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Comparison of the Efficacy of Gutta-percha and Thermafil in Endodontic Treatment in Dogs

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ABSTRACT

Endodontic treatment is performed to save periodontally intact teeth with pulpal inflammation, infection or necrosis. There are some endodontic filling materials used in dogs. The aim of this study was to evaluate the clinical application of two different root canal treatments with thermafil and gutta-percha, in dogs. Nineteen tooth roots were treated in 11 dogs. The treated teeth comprised of six first incisors, five second incisors, three third incisors and five canine teeth. Root canal treatment was decided to be performed after clinical and radiological examination. The depth of the gingival sulcus, dental mobility, haemorrhage after probing and change of tooth colour were assessed and periapical lesions and root resorption were evaluated after dental radiographic examination. In clinical examination, exposed dental pulp, dental mobility, discoloration and fracture were recorded in 14, 3, 6 and 4 teeth, respectively. Periapical lesions were recorded in 4 teeth and root resorption was determined in 2 teeth during dental radiological examination. The root canal was filled with gutta-percha in 12 tooth roots and with thermafil in 7 tooth roots. Afterwards, access openings were closed with a composite resin. Of the 12 tooth roots obturated with gutta-percha, 4 were filled with 55 mm long-gutta-percha plugs manufactured specifically for carnivores and the others were obturated with commercially available 25 mm-long gutta-percha plugs. Both techniques were observed to be applicable; however, obturation with thermafil proved to be much easier. As regards the time needed for application, thermafil was applied within shorter periods compared to gutta-percha. However, the results obtained showed that, instead of using gutta-percha cones and a file of the same size, it would be better to prefer a smaller size thermafil cone to obturate the full length of the root canal.

Key words: Endodontic, gutta percha, thermafil, tooth, dog

INTRODUCTION

Endodontic treatment is performed to save periodontally intact teeth with pulpal inflammation, infection or necrosis. Periapical destruction is observed in untreated cases which may further lead to the resorption of the periodontal ligament, root and alveolar bone, as well as the mobility and even loss of teeth (Yavuz *et al*., 2007; Motlagh *et al*., 2007; Gholami *et al*., 2009). Clinical examination reveals the presence of symptoms such as localized oedema, abscess, fistulas and pain in the face; regional lymphadenopathy; dysphagia; fracture, caries, discoloration and mobility of teeth, as well as haemorrhage in the exposed root canal and gingival recession. Furthermore,

radiological examination demonstrates the presence of periapical radiolucent areas in affected teeth, resulting from dental destruction (Emily, 1998; Gamm, 1988; Lobprise and Bloom, 2001; Lyon, 2001; Niemiec, 2005; Ozer, 1999; Samsar and Akyn, 2006; Kuntsi-Vaattovaara *et al*., 2002).

Root canal obturation with gutta-percha is very common in human and pet dentistry. On the other hand, thermafil is a root canal filling material manufactured as an alternative to gutta-percha. The application of thermafil is easier than the application of gutta-percha cones and requires a shorter time. Owing to this feature, its use is considered to be safer in senile and sick animals, in which prolonged anaesthesia is avoided (Anthony, 1998; Lyon, 2001).

Thermafil can be described as a heated gutta-percha delivery system. In such a system, a plastic carrier is wrapped in gutta-percha. The exposure of the plastic carrier to heat results in the melting of the gutta-percha, thereby, enabling effective and rapid obturation of the root canal and compatibility with the tooth. It is of great significance that the root canal is well-prepared for application and that the manipulation is performed by skilled persons. As the obturator is plastic, it can be easily applied to the root canal. After thermafil hardened, the plastic carrier is cut (Anthony, 1998; Niemiec, 2005).

Thermafil have been used in human dentistry for resent years however their usages have not been investigated in dogs very much. The aim of this study was to evaluate the clinical application of two different root canal treatments with thermafil and gutta-percha, in dogs.

MATERIALS AND METHODS

The material of the present study comprised of 4 Anatolian Shepherd Dogs (Kangal dogs), 3 mongrel dogs, 1 Terrier, 1 German Shepherd, 1 Golden Retriever and 1 Pitbull, aged 4 to 9 years which had been referred to the clinics of the Faculty of Veterinary Medicine of Kirikkale University. Dogs, in which dental mobility, discoloration, fracture, pulpitis, swelling of the apical region of the tooth, fistulas, caries and/or facial oedema were determined during oral examination, were included in the study. Dogs diagnosed with dental lesions were anaesthetized for radiography and their dental radiographs were used for the evaluation of root resorption and lesions in periapical tissues.

