



## Isolated severance of the intrinsic motor branch of the ulnar nerve caused by stab injuries to the hand:a report of three cases

### *Üç olguda elde delici yaralanma sonucu oluşan ulnar sinirin izole intrinsik motor dal kesisi*

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Delici yaralanmalar sonrasında oluşan ulnar sinirin Guyon kanalının distalindeki izole derin intrinsik motor dal kesileri oldukça nadir görülen yaralanmalardır. Bu yazıda elde hipotenar bölgede delici cisimler ile oluşan izole motor dal kesisi nedeniyle ameliyat edilen üç hasta (1 kadın, 2 erkek) sunuldu. İki hastada duyu muayenesi normaldi. Üç hastada da parmaklarda pençeleşme ve intrinsik kas paralizisi vardı. Kavrama ve çimdik (pinch) güçleri büyük ölçüde azalmıştı. Eksplozasyonda ulnar sinirin derin motor dalının kesilmiş olduğu görüldü. Bir hastada epiperinöral teknikte uç-uca mikrocerrahi onarım yapıldı. İki hastada sinir eksizyonu sonucunda oluşan 2 cm ve 4 cm'lik açıklıklar bacadan alınan sural sinir grefti ile kapatıldı. Takip döneminde tüm hastalarda kavrama ve çimdik güçleri normal ele yaklaşmıştı. İki hastada intrinsik kas fonksiyonunda ve parmakların abduksiyon ve adduksiyonlarında dönüş sağlandı. Bir hastada ise ikinci yıl sonunda bile parmak adduksiyon fonksiyonunda dönüş sağlanmadı; bir parmakta pençeleşme devam etmekteydi.

**Anahtar sözcükler:** El/inervasyon; el yaralanması/cerrahi; mikrocerrahi; ulnar sinir/yaralanma/cerrahi.

Laceration of the deep intrinsic motor branch of the ulnar nerve below the Guyon canal is rarely seen in penetrating injuries of the hand. We report three patients (1 woman, 2 men) who underwent microsurgical repair for isolated injuries to the motor nerve branch of the ulnar nerve due to penetrating injuries to the hypothenar area of the hand. Two patients had normal sensation. All the patients had intrinsic muscle paralysis and claw deformity of some fingers, with significantly weakened grip and pinch strengths. Exploration showed isolated severance of the deep intrinsic motor branch of the ulnar nerve. One patient underwent end-to-end repair with epiperineural suture technique. Two patients required bridging with a sural nerve graft from the leg for 2-cm and 4-cm gaps, respectively, that occurred following nerve excision. During the follow-up period, grip and pinch strengths of all the patients approximated to the values of the normal side. Intrinsic muscle function and abduction and adduction of fingers recovered in two patients, whereas in one patient finger adduction was not reversible and claw deformity persisted in one finger even after two years.

**Key words:** Hand/innervation; hand injuries/surgery; microsurgery; ulnar nerve/injuries/surgery.

A female patient 32 years of age was hospitalized with a penetrative injury to the left palm caused by a shattered glass plate while washing dishes ten days prior to the operation (Figure 1). Even though no sensory defect was detected in the ulnar nerve dermatome during the patient's examination, a clawing

