The effect of proximal epineurial stripping on neuroma formation was studied in the peroneal nerve stumps of the rat. After transection of the peroneal nerve, the epineurium of the proximal stump was stripped back by 6 to 8 mm and the nerve fascicles left uncovered in the study group. The transected nerve was left untreated in the control group. All nerves were evaluated by light microscopy 6 months after the operation. Two neuromas occurred in 20 stumps after epineurial stripping while 15 neuromas occurred in the control group. Based on histological data, we conclude that stripping of the epineurium may inhibit neuroma formation in the rat.

Journal of Hand Surgery (British and European Volume, 2006) 31B: 4: 450–452

Keywords: neuroma, proximal epineural stripping, epineurium, rat
surrounding tissue. Neuromas were identified by the following histological criteria: disorganisation, regenerating axon sprouts and associated Schwann cells; erosion of the perineurium; loss of funicular architecture and the presence of intraneural fibrosis (Kryger et al., 2001).

By way of comparison, histological analysis of traumatic amputation neuromas in humans identifies a disorganised proliferation of the proximal nerve (Weiss and Goldblum, 2001). The key feature of human traumatic neuromas is their haphazard arrangement of bundles of regenerating nerve fibres, ensheathed by Schwann cells (Burger et al., 2002). In more organised examples, the bundles resemble micro-fascicles, some with a delicate investment of perineurium (Burger et al., 2002). Myelination varies but is generally scant. An
occasional lesion features granular cell changes. Traumatic neuromas are non-encapsulated (Burger et al., 2002). Peripherally, they merge with fibrocollagenous tissue, and some even extend into adipose tissue or nearby skeletal muscle (Burger et al., 2002).

Statistical analysis was performed by \( \chi^2 \) test and a \( P \) value of less than 0.05 was regarded as statistically significant.

RESULTS
At 6 months, the number of neuromas was considerably less in the study group, who underwent proximal epineural stripping, than in the control group. In the control group, in which the nerves were simply cut, neuroma formation was detected histologically in 15 of 20 of the sectioned peroneal nerves. Only two histological neuromas were detected in the 20 rat peroneal nerves which were sectioned then underwent proximal epineural stripping. The decrease was statistically significant (\( P < 0.001 \)).

DISCUSSION
After transection of a peripheral nerve, the untreated proximal end forms a “classic” neuroma (Al-Qattan, 2000). The terminal portion of the proximal nerve stump displays a bulbous swelling in almost all animals (Kryger et al., 2001). This swelling is a natural part of the regeneration process of a severed nerve and is caused, almost entirely, by perineurial fibrosis (Kryger et al., 2001). Therefore, the gross appearance is not an accurate indication of neuroma formation, which can only be determined microscopically (Kryger et al., 2001). The regenerating axons of a classic neuroma are relatively disorganised, infiltrate into surrounding soft tissues, and may contain myofibroblasts (Al-Qattan, 2000). The statement “no neuroma was observed” should be interpreted with caution because some degree of axonal regeneration occurs in all instances (Al-Qattan, 2000). Nevertheless, it is generally possible to identify those nerve ends which do, and do not, form a neuroma.

In the literature, the incidence of histological neuroma formation in a 6 to 8 month period in rat sciatic nerves after simple section varies between 77% and 100% (Martini and Fromm, 1989; Muehleman and Rahimi, 1990; Rahimi and Muehleman, 1992). In this study, neuroma formation, as defined previously, was detected in 15 of 20 sectioned peroneal nerves in the control group. Proximal stripping of 6 to 8 mm of epineurium impeded the development of histological neuroma formation and only 2 neuromas were seen in 20 rats treated in this way.

Not all neuromas are painful and there is no way to distinguish between the asymptomatic and the painful neuroma histologically or biochemically (Rahimi and Muehleman, 1992). Although proximal stripping of 6 to 8 mm of epineurium produced histologically less neuroma formation in this rat experiment, we do not know if this would produce a similar effect on human neuroma formation or be associated with less pain in the human. This requires further investigation.

References

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