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To: **Abrasive Technology International Dental Distributors**
From: **Don Schlitz**
Subject: **CRA Newsletter September 2001**
Date: **October 1, 2001**

Following is a copy of the main study presented in the CRA September 2001 newsletter. The study is an evaluation of ten different diamond burs regarding the speed at which they cut and the life of the diamonds. Both a 770.8C Two Striper and a TS2000 are included in the evaluation. Brasseler / Komet is represented by the Chamfer bur and NTI/Axis is also included in the study.

Some highlights from the study are:

1. **CONCLUSION** **"Combined lab and clinical data showed highest rated and best per forming diamonds were TS2000 and 770.8C Two Striper multi-use diamonds.** (single use Neo diamond also mentioned because Dr. Rella Christensen believes in single use products)

2. **Each company chose the round-end tapered diamond closest to the Two Striper 770.8C which is the most popular brand & configuration in the U.S.**

3. **Fastest brand (TS2000) cut the 3rd prep faster than the slowest brands cut the first prep, & by the 6th prep the TS2000 was cutting overall about 2 times faster than the slowest brands.**

4. **TS2000 & Galil multi-use brands had the fastest cut & the best longevity in lab tests.**

The report is exciting and certifies that you have chosen to sell the leading diamond bur. We all share in the pride that the Two Striper's performance has earned and we will all share in the benefits of this testing by the world's leading independent clinical testing agency.

I have ordered reprints and will send them as soon as they arrive in four to six weeks.

Don Schlitz

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CRA STATUS REPORT

SINGLE-USE vs. MULTI-USE DIAMOND ROTARY INSTRUMENTS

Diamond rotary instruments are used routinely by restorative dentists. Many brands are available at widely differing costs for single-use or multiple-uses. Critical clinical questions are:

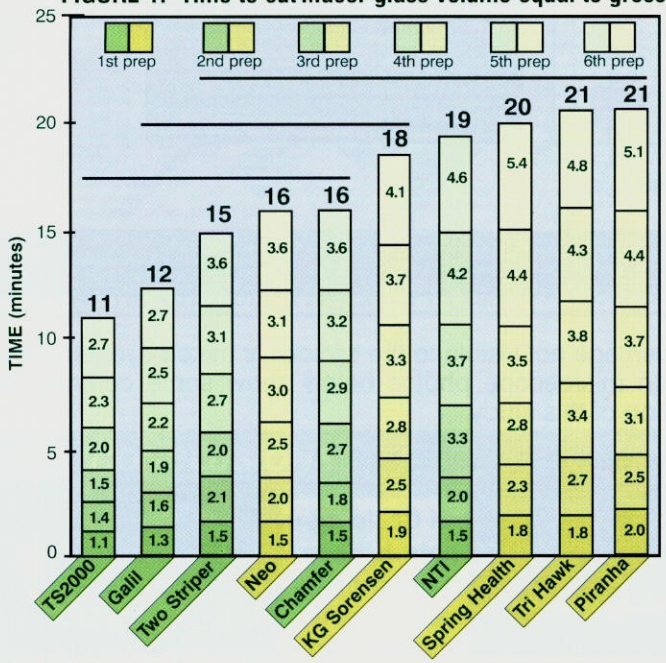
1. **Do more costly diamonds cut better, faster, & last longer?**
2. **When diamonds are reused, do patients receive the same cut quality & cleanliness?**

Report below includes 10 round-end taper diamonds selected by their companies as most similar to the popular Two Striper study control.* Diamonds were tested clinically in 19 dental offices & in controlled tests for cut speed, longevity, clogging, concentricity, retention in handpieces, effect of coolant water, & problems with reuse.

1. DIAMOND CUT SPEED & LONGEVITY

A. LAB TESTS For graph below, special tests using 4 clinicians cutting 8 teeth were conducted to determine mean volume of tooth structure removed & mean time required for gross removal for a full crown prep on a lower first molar.

FIGURE 1. Time to cut Macor glass volume equal to gross removal for lower first molar PFM crown preps.



