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A Bulletin Dealing With Issues For Dental Health Professionals

How Does Milling Fit With Today's Dentistry?

The basic technique in milling is the process of cutting away material by feeding a restorative work piece past a rotating multiple tooth milling cutter. The cutting action of the many teeth around the milling cutter provides a fast method of machining. The machined surface may be flat, angular or curved. The surface may also be milled to any combination of shapes. The machine for holding the work piece, rotating the cutter and feeding is known as the milling machine. The milling machine is one of the most versatile machine tools in existence. In addition to straight milling of flat and irregularly shaped surfaces it can perform drilling, boring and slotting operations. This power driven machine is used for the complex shaping of wax, resin, alloys and ceramic dental restorations. Its basic form is that of a rotating cutter or mill bit, which rotates about a spindle axis and work table that can move up and down. The motion across the surface of the restorative work piece is usually accomplished by having the moveable drill arm (which is capable of three dimensional movement) cross over the surface with a cutter at the speed required. The milling process is as fundamental as conventional drilling and cutting procedures and is very versatile for basic machining processes. Because the milling setup has so many degrees of freedom, milling can become inaccurate, unless especially rigid fixturing is implemented. This can be accomplished with a collet change and larger milling bur or with a stand alone milling model. The Bredent BF1 milling machine is capable of adapting 2.35mm shank tool to a 3mm shank tool, simply by changing the collet in the spindle. This collet is critical for holding the milling tool and for easily releasing it. The vertical movement crank can adjust the table of the milling machine at the side direction (x), the vertical direction (y) and the height direction (z). The table clamp can be adjusted vertically in any direction and

also can be tilted 90° to assist vertical drilling into bars or other restorations. The control box is that part of the drive system that transforms electrical power from the motor to mechanical power in the spindle of the hand piece. The drive system also allows the dental technologist to change the speed of the spindle (RPM) therefore the cutting tool. The quill arm (control arm) moves vertically in the head and contains the hand piece spindle in which the milling tool is installed. The over arm slides on the turret and allows the milling head to be repositioned over the table. The over arm is capable of 360° rotation that provides optimum extension and function, while being very precise. By using the micrometer, one can drill or bore into the restoration at will. To set the dial meter to the predetermined depth number (mm), turn the locking ring counter clockwise, to free the dial indicator, set the dial and then lock the setting ring. In this manner precise drill depths can be accomplished. During wax milling, lower speeds are used, approximately 2,500 to 5,000 RPM. While milling alloys however, increased RPM's of 15,000 to 20,000 rates are required. A properly balanced milling tool with significantly increased chip room will assure proper chip removal and prevent burn up. Milling oil acts as a coolant, eliminates heat and serves as a lubricant as well, thus enabling the tool to move swiftly across the surface. Try to cut a cold block of butter with a cold knife; it's difficult to do because there is nothing helping the blade as it tries to move across the butter's surface. However if the knife is heated, it will effectively melt some of the butter therefore providing lubrication to the blade and enabling it to move easily across the butter so that efficient cutting is accomplished. The same principle applies to milling. The milling tool needs a lubricating agent (Bredent milling oil # 5500008). The proper viscosity in this oil is required because the coolant **Continued on page 2**

How Does Milling Fit With Today's Dentistry? cont'd...



Bredent BF1 Milling Machine.

needs to make it to the cutting edge of the milling tool, at the spindle speeds needed. During the machining process the milling tool carves a chip out of the restoration. The generated heat develops approximately 40% from friction on each side of the tool and 20% from the deformation of the chip, providing for a cleaner cut. The better machining quality is based on cooler tooling, lower machining forces and therefore less vibration. This results in a better surface quality, cooler machining, easier work holding and better accuracy. Milling tool design, low viscosity coolant, controlled speed machining, provide the high degree of efficiency, flexibility and reliability required for completion of a superior restoration. The chip formation process is the same for most machining processes and it has been researched in order to determine solutions for speeds (RPM) feeds and other

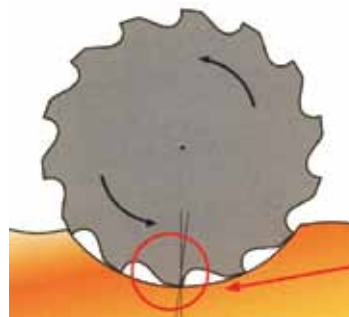
parameters that have been determined by the feel of the technician. The process varies considerably, depending on the restorative materials, temperature and cutting fluids. It also depends on the milling tool, chatter and vibration. Unlike other procedures, a lot of vibration can occur even within the master model supported with pins. Therefore a stand alone milling model is required for most types of machining. The milling cutters that are used in the milling machine are available in many standard and special types, forms, diameters and widths. The teeth may be straight or helical in angle. The helix angle keeps a slow engagement of the milling tool distributing the forces. Typically the Bredent milling cutter is designed for right hand cutting and the double fluted tools are highly diverse as can be **Continued on page 3**



Bredent Wax Milling Tool.