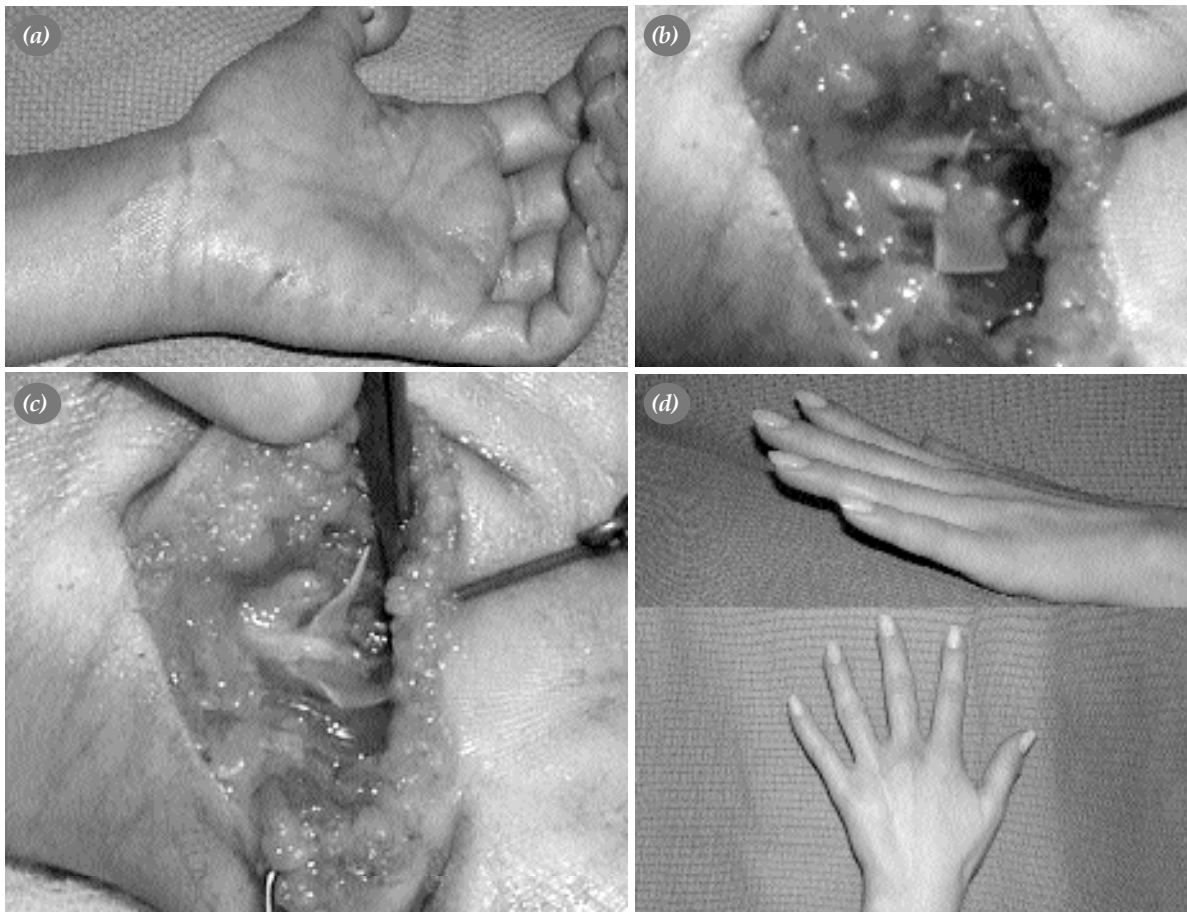
deformity and intrinsic muscle paralysis in the fingers were observed. The grip force in the right/left hand was measured at 28/15 kg. and pinch force at 9/2.5 kg. A detailed examination which followed, revealed that the ulnar nerve had been severed at the Guyon canal immediately distal to the hook of the

hamate where the sensory branches were spared (Figure 2). The severance of the motor branch was repaired via microsurgical epiperineural suture technique (Figure 3). Three months after the procedure, first signs of the return of the patient's intrinsic motor functions were observed and after six months the first dorsal interosseous muscle force reached the level of M4 in conjunction with the disappearance of the clawing deformity in the fingers (Figure 3). One year from the operation the patient's grip force in the right/left hand was measured at 28/25.5 kg and pinch force at 9.5/7 kg consecutively.

