The effect of extending the head length of carbide fissure bur on it's effectiveness in cutting dentin

Angham G. Al-Hashimi B.D.S, M.Sc. [(1)]

ABSTRACT

Background: Extending the head length of carbide fissure bur is one of the major trends in bur design. The Aim of study was to evaluate the effectiveness of one of the major trends in bur design which is the extended head length carbide fissure bur, in cutting dentin.

Materials and methods: The cutting of extended head length (EHL) and non extended head length (NEHL) carbide fissure burs were evaluated on dentin specimens mounted in acrylic blocks. The specimens were divided into two groups: Group I Cutting performed with NEHL carbide fissure bur (10 burs), Group II Cutting performed with EHL carbide fissure bur (10 burs). Ten cuts were performed with each bur and a total of 200 cutting rates or CRs (mm/sec) were recorded. The CRs were statistically analyzed using analysis of variance (ANOVA) test, least significant difference (LSD) test, and student t-test.

Results: A significant difference ($P< 0.5$) appeared between CRs of group I after cut 7 and in group II after cut 2.

Conclusion: Although, extending the head length of carbide fissure bur enhances it's cutting effectiveness, but such a bur is readily dulled during cutting procedure.

Keywords: Extending head, carbide fissure bur. **(J Bagh Coll Dentistry 2005; 17(3):42- 44)**

INTRODUCTION

The availability of some methods of cutting and shaping of tooth structure is essential for the restoration of teeth.[(1)] Powered cutting equipment can be seen as a search for improved means for holding and controlling the cutting in the use of replaceable bladed or abrasive instrument.[(2)] Carbide burs were produced commercially in 1947, and they were performed best at the highest speed available (200,000 rpm).[(3,4)] Although most current air-turbine hand pieces have free-running speeds of approximately 300,000 rpm, the speed can drop to 200,000 rpm or less with work load during cutting. [(4)]

This tendency is an excellent safety feature for tooth preparation but at low speeds burs have a tendency to roll out of the cavity preparation and mar the proximal margin of tooth surface. In addition, carbide burs do not last long because of their brittle blades are easily broken at low speeds.[(5)] As available hand piece speeds increased after 1950, particularly after the high speed turbine hand pieces were introduced, a new cycle of modification of bur size and shapes has occurred [(6-9)], and one of the major trends in bur design is the use of extended heads on fissure burs.[(1,6)]

Carbide fissure burs have been introduced that have extended head length two to three times those of the normal fissure bur of similar diameter [(1)]. Such a design would never have been practical using a brittle material such as carbide if the bur were to be used at low speeds [(1,10)], therefore, this study was done to evaluate the effect of extending the head length of carbide fissure bur on it's effectiveness in cutting dentin using high speed rotary instrument under work load, with a prolonged duration of cutting.

MATERIALS AMD METHOD

A controlled test regimen was performed using Kavo high speed hand piece mounted on a surveyor at a cutting force of 100g with a coolant flow rate of 25 milliliter per minute.[(7-9)]

The specimens were prepared using extracted teeth that had been stored in deionized distilled water, the roots were removed and the occlusal and axial surfaces of each tooth were ground flat until all enamel was removed with a high-speed diamonal stones using air/water spray [(11)].

The occlusal surface of each tooth was placed on glass slab and fixed by a sticky wax, and then cold cure acrylic resin loaded into a metal mold (20X20X10 mm) on the tooth so that the crown will be imbedded in acrylic resin totally except its occlusal surface that faces the glass. Cutting was performed either with extended head length (EHL) carbide fissure bar (Depha Carb FG 014L) or non extended head length (NEHL) carbide fissure bur (Depha Carb FG 014) (Figure 1). Each type of bur was placed into a high-speed hand piece under

(1) Assistant lecturer, Department of Conservative Dentistry, Collage of Dentistry, University of Baghdad.

loading (100g), and the cutting rates or CRs (mm/sec) were recorded as the time in second it tooks the carbide fissure bur to cut a straight (5mm length) channel (and 2 mm depth) in dentin. The bur and the tooth were painted with colored marks to the desired length and width of the straight channel.