Clinical examination revealed that the dental pulp was exposed in 14 teeth while 3 teeth were mobile, 6 were discoloured, 4 were fractured and 4 had moderate gingivitis. On the other hand, radiological examination showed that 4 teeth had periapical lesions and 2 had root resorption. In the six discoloured teeth, the severity of discoloration was scored (from 0 to +3) as +3 in two, +2 in two and +1 in another two. While the sulcus hemorrage index was 0 in all teeth, excluding those suffering from gingivitis, the same parameter was 2 in teeth diagnosed with gingivitis (within a range of 0-2) (Table 1).

In teeth, in which the dental pulp was directly exposed, cleansing was performed so as to remove the organic and inorganic material in the root canal (Fig. 1). In teeth with lesions but without the opening of the root canal, a hole was opened in the dentine using a micro-motor to access the dental pulp (Fig. 2). The dental pulp was cleansed using root canal files. In the meantime, the length, diameter and depth of the root canal; and the quality of the preparation of the canal for application were assessed by radiography while the file was inside the root canal. After prepared, the canals were sterilized with 1:1 diluted sodium hypochlorite. Irrigation was continued until a clear fluid was withdrawn from the root canal. After cleansed with sterile physiological saline, the canal was dried with absorbent paper points. In those fully dried, an AH plus sealer was used to seal small root canals.

Table 1: The clinical and radiological evaluation of the teeth and their endodontic treatment methods

Breed	Sex	Teeth	Periapical lesions	Mobility	Fractured teeth	Exposed pulp	Gingivitis	Discoloration	Filling material
Anatolian sheep dog	M	C_{max}		-	X	X	Moderate	+1	Gutta percha (55 mm)
Anatolian sheep dog	F	C_{max}		-				+1	Gutta percha (55 mm)
Anatolian sheep dog	M	Man I_1,I_2,I_1,I_2		-		X (n = 4)		-	Thermafil (I_1,I_2), Gutta percha (25 mm) (I_1,I_2)
Anatolian sheep dog	M	Max I_1,I_2	Root resorbtion	+1 (I_1)				-	Thermafil (I_2), Gutta percha (25 mm) (I_1)
Mongrel	F	I_1, I_3		+1 (I_3)		X (I_1)	Moderate	-	Gutta perca (25 mm) (I_1, I_3)
Mongrel	M	C_{max}		-	X	X		-	Gutta percha (55 mm)
Mongrel	M	Max I_1,I_2,I_1,I_2		-		X (n = 4)		-	Thermafil (I_1,I_2), Gutta percha (25 mm) (I_1,I_2)
Terrier	M	C_{man}		-	X	X	Moderate	+2	Gutta percha (25 mm)
German shephard	M	I_3	Root resorbtion	-		X	Moderate	+3	Thermafil
Golden	F	C_{man}		-				+2	Gutta percha (55 mm)
Pitbull	F	I_3		+1	X	X		+3	Thermafil

M/F: Male/female, Max: Maxillar, Man: Mandibular, I_1: First incisive, I_2: Second incisive, I_3: Third incisive, C: Canine

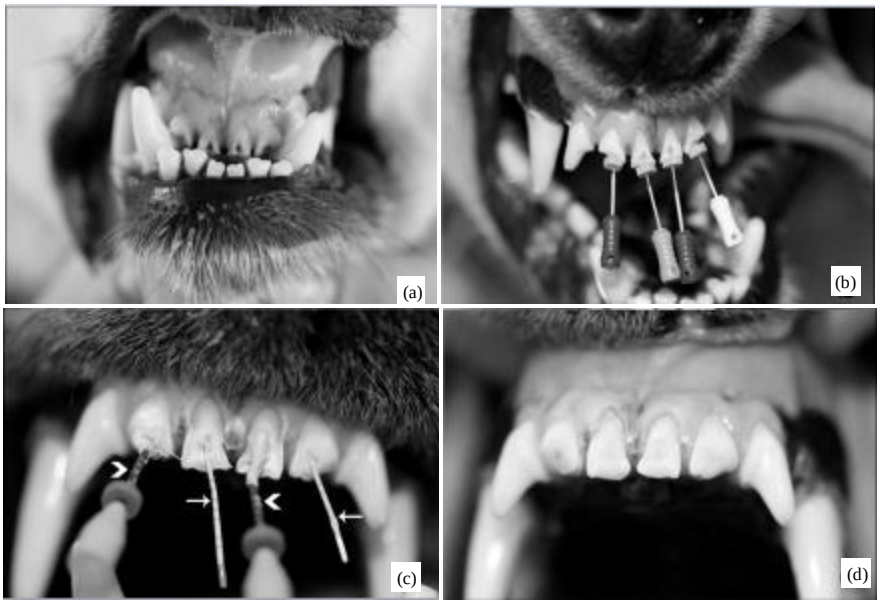

Fig. 1: (a) The appearance of the open pulpa on the maxillar insisives due to malocclusion, (b) preparation of the root canals with files, (c) application of thermafil (arrow heads) and gutta-percha (arrows) cones and (d) the clinical appearance of the teeth after endodontic treatment