### Case report

**Case 1**– A female patient 32 years of age was hospitalized with a penetrative injury to the left palm caused by a shattered glass plate while washing dishes ten days prior to the operation (Figure 1). Even though no sensory defect was detected in the ulnar

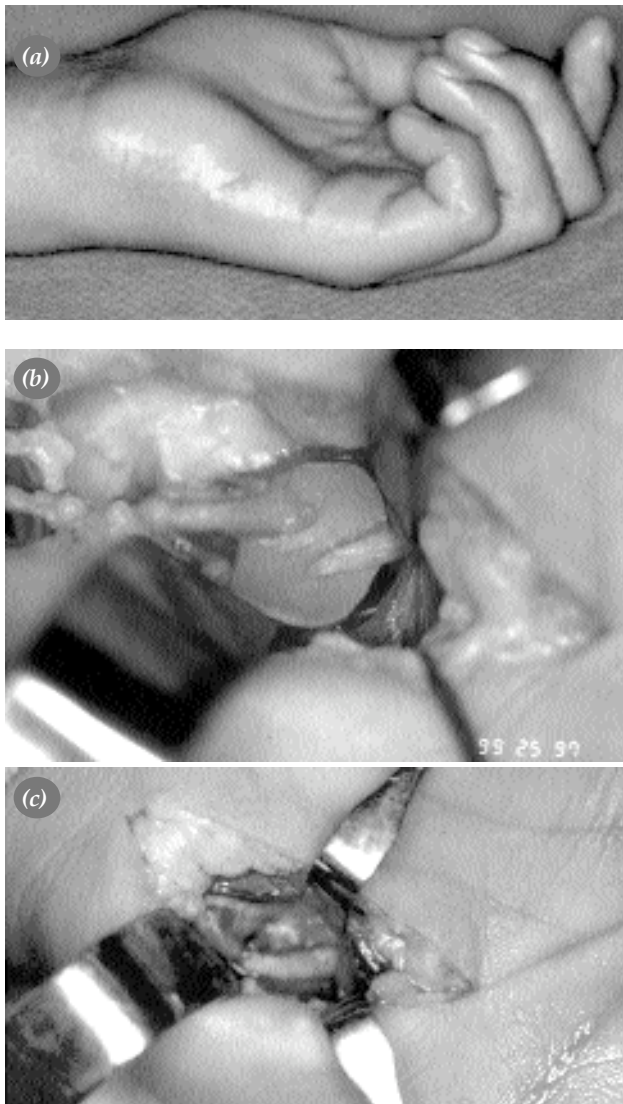
nerve dermatome during the patient's examination, a clawing deformity and intrinsic muscle paralysis in the fingers were observed. The grip force in the right/left hand was measured at 28/15 kg. and pinch force at 9/2.5 kg. A detailed examination which followed, revealed that the ulnar nerve had been severed at the Guyon canal immediately distal to the hook of the hamate where the sensory branches were spared (Figure 2). The severance of the motor branch was repaired via microsurgical epiperineural suture technique (Figure 3). Three months after the procedure, first signs of the return of the patient's intrinsic motor functions were observed and after six months the first dorsal interosseous muscle force reached the level of M4 in conjunction with the disappearance of the clawing deformity in the fingers (Figure 3). One year from the operation the patient's grip force in the right/left hand was measured at 28/25.5 kg and pinch force at 9.5/7 kg consecutively.