Wax Milling Bur.



Radical rake angle of a helical plain milling cutter.



Close up view of the helical tooth used for smooth milled surfaces and chip removal.



Bredent Interlock.

Product Showcase: Bredent Interlock

Introducing the Bredent Interlock, for a fast reliable slot attachment in conjunction with a shear distributor; this interlock can also be used to segment bridge work. The interlock is made of a special high-melting wax and is available in either a 0° or 2° configuration with the appropriate mandrels. The casting can be refined further with Bredent's groove

bur F5382H10 for finishing and polishing. This will provide a reliable and durable, removable denture with the correct interlock and shear distributor. The interlock is packaged in eight pieces and the mandrels are sold separately. **For additional information contact the order desk at Dent-line of Canada at 1-800-250-5111.**



Renfert's new Easy Glide Bi-V-Pins & sleeves, also shown with red rubber stoppers.

Product Showcase: "New" Renfert Easy Glide Bi-V Pins

Provide tension free bridge removal from diverging die preparations. The new glide plastic sleeve provides rapid release and a stable hold for the pins. Pins are released with a short tapping movement instead of with the use of force. The outer surface is covered with retention for a perfect hold in the model base. A membrane situated in the lower exit area inside the sleeve prevents dental stone from entering while

pouring the base. The plastic sleeve by passes tolerances much more readily than metal sleeves; thus guarantees the best possible hold ever after repeated insertions and removables. The Easy Glide System is more economical than the original bi-pins and is also designed to work perfectly with Renfert's rubber caps. **Contact the order desk at Dent-line of Canada Inc., at 1-800-250-5111.**

How Does Milling Fit With Today's Dentistry? cont'd...

expected from such a widespread process. Examples of the most common type of milling cutters are wax cutters, profile and polishers which are 0° or parallel, with either a ball nose or flat end tip in four sizes. Also available are conical milling cutters in 2°, 4° and 6° configurations, with either a ball nose or flat end tip in three sizes. The specialized milling tools consist of the groove tool which has five sizes and the shoulder cutting tool with two. Also available are twenty assorted diamond milling tools for special situations. There are two methods of milling; up milling and down milling. Up milling, also referred to as conventional milling, feeds into the rotation of the cutter. The direction of the milling cutter rotates clockwise, the restorative work piece is fed to the right; this is ideal for metals, and ceramics. Down milling is also referred to as climb milling. The direction of the cutter rotation is the same as the feed motion. For example, if the cutter rotates counter clockwise the restoration is fed to the right in down milling. The chip formation in down milling is opposite to the chip formation in up milling which is ideal for

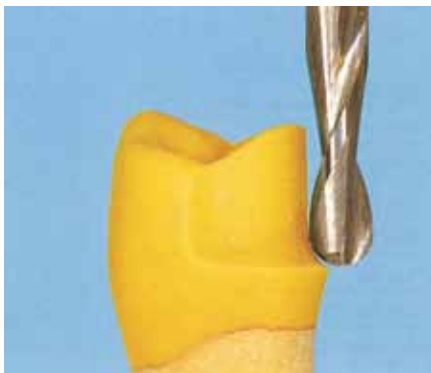
waxes. In most cases the first step would be to mill in wax in order to reduce much of the bulk. After casting, the surface would be refined and then polished. There are many indications where milling is required, such as for telescopic work, whether in metal or ceramics and also for attachments such as the RS, RSS, T attachments, cone crowns, grooves, hinge and swivel locks and for milled shear distributors. The most common type of milling is needed for a bracing arm or shear distributor in the construction of attachment borne bilateral partial dentures. The shear distributor protects the attachment and abutment against the effects of torsion, rotation and leverage forces. Using controlled strategies, a plan should be considered on how each of the restorative parts or sections will be machined. Then the milling machine tools, jigs, fixtures and materials must be prepared. The most common approach would be to begin cutting the restoration to rough size and then machine the piece with the profile cutting tool, finally adding the finishing touches such as drilling a hole or cutting grooves. **Continued on page 4**



The 6° Conical wax cutter prepares the tapered telescopic crown.