SUMMARY OF GRAPH:

- **All 10 brands cut the first crown prep within 2 minutes. Mean time needed by clinicians was 2.25 min. Therefore, *if discarded after the first prep*, all 10 brands cut fast enough.**
- **All 10 brands cut slower on each subsequent prep, & cut times *doubled* for all brands after about 4 preps.**
- **Fastest brand (TS2000) cut the 3rd prep faster than slowest brands cut the 1st prep, & by the 6th prep the TS2000 was cutting overall about 2 times faster than the slowest brands.**
- **TS2000 & Galil multi-use brands had the fastest cut & best longevity in lab tests.**
- **Single-use diamonds used for 1 crown prep had best *combination* of speed & low cost.**

B. CLINICAL TESTS

Clinically diamonds are subjected to stresses difficult to reproduce in lab tests. In addition to enamel & dentin, clinicians cut on metals, ceramics, & polymers which can cause severe damage to cutting surfaces. Therefore, clinical tests are needed to provide the full story on diamond performance. Below is the overall grading of the 10 diamond brands by 24 clinicians grading cut speed, longevity, lack of clogging, concentricity, & retention in their handpieces.

TABLE 1. Overall clinical rating of 10 brands by 24 clinicians.

	Excellent	Good	Fair	Poor
TS2000	55%	32%	14%	0%
Two Striper	48%	48%	4%	0%
NTI	55%	27%	14%	5%
Neo	48%	30%	13%	9%
Chamfer	44%	26%	30%	0%
Tri Hawk	23%	55%	23%	0%
Spring Health	22%	57%	22%	0%
Galil	30%	43%	22%	4%
Piranha	18%	45%	23%	14%
KG Sorensen	9%	45%	36%	9%

Multi-use diamonds Single-use diamonds

SUMMARY OF CHART:

- **Clinicians' diamond performance ratings generally agreed with lab test data on page 1 except for the 3 following brands:**

  NTI was rated higher by clinicians. Reasons for this are not readily apparent.

  Galil was rated lower by clinicians. Some described its "feel" during cutting as rough compared to the other 9 brands, possibly due to its larger grit.

  KG Sorensen was rated slower by clinicians. Some noted it stalled more easily. This may have been due to its smaller diameter which caused it to bind & stall more easily during cutting.

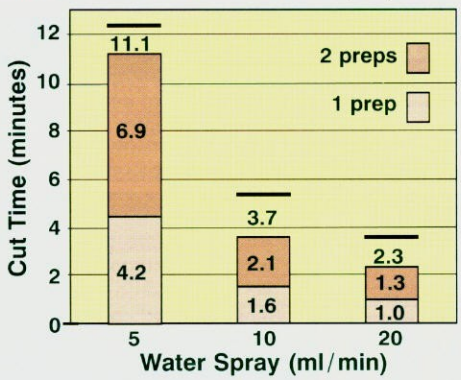
  NOTE: Ideally all the diamonds tested would have had identical size, shape, & grit size. However, currently all companies do not follow the international specification & this impedes standardization. Each company chose the round-end tapered diamond closest to the Two Striper 770.8C which is the most popular brand & configuration in the U.S.

- **Overall, clinicians rated TS2000, Two Striper, NTI, Neo, & Chamfer highest.**

2. EFFECTS OF VARYING AMOUNT OF COOLANT WATER

CRA tested water spray volume used in 9 offices & found an average of 15 ml/min (range 5-47 ml/min). CRA tests showed water spray was an important variable. It cooled, minimized clogging, & lubricated during cutting. Data below show clinicians should use as much water as possible without impeding their visibility in order to achieve fast cutting.

FIGURE 2. *In vitro* effect of water spray on cut speed.



SUMMARY OF GRAPH:

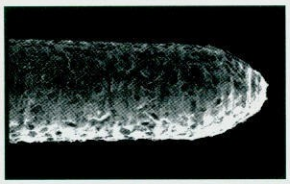
As amount of water was increased, cut time decreased. Increasing water spray from 5 to 10 ml/min increased cut speed 67%. Increasing water spray to 20 ml/min increased cut speed 79%.

3. PROBLEMS WITH REUSE

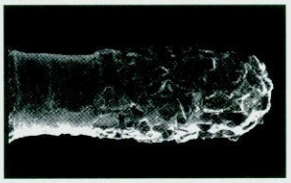
A. DAMAGE DURING USE

During use diamonds can sustain considerable damage not visible to the clinician's naked eye, but deleterious to the diamond's cut quality. Scanning electron microscope photos below show some common damage patterns encountered during the clinical use portion of this study.

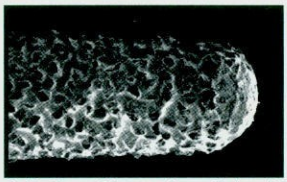
FIGURE 3. Damage to diamonds used in clinical testing.



General loss of diamond particles: Diamond particles have been stripped from electroplating over the entire surface.



Change of shape: Diamond particles & plating have been torn away from a portion of the underlying shank, causing a change in shape of the cutting surface.