The specimens were divided into two groups according to the head design of carbide fissure bur:

Group I cutting performed with NEHL carbide fissure bur (10 burs)

Group II cutting performed with EHL carbide fissure bur (10 burs) ten cuts were performed with each bur began with cut 1 (5 mm) and up with cut 10 (50 mm), a total of 200 CRs measurement were recorded.

The CRs data was statistically analyzed using analysis of variance (ANOVA) test and least significant difference (LSD) test, the mean CRs for all ten cuts were statistically analyzed using student t-test.

RESULTS

The EHL and NEHL carbide fissure burs CRs (mm/sec) of dentin for the ten cuts are summarized in table 1, figure 2 and 3.

It is clearly obvious that CRs decreased with prolonged duration of cutting procedure, group II (EHL carbide fissure bur) showed higher CRs than group I (NEHL carbide fissure bur) at cut 1, while showed lower CRs at cut 10.

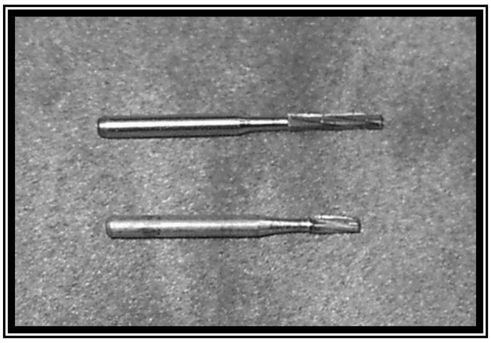

Figure 1: EHL carbide fissure bur (above) NEHL carbide fissure bur (below)

The statistical analysis of data using ANOVA test showed a statistical difference (P> 0.5). Further analysis using LSD test (LSD 0.5= 1.174) showed a significant difference began to appear in group I (NEHL carbide fissure bur) after cut 7 and in group II (EHL carbide fissure bur) after cut 2 in comparison with cut 1 (control).

The mean CRs for all ten cuts of groupI and Ii were statistically analyzed using student t-test, and there was no significant difference (P> 0.5) between the two groups.

DISCUSSION

Although the development of new bur sizes and shapes has greatly increased the number of different types in current use, the number actually required for clinical effectiveness has been reduced. [1,2]

One of the major trend in bur design is the use of extended heads on the fissure burs[10].

Table 1: The EHL and NEHL carbide fissure bur CRs (mm/sec) of dentin for the ten cuts.

Cut	Group I	Group II
1	1.821 ± 0.08	2.972 ± 0.22
2	1.599 ± 0.09	1.884 ± 0.1
3	1.097 ± 0.05	1.576 ± 0.11
4	0.983 ± 0.06	0.931 ± 0.09
5	0.981 ± 0.02	0.652 ± 0.08
6	0..834 ± 0.01	0.303 ± 0.05
7	0.73 ± 0.05	0.255 ± 0.04
8	0.626 ± 0.02	0.16 ± 0.05
9	0.591 ± 0.06	0.124 ± 0.01
10	0.534 ± 0.02	0.068 ± 0.02
*	0.979 ± 0.04	0.892 ± 0.07

*** mean CRs for all ten cuts**

In this study the effectiveness of such a design was evaluated and compared to the normal fissure bur of similar diameter in cutting dentin, and dentin specimens were prepared to perform the cutting study. The dentin was selected to coincide with other cutting studies that investigate the effectiveness of diamond fissure bur in cutting enamel or Macor bar,[7,8,9,13] while the effectiveness of carbide bur usually investigated on dentin specimens[11]. Furthermore, the carbide burs used, nowadays, for intra coronal cutting due to their approved superiority to diamond bur in cutting ductile material such as dentin, while diamond burs used for extracoronal cutting since their superiority come in cutting brittle materials such as enamel. [13,14]

The result of this cutting study indicated that the CRs decreased with prolonged duration of cutting. These finding attributed to the fact that cutting effectiveness tend to decrease as bur wear out and as debris accumulated on the bur.

[14,15] These findings come in agreement with Wasteland et al 1980 [6] and Siegel et al 2000 [5].