Following the preparation of the root canals, 12 teeth were applied gutta-percha cones by lateral condensation and 7 teeth were applied thermafil (Fig. 3). Of the 12 teeth which were applied lateral condensation, 4 were filled with 55 mm-long gutta-percha plugs specifically designed for carnivores, whilst the remaining were filled with standard 25 mm-gutta-percha sections. When applying the

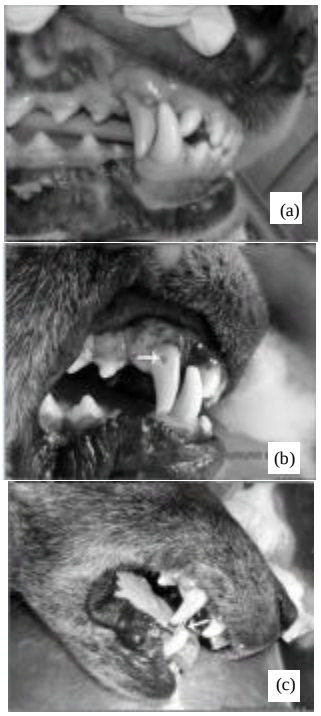

Fig. 2: (a) discoloration of the maxillar canine tooth, (b) after the preparation of a hole for root canal enterance (arrow) (c) application of the 55 mm long gutta-percha cones (arrow)

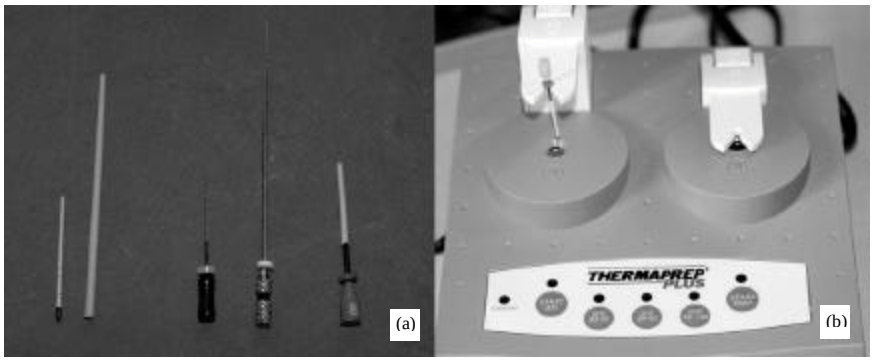

Fig. 3: (a) 25 mm and 55 mm-long gutta-percha cones (in the left) and files (in the middle) and thermafil cones (in the right) and (b) termafil and its oven

lateral condensation technique, the gutta-percha cone was placed in the root canal using a spreader and the extruding tip was cut with heated metal and disposed of. After the root canals were sealed the quality of the applications was confirmed by radiological examination.

In the termafil group, heated thermafil were applied to the prepared canals. The sizes of the thermafil cones were arranged, such that they were one size smaller than the file size used during the canal preparation.

In both groups, following the completion of the closure of the root canal, the dentine was first coated with acid and bonding material and was then applied with composite resin. As light-cure composite was used, the teeth were irradiated for 20 sec so that the composite resin would harden. For the closure of large cavities, the composite was applied gradually and irradiation was applied at each stage to ensure the hardening of the composite material.

During controls performed at 6 months post-treatment, the teeth and periodontal structure were examined both clinically and radiologically.

RESULTS AND DISCUSSION

Knowledge of the root canal anatomy is significant to prevent the irreversible damage. In the veterinary field, the size of teeth varies greatly between animal species of different body size. The root length of the mandibular canine teeth ranges from 30 to 45 mm in small dog breeds, whereas in the German Shepherd Dog, the same measurement ranges from 50 to 55 mm. For this reason, it has been reported that conventional files used in human dentistry fail in large dogs and therefore, 55-mm-long files should be used (Bellizzi *et al*., 1981; Gamm, 1988; Schindler and Doran, 1986). In the present study, as the conventional gutta-percha cones were determined to be short, files and gutta-percha cones specifically manufactured for carnivores were used in four canine teeth. Dental checks performed by the end of the 6th month demonstrated that the treatment applied was successful.

