Role of Microdebriders in otolaryngology

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Introduction:

Microdebriders should be considered to be next only to an endoscope in rhinological surgical procedures. It is hence considered to be the most important innovations in the field of rhinology and endoscopic sinus surgery. In recent times this instrument is becoming really popular thereby reducing the reliance on traditional non powered sinus instruments like currettes and forceps.
Advantages of microdebriders include:

1. It spares the adjacent mucosa (Mucosal sparing)
2. It is precise
3. Removes tissue real fast
4. Visualization is really good
5. Since the blade comes in different angles it can be used to cut tissues from even inaccessible areas inside the nose
6. The suction applied to the blade sucks and holds the tissue for better cutting effect

History:

Originally the concept and design of microdebrider was patented by Urban in 1969. In his patent application he called the equipment “Vacuum rotatory dissector”. This equipment was originally used by the House group to remove acoustic neuroma during 1970's. Orthopedic surgeons started using it for arthroscopic surgeries from the year 1975.

It was only from the year 1994 Setliff and Parsons started using this equipment for nasal surgeries. Improvements to this original vacuum dissector started taking place by leaps and bounds.

The originally patented Vaccum dissector was cylinderical, electrically powered shaver system which is supplied with continuous suction. The basic design which was patented has a hollow shaft with a rotating / oscillating inner cannula.
The suction applied draws the soft tissue inwards and is trapped there. This trapped tissue is sheared off by the rotating blade between the inner and outer cannulas.

The slower the rotating speed of the blade larger is the tissue bite, at higher speed rates the instrument becomes less aggressive. The sheared bits of tissue is sucked by the suction effect. Irrigation via a side portal is performed in a continous basis. Irrigation helps in preventing the bits of tissue from blocking the suction portal of the hand piece. The bits of tissue sheared by debrider blade can be collected and sent for histopathological examination also.

Hand piece design:

All the commonly used debrider handpieces still maintain the cylinderical design of the original patent of Urban. The cylinderical design permits the surgeon to hold the hand piece as if it were a scalpel.

Microdebrider cylinderical hand piece

The Diego microdebrider provides a pistol grip handpiece. Some surgeons find this comfortable.

Figure showing pistol grip handpiece

With the image guidance systems becoming common handpiece manufacturers have made handpieces that can be easily coupled with image guidance system.

Debrider blades:

These blades are disposable. They come in various configurations. Their edges can be straight or serrated. Straight edged blades are less traumatic and has more tissue sparing effect, whereas serrated ones allow for better gripping of tissue. It has an inner and outer cannula. The inner cannula's edge happens to be the blade. The outer cannula serves as a conduit for suction, irrigation and the inner cannula.

Depending on the relative angles of the inner and outer cannulas the cutting action of the debrider blade could either be gulliotine or scissors. Most of the debrider blades has a scissors like cutting action with an angle between the openings of the inner and outer cannulas hence the shearing force is applied only to a small tissue area at a given time. In debrider blades with a guillotine cutting mechanism the apertures of the two cannulas run parallel to one another hence it shears off the entire bit of tissue.

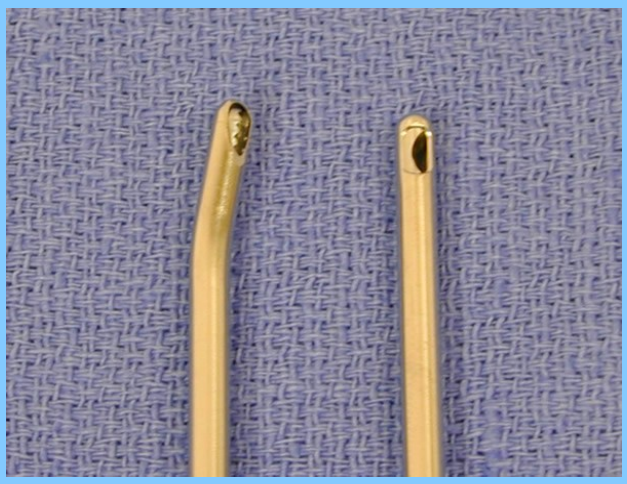

Figure showing the two basic types of debrider blades

These blades can either be set to osscilate or rotate. Oscillation usually runs at a slow speed (5000 rpm) and is useful for soft tissue resection. At slower speeds the port remains open longer allowing more soft tissue to be drawn into the aperture before the cut could be made. This adds to the efficiency of soft tissue resection.

Forward and reverse rotations are faster (upto 15,000 rpm) and more or less has a drill like action and hence could be used to drill bony structures as in endoscopic dcr, reduction of bony septal spur etc. Since the speed is too low for drilling bony structures when compared to the mastoid microdrills, it takes a long time to drill bony structures using a microdebrider. Recent innovations in microdebrider blades is the availability of blades which are prebent to suit the various angulations of resection inside the nasal cavity.

