houve diferença estatística significante entre as medidas das zonas de risco nos canais mésio-vestibulares e mésio-linguais de molares inferiores.

UNITERMOS: Zona de risco; Zona de segurança; Molares inferiores.

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