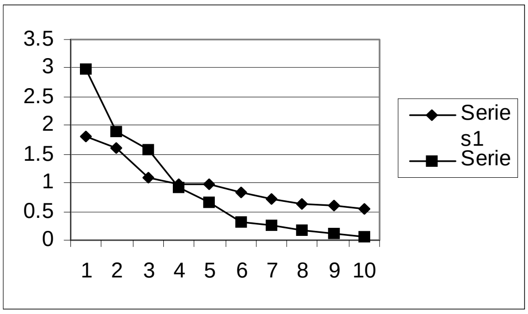

Figure 2: Polygon chart shows the ENL and NEHL carbide fissure bur CRs for 10 cuts.

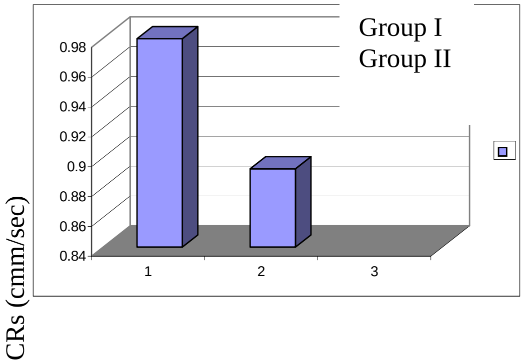

Figure 3 … e in mean CRs (f… I and II.

EHL carbide fissure bur CRs was higher than NEL carbide fissure bur CRs at cut 1. Such a result is expected and it is the reason for increasing the head length of carbide fissure bur. This extending in the head length will enhance the peripheral speed of the blades and thus enhance cutting. Such extension in the head length result in attenuation to the brittle carbide blades of the bur, therefore a brittle material such as carbide blades can't be durable under such circumstances, thus, in group (NEHL carbide fissure burs) the significant difference began to appear after cut 7, while in group II (EHL carbide fissure bur) the significant differences began to appear much more earlier, and readily dulled.

However the comparison between the mean CRs for all ten cuts of group I and II showed no significant difference, so both carbide fissure burs were effective in cutting dentin.

REFERENCES

1- Sturdevant CM, Roberson TM, Heymann HO, Sturdevant JR. The art and science of operative dentistry, 3rd ed. St. Louis: Mosby 1995; Ch 8: 325-60.
2- Morrant GA. Burs and rotary instruments: introduction of a new standard numbering system, Brit Dent 1979; 147 (4): 97-98
3- Nelson RJ, Pelander CE, Kumpula JW. Hydraulic turbine contra angle handpiece, J Am Dent Assoc 1953; 47: 324-9.
4- Taylor DF, Perkius RR, Kumpula JW. Characteristics of some air turbine hand pieces, J Am Dent Assoc 1962; 64: 794-805.
5- Peyton FA. Temperature rise in teeth developed by rotating instrument. J Am Dent Assoc 1955; 50: 629-30.
6- Eames WB, Nale JL. A comparison of cutting efficiency of air-driven fissure burs. J Am Dent Assoc 1973; 86: 412-5.
7- Van-Fraunhofer JA, Siegel SC. Enhanced dental cutting through chemomechanical effects. J Am Dent Assoc 2000; Oct: 131 (10): 1465-9.
8- Von-Fraunhofer JA, Siegel SC. Hand pieces coolant flow rates and dental cutting. Oper Dent 2000; Nov-Dec; 25 (5): 544-8.
9- Peyton FA. Effectiveness of water coolant with rotary cutting instrument J Am Dent Assoc 1985; 56: 664-75.
10- Sockwell CL. Dental hand pieces and rotary cutting instrument. Dent Clin North Am 1971; 15 (1): 219-44.
11- Lambert RL, Lambert RF. Variation I the design of # 330 dental burs. Oper Dent 1989; 14, 73-6.
12- Henry EE, Peyton FA. The relationship between design and cutting efficiency of dental burs, J Dent Res 1954; 33: 281-2.
13- Siegel SC. Cutting efficiency of three diamond bur grit sizes. JADA 2000; 13:12
14- Craig RG, Marcus L. Restorative Dental Materials, 10th ed. St. Louis: Mosby 1997; Ch 4: 56-103.
15- Westland IN. The energy requirement of the dental cutting process, J Oral Rehab 1980; 7(1) :51,