INTRODUCTION
During flexor tendon repairs, surgeons may need to perform partial pulley excisions to improve exposure and facilitate repair. A tendon avulsion injury may also be accompanied by complete or partial pulley rupture. In these cases, surgeons are often irrefutable as to whether the pulley should be repaired or excised. Such excision may facilitate flexor tendon surgery by improving exposure and preventing postoperative tendon triggering or adherence caused by impingement between the repair site and edge of the pulley. The purpose of this study was to investigate the gliding resistance of the tendon-partially excised pulley interface and strength of the partially excised pulley.

METHODS
Thirty-two cadaveric human fingers were used from eleven cadavers. The flexor digitorum profundus (FDP) tendons and A2 pulleys from the second, third, and fourth digits were used in this study. The flexor tendon in zone II and A2 pulley were exposed and the flexor digitorum superficialis (FDS) tendon and its insertion were preserved. Two marks were made at the distal edge of the A2 pulley on the FDP tendon with the digit in full extension and in full flexion position. The distance between these 2 marks was considered to be the tendon excursion.

Gliding resistance measurement
The peak gliding resistance between intact or repaired tendon and partial excised pulley were measured using a method previously reported and repeated with the following four conditions. (Figure 1)(1) Intact tendon group
Group I: intact A2 pulley, successive excision of 25%, 50% and 75% of the A2 pulley, cutting from the distal edge toward the proximal edge in 8 fingers.
Group II: intact A2 pulley, successive excision of 25%, 50% and 75% of the A2 pulley, cutting from the proximal edge toward the distal edge in 8 fingers.
(2) Repaired tendon group
Group III: intact A2 pulley, successive excision of 25%, 50% and 75% of the A2 pulley, cutting from the distal edge toward the proximal edge in 8 fingers.
Group IV: intact A2 pulley, successive excision of 25%, 50% and 75% of the A2 pulley, cutting from the proximal edge toward the distal edge in 8 fingers.

A complete tendon laceration in group III and IV was created at a level 10 mm distal to the proximal marker, in order to allow the repair site to travel the full length of the A2 pulley during normal excursion. The FDP tendons were repaired with a modified Becker suture of 3-0 Ti-Cron, and an epitenon running suture of 6-0 nylon.

Pulley strength measurement
After the gliding resistance test, the breaking strength of the same pulley was measured using a servohydraulic machine (MTS, Minneapolis, MN). Sixteen A2 pulley were tested with a 75% excision, cutting from the distal toward the proximal edge (8 fingers) or from the proximal toward the distal edge (8 fingers). The pulley was tested by the methods of Lin et al 3. inserting a custom made rigid metal hook into the pulley canal. With the tendon hook placed beneath the A2 pulley, the fingers were firmly held in place and pulleys were distracted at a rate of 50 mm/min until rupture occur. Load and displacement data were simultaneously recorded.

RESULTS
In groups I and III, peak gliding resistance was not significantly different at any excised pulley. In groups II and IV, there was a significant increase comparing the 75% excised pulleys to the intact, 25%, and 50% excised pulleys (p<0.05). The peak gliding resistance between intact or repaired tendon and partially excised pulley showed the same trend (Figure 2). The excision of 75% of the A2 pulley, cutting from the proximal toward the distal end, resulted in strength and stiffness of 160N and 120N/mm respectively, that were significantly higher than the excision of 75% cutting from the distal toward the proximal A2 pulley, which were 96.7N and 70.5N/mm (p<0.05) (Figure 3).

DISCUSSION
The peak gliding resistance of the 75% excised pulley, cutting from the proximal edge toward the distal edge of the A2 pulley had a statistically significant higher gliding resistance than the 75% excision cutting in the opposite direction. The distal 25% portion of A2 pulley was 165% stronger and stiffer than the proximal 25% portion of A2 pulley. Our data suggest that partial excision of the A2 pulley is feasible with little risk of rupture and little increase of gliding resistance, especially if excision is limited to 50% of the pulley. This data supports the clinical practice of partial pulley excision to facilitate exposure and tendon repair.

REFERENCES

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