Image showing the prebent microdebrider blades

Special microdebrider blades:

These blades are made to perform specific tasks.

Tonsillectomy blades:

These blades are used to perform extracapsular tonsillectomy. These blades are wider with low angles to enable it to function as a guillotine. These blades usually come in 4mm diameters.

Adenoidectomy blades:

These blades are curved and hence can be introduced through the nasal cavities. The curvature of these blades mimics the curvature of the nasal cavity.

Figure showing the debrider blade used for adenoidectomy

Figure showing debrider blade used in tonsillectomy

Turbinectomy blades:

These blades are used to perform inferior turbinectomy. These blades are small diameter blades (2-2.8 mm). It has a bevelled guard at the back which protects the turbinate mucosa while the vascular erectile tissue is being dissected. This mucosal protection causes lower incidence of osteitis of the inferior concha.

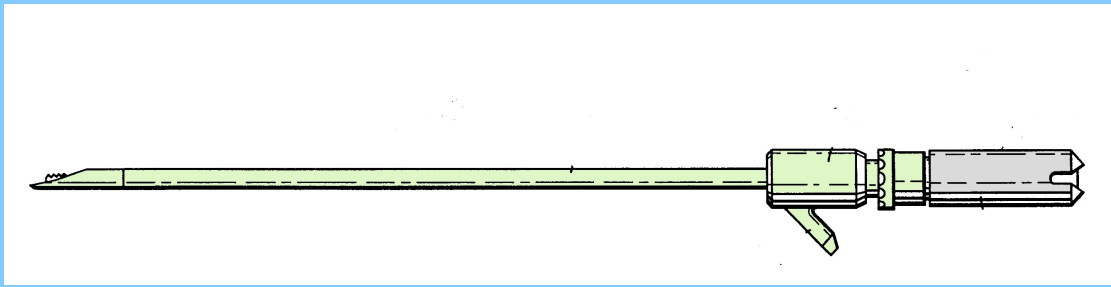

Figure showing turbinectomy blade

Role of debriders in clearing up the operating field:

Clearing the operating field of blood and other secretions is a must for better visibility during nasal endoscopic sinus surgery. Even small amounts of bleeding can significantly impair visibility during endoscopic surgeries. Debriders have the ability to continuously suck blood and dissected tissues out of the surgical field is a great advantage.

Recent modifications in debrider technology have managed to add the ability to cauterize bleeders using bipolar cautery delivered via the end of the blade. These blades themselves are surrouned by layers of insulation causing a sandwiching of the inner and outer electrodes. These instruments can be set to cauterize bleeders in three settings:

1. Low – 10 Watts
2. Medium – 20 Watts
3. High – 40 Watts

The only drawback of these blades is that only a small zone of bipolar cautery is present.

Microdebrider drills:

Eventhough microdebriders are not suited for drilling bone, the thin ethmoidal bones can easily be drilled using drill bits in place of debrider blades. These drill bits are commonly used in endoscopic dacryocystorhinostomy procedures. These drill bits are diamond drill bits (2.5 mm) size. The number of grooves in the drill bit

determines the speed of drilling. Fewer grooves result in faster and aggressive drilling of bone. This always comes with a price (poor control). As the number of grooves in the drill bits increases, the bone take down rate slows down but the control is much better. Diamond burrs cause less aggresive drilling than normal burrs.

Figure showing sheathed microdebrider drill bits

Where do you use microdebrider drill bits:

1. In Endoscopic DCR
2. In frontal sinus surgeries
3. In trans sphenoid pituitary surgeries
4. In Endoscopic skull base surgeries

Limitations of microdebriders:

1. Slow rotation rates – Debriders rotate at slow rates (15,000 rpm) as compared to that of microdrills (80,000 rpm) thus making it inefficient to drill bony structures.
2. Tactile feedback is less while operating with microdebriders when compared to that of conventional instruments
3. It should be used carefully in confined spaces close to vital structures in order to avoid damage to them
4. Initial cost of equipment and recurring expenses incurred towards purchase of

blades increase the cost of surgery.

Various components of microdebrider:

A debrider contains three components.

1. The console which helps in controlling the speed of rotation/direction of rotation. These parameters can easily be changed with the help of a attached foot pedal.
2. The blade: This is a tubular metal structure with serrated edge / smooth edge. The cutting edge is present only on one side only, while the smooth opposite surface does not cut. It is usually connected to a suction tube. These blades come in various sizes and configurations. This blade allows for simultaneous cutting and removal of cut tissue by suction.
3. Handpiece: Which is a portable micromotor. It derives its power supply from the console. The blade is attached to the shaft of the hand piece.

Figure showing the Microdebrider console

You can view the microdebrider in action by going to this url:

http://youtu.be/SlrO6hzEOY4