

A disposable instrument to optimize the sharp cut of nerves

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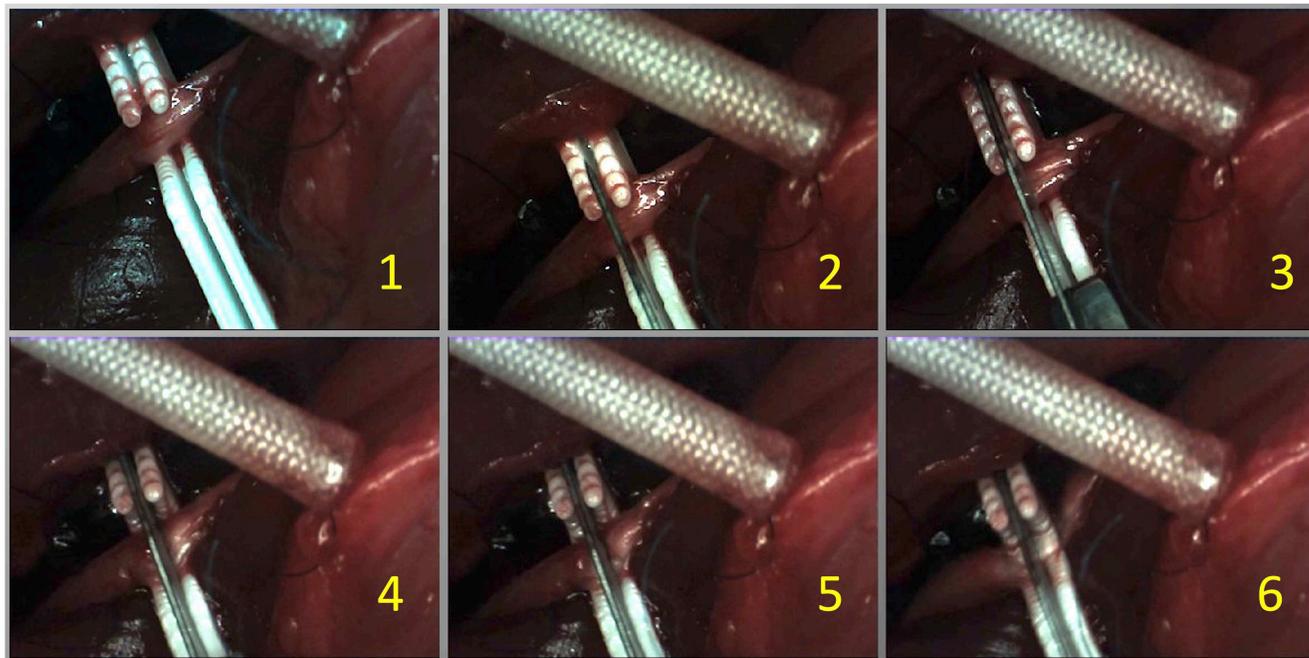
Objectives

The plexiform structure and the different elastic properties of nerve components (nerve fibers; perineurium; vessels; epineurium) makes the nerve very resilient to any attempt to cut it sharply by blades or scissors. Accurate surgical technique may succeed in this task; however, we searched for a dedicated surgical instrument able to facilitate and standardize the cutting procedure. A sharp cut technique has been associated with a reduced rate of complications like neuroma and exuberant scar formation.

Results

The smooth tip allowed the accurate positioning of the instrument in the area where the nerve is located. Availability of different sizes allowed the precise matching of the diameter of the nerve with the circular compartment. The slit provided a path for the surgical blade to cross the nerve at right angle with the elongation of the fibers.