It has been demonstrated in previously conducted research that the apical foramen is 0.5 mm shorter than the radiographic apex, therefore, if this distance is not observed, the apical foramen may be lacerated and root canal restorative material may leak into the periapical region (Lyon, 1998, 2001). The apical foramen is not the only opening which links the dental pulp to the external environment. The dentinal tubules which can be observed in microscopic sections and the lateral and accessory canals which can be observed macroscopically, link the root to the exterior. For this reason, it is of great significance that the root canal is obturated such that microorganisms are prevented from entering (Emily, 1998; Jawad *et al*., 2011). Grecca *et al*. (2001) investigated healing after endodontic treatment in dogs with periradicular periodontitis and reported that the antimicrobial activity of the root canal sealers used after biomechanical preparation influenced the success of the treatment. In the present study, it was determined that the application of an AH plus sealer for the obturation of micropores after sterilisation with sodium hypochlorite yielded success in endodontic treatment.

The success of endodontic treatment depends on the sterilisation and obturation of the root canal system. If the root canal is not obturated completely it is filled with organic materials which leads to infection (Asadzadeh *et al*., 2009). Filho *et al*. (2002) compared two treatment methods (one and two-step procedure) after inducing pulpal necrosis and chronic periapical lesions in dogs. They applied the lateral condensation technique with gutta-percha in the first treatment to one group and they cleansed and obturated with calcium hydroxide in the first treatment to another group and recleansed and obturated after 15 days in the latter group. In result, they observed that clorhexidine solution used to sterilize the canal was more effective than sodium hypochlorite and that the two-step treatment gave better results. In this study, sodium hypochlorite was used to sterilize the canal and the treatment was performed at one time and no periapical infection was recorded after the treatment. According to the results of this study, it can be concluded that one-step treatment with the use of sodium hypocloride for sterilization gave satisfactory results in dogs.

The most common material used for the obturation of the root canal in veterinary endodontics is gutta-percha. Gamm (1988) reported that gutta-percha gave good results in root canals prepared with conventional files, whereas in long teeth measuring 55 mm this could fail to satisfy the needs and therefore obturation by means of injection could yield better results. In a study conducted in 56 teeth of German Shepherd Dogs, Sabeti *et al.* (2006) obturated the root canal completely in one group and partially in another and indicated that the complete obturation of the root canal was not of primary significance and that the sterilisation of the root canal and the complete mechanical closure of the dental crown was sufficient. The results obtained in the present study are in compliance with those reported by Sabeti *et al.* (2006). In the present study, all incisive teeth were obturated completely, yet, as the diameter of the dental pulp varied along the root canal in canine teeth, these were not able to be obturated completely. However, dental checks performed 6 months after treatment showed that there was no problem with these teeth. This suggests that the preparation of the root canal and the closure of the dental crown are more important than root canal obturation.

In this study, it was also ascertained that, thermafil which was of the same thickness with the file used in its application, did not reach the end of the root canal, in other words, it did not fill the canal completely. Therefore, these materials were removed and replaced by smaller sized thermafil. However, as thermafil hardens when it dries, difficulties were encountered in its removal. These difficulties were eliminated by using thermafil of a smaller size than the file, in the further stages of the trial.

It has been reported that composite material bonds dentin as strong as enamel and it has not been displaced unless the animal is orally abusive (Colmery, 1998). In the present study, controls performed 6 months after treatment revealed that the composite material on the incisive teeth of large dog breeds was displaced. It was determined that, as these breeds possessed a rather strong jaw and consumed food of hard texture, the strong force affecting the composite material led to its displacement. However, this did not constitute a major problem and both materials used to fill the root canal remained within and no periapical lesions were observed.

In result, the absence of dental mobility and loss of teeth as well as any enlargement in periapical radiolucent areas in radiographs during dental checks performed 6 months after treatment suggested that the endodontic treatment applied was successful.

It was determined that both techniques could be applied easily in practice, but that thermafil application was advantageous in that it could be applied within a shorter time period. However, it was also ascertained that better obturation of the canal was achieved with the use of thermafil one size smaller than the root canal file. It was determined that in the endodontic treatment of the canine teeth of dogs, 55 mm-long files and gutta-percha cones should be used.

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