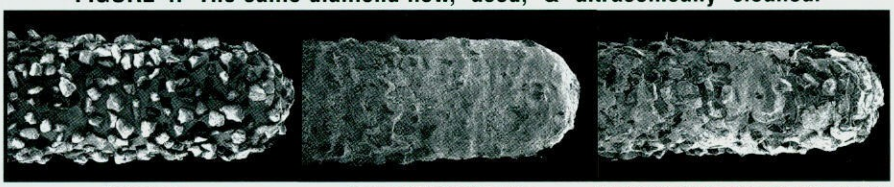


Bald tip: Diamond particles have been stripped from the the critical tip of the instrument which is used to form the prep margins.

B. DIFFICULTY CLEANING

Ultrasonic cleaning often fails to remove all debris. Mechanical cleaning with nylon or steel brushes can be effective, but is tedious & increases aerosols & splatters. Diamond cleaning stones clean well, but can strip diamonds & require a handpiece.

FIGURE 4. The same diamond new, used, & ultrasonically cleaned.



Before use. Immediately after use. After ultrasonic cleaning 15 minutes.

Critical factors in diamond cleaning:

- Amount of debris: Heavily clogged diamonds are more difficult to clean.
- Time before cleaning: The longer cleaning is delayed, the more difficult & time consuming it becomes.
- Condition of ultrasonic cleaner: Ultrasonic cleaners can become defective over time without the clinician's knowledge. CRA's website shows a simple test that can be conducted by clinicians to test their unit's consistency & cleaning power.

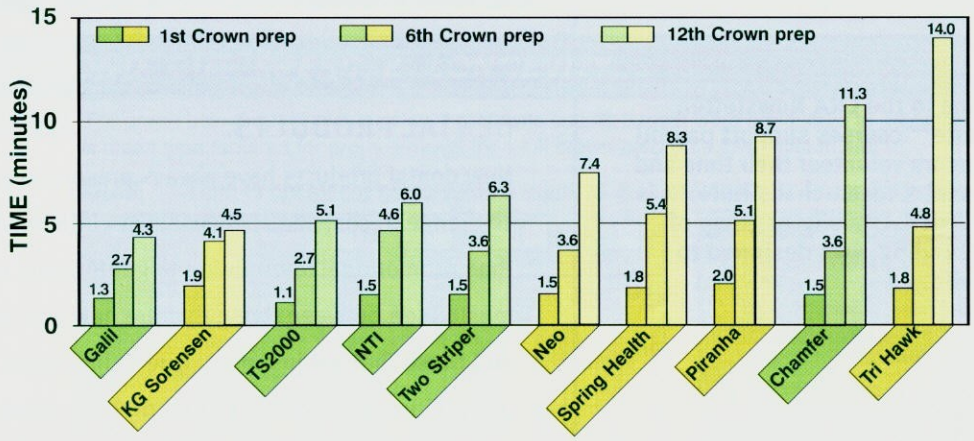
C. OBTAINING & PRESERVING STERILITY IN PRESENCE OF DEBRIS

CRA tests showed most individually packaged diamonds tested were sterile, but bulk packaged diamonds were not. Chemical vapor & steam sterilizers killed test spores on diamonds, even if heavily clogged with tooth debris. To maintain sterility after processing, diamonds must be wrapped.

D. TIME, EFFORT, & COST REQUIRED TO RECYCLE

E. SLOWER CUTTING WITH EACH USE

Cut speed of all brands tested decreased with use. Below are cut times for the 1st, 6th & 12th preps cut by the 10 brands. To compensate for decreased speed, many clinicians increase pressure which causes them to work harder, puts more stress on the instrument, & raises heat if coolant water volume is low.



SUMMARY OF GRAPH:
Crown prep times for all diamonds more than doubled by the 6th prep. By the 12th prep, cut times of some brands increased 3 to 7 times longer.

F. GIVEN THE CHOICE, PATIENTS PREFER A NEW DIAMOND FOR THEIR TREATMENT

4. CRA CONCLUSIONS:

When new & cutting the first prep, all 10 brands tested cut fast & well, regardless of cost or designation as single or multi-use. All diamonds degraded during use, & reuse accentuated degradation. Combined lab & clinical data showed highest rated & best performing diamonds were TS2000 & 770.8C Two Striper multi-use diamonds & Neo 1118.9C single-use diamond. Due to damage during use, difficulty cleaning, & increasingly slower cut, patients recieve optimal service when a new diamond is used for each prep. Clinicians will save money & provide better care if they use single-use diamonds to cut a single prep.

See CRA Website (www.cranews.com) for test methods & full data from testing.