The profile milling tool finishes the surface of the 6° tapered crown precisely.



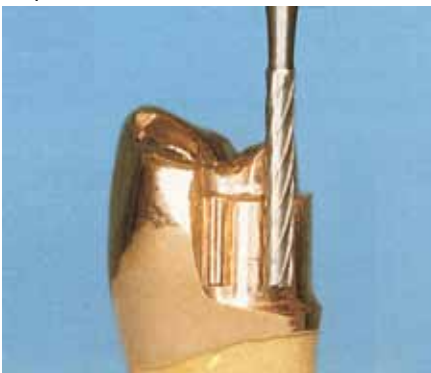
Using the wax bur F1372W23, prepare a semi-round shoulder with a marginal step.



The groove is completed with F5382H10 & the occlusal shoulder with F2052H27.



After casting & finishing, the parallel surface is remilled with profile bur, F1272H23.



Remilling of the groove is carried out with the tool, F5382H10. During this process the groove bur should only be moved vertically in the slot.



The occlusal shoulder is reworked with milling tool, F2052H27.



Perfect high lustre is accomplished so that additional polishing is not required.

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The most important part is to plan the machining of the individual parts. Naturally the process differs from case to case, the shape of the part, the material used and the accuracy required; all these factors contribute to the over all completion of the final restoration.
Source: Peter T. Pontsa, RDT
References: Michael Sherring-Lucas and Paul Martin, Quintessence Publishing; Attachments for Prosthetic Dentistry. Peter T. Pontsa, RDT Spectrum Jan/Feb 2002 pg 40-44 & 75; Bilateral Attachment Placement with Milling Model

Fabrication. Peter T. Pontsa, RDT Denturism Magazine Winter 2005 pg 18-23; Attachment Borne Removable Partial Dentures. Kalpakjian S.; Introduction to Manufacturing Processes. Olivo CT; Machine Tool Technology and Manufacturing Processes. DeVries W.R.; Analysis of Material Removal Processes. Lmabert B.K.; Milling: Methods and Machines, Society of Manufacturing Engineers. Cincinnati Milling Machine Co.; A Treatise on Milling and Milling Machines. Boothroyd G. & Knight W.; Fundamentals of Machines and Machine Tools.

The Written Word: our readers' letters or emails

Dr. Doug Lobb writes:
Hi Peter,

I enjoyed your lingualized occlusion article for full denture treatment in the recent Dent-Liner issue. I am unable to locate the setup template for the Kavo Protar articulator, as pictured in your article. I have looked through the latest Kavo catalogue. Is there a number on the setup template? The catalogue shows a template for setting up the manibular teeth but not for one setting

up the maxillary teeth as shown in the article. Thanks for any assistance, Doug.

Peter Pontsa, RDT replies:
Hi Doug,

Thank you for your interest in the dent-liner. I'm going to refer you to the gentleman who created the setup template. It is prototype and was passed onto me by him for me to use. Hopefully he will be able to assist you. Sincerely, Peter.

Special Announcement:

Dent-line of Canada Inc. would like to announce the completion of the hands on workshop "Reaching a New Standard in Denture Aesthetics". The seminar was presented on Saturday February 11, 2006 at George Brown College by Mr. Peter T. Pontsa, RDT. The course covered the lingualized occlusion, colour tone placement and denture fabrication. Each participant left the course with a completed Enigma denture and a certificate of accomplishment. Mr. Peter T. Pontsa, and Mr. Hatem Raslan extend their warm thanks to the course participants for a succesful hands-on Colour Tone Enigma workshop.



Dent-Line extends its thanks to all the course participants for a successful day.

Special Birthday Announcement:

Dent-line of Canada Inc. is pleased to announce our 15th birthday was on March 19, 2006. During the last fifteen years we have provided Bredent and Renfert high quality products without compromise. Peter T. Pontsa RDT, Angela van Breemen BA and our dedicated staff would like to thank our

many customers who over all the past years have supported our company. We realize that our customers are our best asset. We will continue to supply the specialty products we are known for, give technical advice and courteous service well into the future. **Thanks to you - our valued customers!**

Trade News:

Technorama 2006 will be held May 12th and 13th of this year. We welcome you all to our booth to visit with us and see the new products we will be exhibiting. **Perfecting Your Practice** will take place

June 1st to the 3rd at the University of Guelph. The Denturist Association of Ontario will provide a wide variety of venues, speakers and topics. Drop by our booth for the latest in product innovations.