Campden Instruments

VIBROTOME BLADES AND MATERIAL HARDNESS

Campden Instruments has developed both stainless steel and ceramic blades to complement our range of high precision vibrotomes systems.

Key performance factors of any blade

- Material hardness
- Acuteness of the edge
- Grinding or polishing of the beveled edge

Importance of material hardness

There are a number of material hardness tests. Amongst the most common are Rockwell C (HRC) and Vickers Hardness Test (HV). This table represents approximations of the materials used to make vibrotome blades.

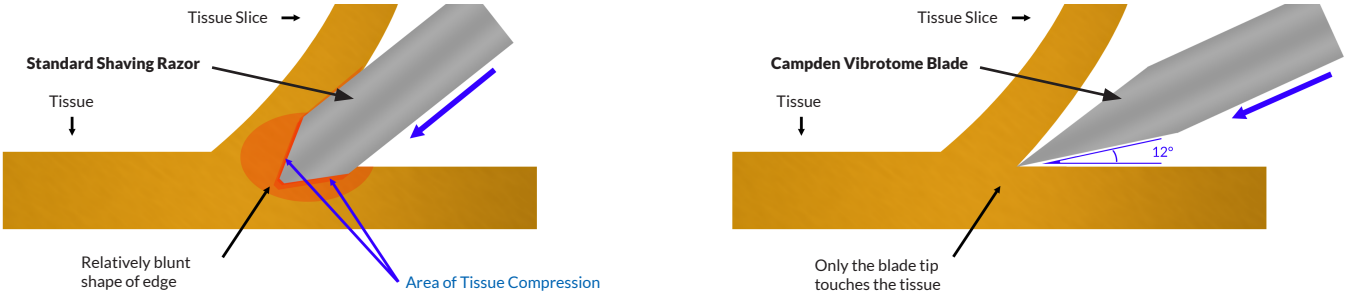
Material	Rockwell Value (HRC)	Vickers Value (HV)
Stainless steel	45-55	440-590
Zirconia Polycrystal*	N/A	1300

* Material used to make Campden's Ceramic Vibrotome Blades

As shown, the ceramic material boasts an HV scale value almost triple of the stainless steel. Due to the additional material hardness, it is possible to hone the ceramic blade edge to a greater sharpness. This hardness also improves the longevity of the blade's sharpness and facilitates development of a highly polished facet, which imparts less drag and sheer forces on the tissue surface. As a result, when properly cleaned and stored, these blades can still be in premium condition even after 3-4 weeks of use.

Effects of blade edge, bevels and facets on a tissue

The angle of the sharp edge, hardness of material, and smoothness of the surface are all features that will affect slice quality and the mechanical precision of the oscillating movement of the machine. The figure below demonstrates how a standard razor can cause compression and tissue stress in comparison to a specially designed vibrotome blade.



Blade Design: Stainless Steel Blades

Our stainless steel blades have two beveled angles of facet ground in an acute profile similar to scalpel blade, whereas a simple shaving razor has a relatively blunt edge to avoid cutting the skin. Laser examination of a blade's edge in our engineering lab showed that shaving razors are relatively blunt and are designed this way on purpose in order that they do not damage the skin during the process of shaving.

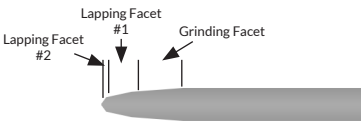
Blade Design: Ceramic Blades

Our ceramic blades are ground and then polished using micron diamond grit for superior flatness and smoothness. This polished face exerts less drag on the tissue as the blade oscillates when compared to the ground facets of the stainless blade. Additionally, these ceramic blades are only beveled on one side giving the edge a more acute angle than a stainless steel blade.

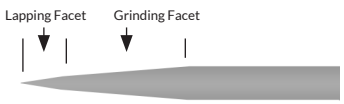
Appropriate usage of vibration frequencies and amplitudes

Regardless of tissue or application, usage of lower frequencies and amplitudes inevitably causes lower friction and therefore less shear stress on a tissue. As a general rule, tougher tissues (example: aged brain, cauterized brain, diseased human heart, and rodent heart) will require wider amplitudes and/or higher frequencies to cut in comparison to tissue that is more delicate and/or easier to cut. As such, delicate tissue can be preserved better with lower frequencies and smaller amplitudes. In principle, it is recommended to only use the minimum force required to achieve the desirable result.

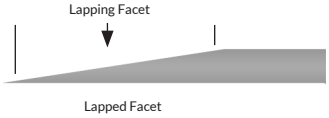
Blade Design: Blade Edge Profiles



Standard Shaving Razor



Campden Stainless Steel Blade



Campden Ceramic Blade