The effectiveness of carbide fissure bur in cutting dentin with light, moderate and heavy work load.

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ABSTRACT

Background: The dentist believes that pressing harder on the tooth enhances the cutting effectiveness of the bur performance. The aim of the study was to evaluate the effectiveness of carbide fissure bur in cutting dentin with light, moderate and heavy work load.

Materials and Methods: The cutting of carbide bur under different work load was evaluated on dentin specimens mounted in acrylic blocks. Group I: Cutting performed with light work load (=25g), Group II: Cutting performed with moderate work load (=100g), Group III: Cutting performed with heavy work load (=175g). Ten cuts were performed with each work load and a total of 30 cutting rates or CRs (mm/sec.) were recorded and were statistically analyzed using analysis of variance (ANOVA) test, student t-test.

Results: A significant difference (P<0.5) appeared between CRs of group I and III, and between group II and III.

Conclusion: The effectiveness of carbide fissure bur in cutting dentin markedly reduced with heavy work load.

Keywords: Effectiveness, Carbide bur, Work load.

INTERODUCTION

Powered cutting equipment can be seen as a search for improved sources of energy and means of holding and controlling the cutting instrument. This culminated in the use of replaceable bladed or abrasive instrument held in a rotary hand pieces usually powered by compressed air. (1-4)

Three speed ranges are generally recognized: low or slow speed (bellow 12,000 rpm), medium or intermediate speeds (12,000-200,000 rpm) and high or ultra-high speeds (above 200,000 rpm). Most useful instrument are rotated at either low or high speed. (1)

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)

Although intact tooth structure can be removed by an instrument rotating at low speeds, it is a traumatic experience for both the patient and the dentist. Low-speed cutting is in effective, time consuming, and requires a relatively heavy force application. This results in heat production at the operating site and produces vibration of low frequency and high amplitude. Heat and vibration are the main sources of patient discomfort. Furthermore, at low speeds burs have a tendency to roll out of the cavity preparation and mar the proximal margin or tooth surface. (5-10)

In addition, carbide burs do not last long because their brittle blades as easily broken at low speeds. (10) therefore , this study was done to evaluate the effectiveness of carbide fissure bur in cutting dentin with light, moderate and heavy work load.

MATERIAL AND METHODS

A controlled test regimen was performed using KaVo high speed hand piece mounted on a surveyor with a coolant flow rate of 25 milliliter per minute. (7-9)

The specimens were prepared using extracted teeth (molars) 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 diamond stones using air/water spray. (11)

The occlusal surface of each tooth was placed on glass slab and fixed by a sticky wax, then cold cure acrylic resin loaded into a metal mold (25x25x10 mm) on the tooth so that the crown will be imbedded in acrylic resin totally except it's occlusal surface that faces the glass.

Cutting was performed with carbide fissure bur (Depha Carb FG 014), The bur was placed into a high-speed hand piece under different loading, and the cutting rates or CRs (mm/sec) were recorded as the time in second it took the carbide fissure bur to cut a straight channel (5mm length 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 (figure 1).

The specimens were divided into three groups (each one of 10 specimens) according to the working load of carbide fissure bur:

Group I cutting performed with carbide fissure burs with light work load (=25 g).
Group II cutting performed with carbide fissure bur with moderate work load (=100g).
Group III cutting performed with carbide fissure bur with heavy work load (=175g).

Ten cuts were performed with carbide fissure bur began with cut 1 up to cut 10 for each work load.

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load, a total of 30 CRs measurement were recorded. The CRs data was statistically analyzed using analysis of variance (ANOVA) test; the mean CRs for all ten cuts were statistically analyzed using student t-test.

RESULTS

The mean and standard deviation of burs CRs (mm/sec) of dentin for the ten cuts are summarized in table 1 and figure 2.

It is clearly obvious that CRs decreased with increase work load, group I (light work load) showed higher CRs, while group III (heavy work load) showed the lowest CRs.

The statistical analysis of data using ANOVA test showed a statistical significant difference (P>0.5). Further analysis using student t-test showed a significant difference between:

- group I vs. group III
- group II vs. group III

In addition to that, there was no significant difference (P<0.5) between group I vs II.

Table 1: The mean and standard deviations of carbide fissure burs CRs (mm/sec) of dentin.

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>0.719</td>
<td>0.097</td>
</tr>
<tr>
<td>II</td>
<td>0.631</td>
<td>0.085</td>
</tr>
<tr>
<td>III</td>
<td>0.281</td>
<td>0.052</td>
</tr>
</tbody>
</table>

DISCUSSION

Carbide fissure burs perform better at the high speeds. However, the rotational speed of the hand pieces can drop down with work load during cutting.(3,4)

In this study the effectiveness of carbide fissure bur was evaluated with light, moderate and heavy work load, the selection of the range of working load (25-175) that set at the head of the turbine was done according to the result of a pilot study on the applied load range of the hand as well as a review for all the other cutting effectiveness study that investigate CRs at different loading all at that range.(7,9,12,13)

A 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(7,9,15) while the effectiveness of carbide bur usually instigated on dentin specimens. (11) Furthermore, the carbide burs used, now a days, for intra coronal cutting due to their approved superiority to diamond bur in cutting ductile material such as dentin.(13,14)

The result of this cutting study indicated that CRs decreased with increased work load.

Group I: The light work load (=25g) didn't drop the rotational speed of the air- turbine down to a lower level, therefore carbide fissure bur perform well at that load.

Group II : The moderate work load (=100g) slightly drooped the rotational speed of the air-turbine to a lower level, therefore carbide fissure bur perform well at that load.
turbine resulted in slight reduction in the cutting performance of carbide fissure bur since the peripheral speed of the bur will reduced at the lower speed thus reduce the cutting effectiveness of the blades, however such a reduction was non significant.

Group III: The heavy work load (=175) markedly drop the rotational speed to a lower speed range (from high moderate speed) as measured by Siegel et al 2000 (13), Therefore the cutting effectiveness of carbide fissure bur markedly reduced and a significant difference began to appear.

REFERENCES