

Pullout Strength of Ciprofloxacin-Containing Poly lactide-Polyglycolide Screws in Human Cadaver Parietal Bone

Johanna Tiainen¹, Minna Veiranto², Esa Suokas³, Pertti Törmälä², Timo Waris¹,
Nureddin Ashammakhi^{1,2}

1. Department of Surgery, Oulu University Hospital, Oulu, Finland.
2. Institute of Biomaterials, Tampere University of Technology, Tampere, Finland.
3. Linvatec Biomaterials Ltd., Tampere, Finland.

The aim of this study was to compare the pullout forces of recently developed bioabsorbable ciprofloxacin-containing and plain self-reinforced poly lactide/polyglycolide (SR-PLGA) miniscrews in human cadaver parietal bones. Parietal bone pieces (approximately 6 x 20 cm) were collected from five human male cadavers (44-75 years of age). Fifty plain SR-PLGA 80/20 miniscrews (diameter = 1.5 mm, length = 4.0 mm) and 50 ciprofloxacin-containing SR-PLGA 80/20 miniscrews (diameter = 1.5 mm, length = 4.0 mm) were used in this study. The force needed to pull the screws from human parietal cadaver bones was measured using a tensile strength-testing machine. The screw pullout speed was 10 mm/min. Means and SDs were calculated and analyzed using the Student t test (SPSS version 10.0 for Windows). The pullout forces of the ciprofloxacin-containing and plain miniscrews were 66.8 +/- 4.9 N and 96.3 +/- 9.3 N (significant difference, $P < 0.001$), respectively. The most common cause of failure was screw-shaft breakage (60% in the case of ciprofloxacin-containing screws and 52% in the case of plain SR-PLGA screws). Scanning electron microscopy showed that the fibrillar strip-like microstructure of plain SR-PLGA miniscrews turns into a coarse, uniaxial, platelet-like morphology in antibiotic SR-PLGA miniscrews as a result of the addition of ciprofloxacin. Ciprofloxacin-containing SR-PLGA screws consequently have a lower pullout strength than corresponding plain conventional SR-PLGA screws. Nevertheless, it is evident that the ciprofloxacin-containing screws can be applied in craniomaxillofacial surgery in nonload-bearing or slightly load-bearing applications.