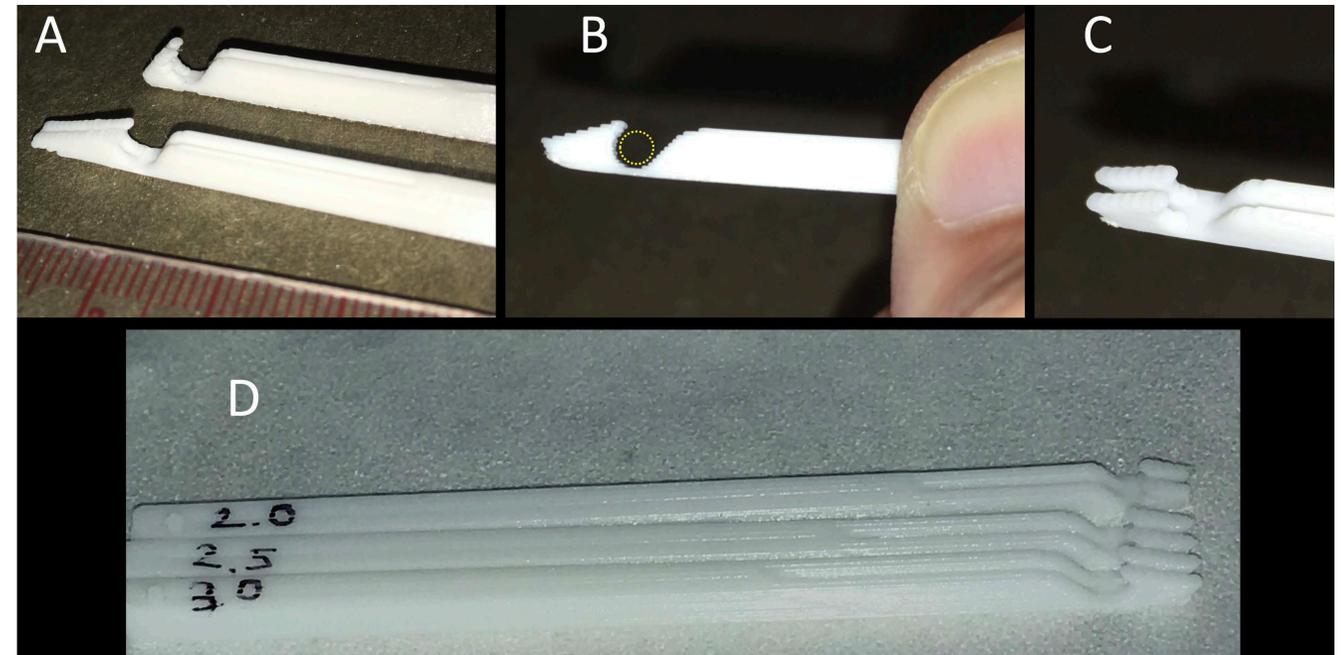
The instrument allowed a fast and accurate sharp-cut of the nerve. The manufacturing technique (3D printing) provided easily several different diameters available for surgery. The disposable character of the instrument eliminated the need for any problematic cleaning of the slit from biological materials (as it would be required for the re-use of more traditional non-disposable tools).



Sequential stages of the sharp cut during the implantation of a braided nerve-guide.

Methods

A probe with a double-profiled tip was designed to accommodate the nerve transverse section into a circular compartment which is open for about 1/3 of its circumference. A slit is present at right angle with this compartment and has been dimensioned to accommodate a surgical blade. The instrument has been 3D printed in several sizes. Polymeric materials have been tested for the printing procedure and our final choice was poly-Lactic Acid.

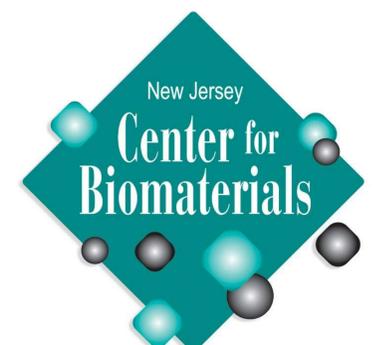


A)-several different shapes have been rapidly prototyped by 3D-fused deposition method. B)-the nerve can be accommodated into a compartment which matches its diameter (dotted yellow circle). C)-our preferred design has a double-profiled tip. D)-several disposable instruments, matching different nerve diameters, can be packaged into sterilized sets for surgery.

Conclusions

The instrument may be useful to assist the trimming of cut-ends in gap-lesions. However, it is particularly suited for the sharp cut of an intact nerve as it is required in the harvesting of a donor autograft, in taking a whole nerve biopsy, in producing experimental gap-lesions

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