“GOOD VIBRATIONS”: Longitudinal vs Torsional Ultrasonic Shears in Surgery

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SAFER TOOLS FOR SURGERY?

In recent years, ultrasonic shears are being used for coagulation and cutting during surgery in place of the conventional electrosurgery.

Currently, two different vibration modes are being employed by these devices. The longitudinal mode is used by most devices, **Harmonic Scalpel** being the most widely marketed in Europe. The **LOTUS** uses a unique torsional mode of vibration to deliver energy to the tissues.

AIMS

This research aims to investigate their characteristics that are important to clinical practice.

My specific goals were to analyse:

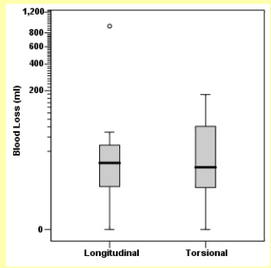
I efficiency and safety during laparoscopic cholecystectomy
II strength of seals made on blood vessels
III lateral thermal spread, i.e. potential to cause burn injury to adjacent tissues

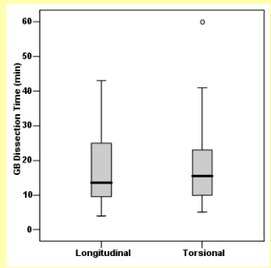
CLINICAL STUDIES

Study	Patients	Design	Object of the Study
I	200 undergoing laparoscopic cholecystectomy	Prospective, randomised, single-blinded	Comparison of blood loss and gallbladder dissection time
II	20 undergoing varicose vein ligation and stripping	Prospective, non-randomised	Comparison of vessel sealing burst strength, Microscopic study of seals and assess thermal damage

Study I

To date, 47 patients have been recruited into the study. Preliminary results suggest no differences in blood loss and gallbladder dissection time.





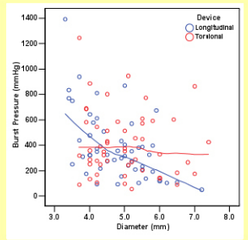
Study II

This study has not started

LABORATORY STUDIES

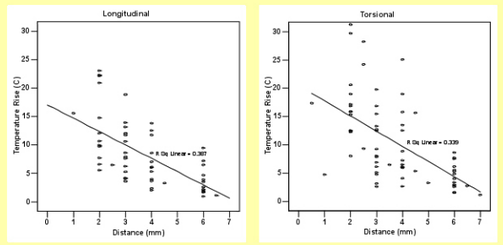
Study	Materials	Design	Objective of the Study
III	Porcine carotid arteries	Using a pressure transducer	Comparison of vessel sealing burst strength
IV	Chicken muscle	Using thermocouples	Comparison of lateral thermal spread
V	Bovine muscle	Using infrared thermal imaging	Comparison of waveguide and tissue temperatures

Study III



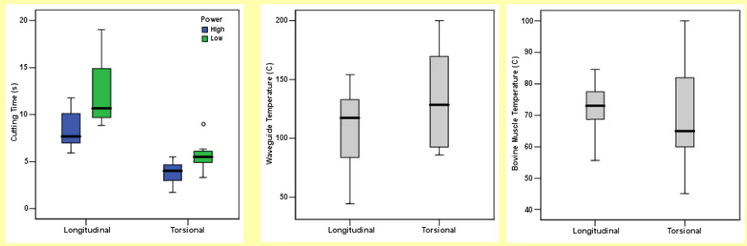
The lines of best fit suggested that the burst strength was more consistent across the diameter range with the LOTUS, while there was a steady decline in burst strength as vessel calibre increases with the Harmonic Scalpel. For vessels of diameter above 5.2 mm, this difference became significant.

Study IV



Higher temperature rise with the LOTUS at distances 2 to 4 mm from the cut edge. Thermal spread was insignificant at distances above 5mm with both devices.

Study V



CONCLUSIONS

This research shows that torsional mode ultrasound is as safe as longitudinal mode ultrasound during surgery; its vascular seals were stronger for larger vessels; and it was quicker in cutting. There were no significant differences in waveguide and tissue temperatures during cutting.