

Comparative efficiency testing 330 carbide dental burs utilizing Macor[®] substrate

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Abstract

Traditionally, it has been difficult to compare the clinical performance of carbide dental burs. The purpose of this laboratory study was to investigate the comparative cutting efficiency of number 330 dental burs from six manufacturers. These burs were tested utilizing custom-built equipment consisting of a frictionless air sled to which the Macor[®] substrate was attached. The substrate was fed to the bur at constant pressure. The efficiency of each bur, defined as the distance of the cut divided by the time taken, then was calculated. Of the six bur types tested, only one was found to be markedly superior, and four types were comparable in performance.

Introduction

Since the introduction of the carbide dental bur in 1948, manufacturers have strived to improve the performance of carbide burs. One parameter often examined is cutting efficiency, which relates to the amount of tooth structure removed by the rotary instrument vs. time. In most laboratory testing, cutting performance has been determined by cutting through a material which approximates natural teeth. The substrate material usually is forced against the bur with constant pressure, and the rate of cutting is determined by measuring the length of the bur cut and dividing by the time. The resulting number has been defined as cutting efficiency.

A major difficulty in bur testing is finding a suitable substrate. In the past such diverse materials as bone, ivory, float glass, and cast iron have been used (Schuchard and Watkins 1965; Norling and Stanford 1976). Recently, Macor[®], a machinable ceramic material, has been introduced (Corning Glass Company, New York, NY). The Knoop hardness of Macor is 250, ranked between enamel at 343 and dentin at 68. This material also closely duplicates the consistency and crystalline structure of natural tooth structure (Atkinson 1983).

This study compared the cutting efficiency of commercially available 300 burs. The number 330 pear-

shaped dental bur was selected, since it commonly is used in pediatric dental operative procedures.

Materials and Methods

Number 330 friction grip burs from six manufacturers were evaluated in this laboratory study. Five burs of each brand were obtained from retail dental suppliers. Six groups of five burs were assembled, each group containing one bur from each manufacturer. These groups were then tested in sequence. Burs from the following companies were tested:

Brasseler USA, Savannah, GA	(B)
Centra Dental Products, Minneapolis, MN	(D)
L.D. Caulk Co., Milford, DE	(C)
Emil Lange Co., Germany	(L)
Midwest (Sybron), Des Plaines, IL	(M)
S.S. White Co., Holmdale, NJ	(S)

A custom-fabricated bur-testing instrument was used for this study. A frictionless air sled held the Macor substrate which was drawn past the bur. The force was determined by using variable weights. The force was transmitted by a filament which ran over a pulley. This pulley was attached to a rotary transducer which was interfaced to a chart recorder. A Star 430K high-speed handpiece was used (Star Dental Manufacturing Co., Inc., Valley Forge, PA), running at a constant air pressure of 34 psi. The handpiece was lubricated after each cut, and a water spray of 3.5 cc/min was used (Eames and Nale 1973).

Macor, supplied in 3 x 3 in sheets of 1/8-in thickness, was chosen for its crystalline structure and intermediate hardness between enamel and dentin. Each bur was tested for five min, or until the bur cut the length of the Macor sheet.

The 330 burs were tested at 40 g of force. Other burs have been tested from 20 to 200 g of force (Atkinson 1983). It was felt that 40 g was reasonable, considering the size of the bur and its normal clinical usage.

The time taken and distance cut were later read from the chart record, and the cutting efficiency was calculated.

Results

The results are present in Table 1. The number listed as efficiency is calculated by dividing the millimeters of substrate cut by the minutes taken for that particular cut.

Discussion

A *t*-test was run comparing the range of cutting efficiencies for each of the six groups of burs tested. At the 95% confidence level, the *t*-intervals were shown to be similar for four of the six groups tested (types C, S, M, and D). Statistically, the type B burs were superior to this group, and the type L burs were inferior.

The standard deviations of the efficiencies are notable but not easily explained. Further study is needed to determine whether the range of efficiencies is due to simple variation or a fault in manufacturing quality control. This variation also has been present with other types of burs we have tested.

Bur durability was not tested directly in this study, since the Macor material is not sufficiently abusive to the bur. Glass and cast iron have been used for durability testing; in most cases the bur is used until it will not cut. When cutting the Macor, there is a gradual degradation of efficiency, but we were not able to test a bur to the point of failure. Judging from the efficiency degradation rate, we felt that the durability of all burs tested was similar (Luebke et al. 1980).

Since all burs tested by us were comparable in price, the advantages of a more efficient bur are clear. A more efficient bur also would be expected to be less traumatic to the tooth, since

it would spend less time in contact with the tooth, or could be used with less pressure (Phillips 1982).

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TABLE 1. 330 Bur Cutting Efficiency

	Bur Type					
	C	S	B	M	L	D
Average cutting efficiency mm/min	29.4	25.0	57.3	24.7	11.4	37.7
Standard deviation	11.9	7.4	20.8	11.5	7.4	12.3

Bur Code	Manufacturer and location	
C	Cauk	Milford, DE
S	SS White	Holmdale, NJ
B	Brasseler	Savannah, GA
M	Midwest	Desplains, IL
L	Lange	Germany
D	Centra	Minneapolis, MN

Despite warnings, many HIV-seropositive hemophilic couples plan pregnancies

Despite being well informed of the dangers of unprotected sex, 37% of the sex partners of hemophilic men became pregnant and gave birth, according to a study in the April, 1990 issue of the *American Journal of Diseases of Children*. Janine Jason, MD, of the Center for Infectious Diseases, Centers for Disease Control, Atlanta, GA, studied 24 completed pregnancies of 20 healthy, HIV-seropositive sex partners of hemophilic men. No woman was known to have used illicit drugs. Nearly one-third of the fathers were seropositive before conception. Overall, the median birth weight of the couples' offspring was a pound or more lower than the national average.