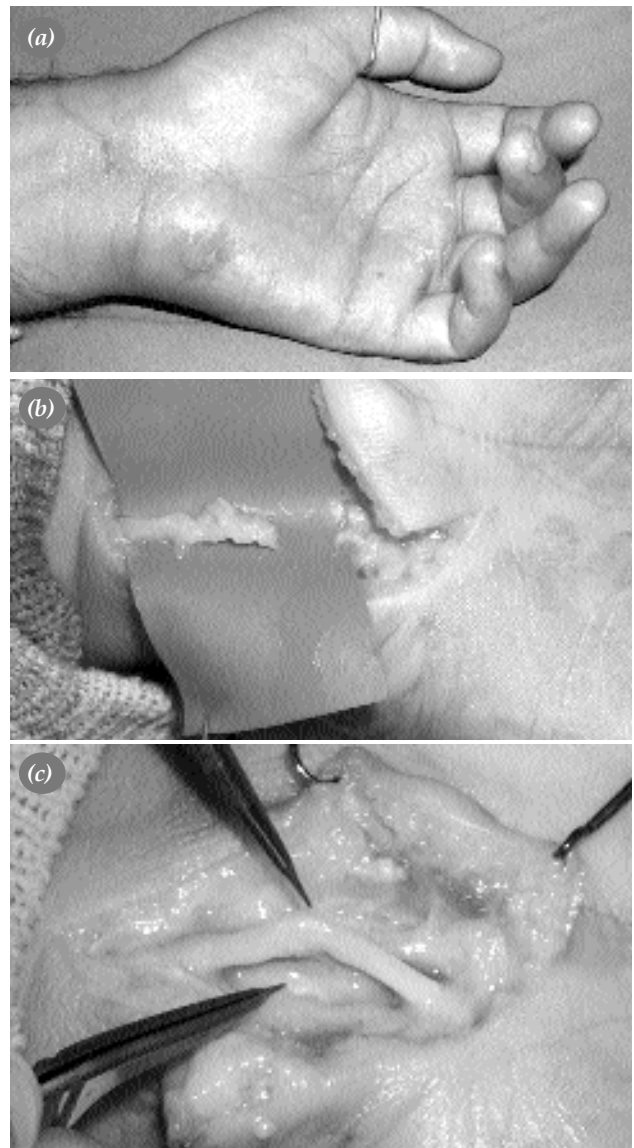
**Figure 1.** (a) The preoperative picture of the penetrating injury distal to the guyon canal. (b) Peroperative appearance of the severed deep motor branch of the ulnar nerve. (c) Peroperative picture of the same patient after repair of the nerve. (d) Postoperative picture of the same patient the disappearance of claw hand deformity.

**Case 2**— A male patient 17 years of age had his left palm lacerated by a stabbing incident three weeks prior to admittance of our hospital (Figure 5). This patient also had no detected sensory defect in the hand but clawing deformity and intrinsic muscle paralysis in the fourth and fifth fingers were observed. During the operation an incision was made above the Guyon canal along the palmar area. After a dissection of the ulnar artery and nerve, the sensory branches were found uninjured. A partial incision was made where Opponens Pollicis, Digiti Minimi and Flexor Digiti Minimi muscles meet the hook of the hamate and it has been observed that the

intrinsic motor branch had been severed at this area (Figure 6). Following the excision of the lacerated nerve ended up with a 2 cm. gap in the nerve. A sural nerve graft of equal length obtained from the ipsilateral leg was interposed in the gap as a single cord and routine nerve repair was carried up. (Figure 7). Four months after the operation, the first signs of intrinsic muscle function was detected, and at the end of the eight month abduction and adduction functions of the fingers had been restored. Moreover, the first dorsal interosseous muscle force reached the level of M4.



**Figure 2.** (a) Scar tissue at the hypothenar area of the second patient. (b) The severance of the motor branch of the ulnar nerve as seen perioperatively distal to the hook of the hamate. (c) The repair of the nerve with sural nerve graft.



**Figure 3.** (a) Scar tissue of the hypothenar area caused by a dog bite. (b) The severed motor branch of the nerve as seen at the operation. (c) As the superficial sensory branch of the ulnar nerve is elevated, one can see the repaired motor branch with sural nerve graft interposition.

**Case 3**— A male patient 36 years of age had his left hand bitten by a dog and had received first aid dressing to the wound one month prior to admittance (Figure 8). The patient's examination revealed paralytic deformation in the ulnar nerve innervated muscles as well as clawing of the fingers. Sensory measurement in all fingers was recorded as 2.83 at the initial examination. The grip force in the right/left hand was measured at 48/30 kg and pinch force at 12/4 kg. An operation aiming to explore the nerve was undertaken via an incision over the Guyon canal to observe that the motor branch of the ulnar nerve. It was severed at the hook of the hamate level although the sensory branches were unharmed. An excision of the damaged nerve endings left a gap of 4 cm. in the nerve. This defect was remedied by a sural nerve graft obtained from the right leg which was interposed into place as a single line and routine microsurgical repair was carried out. The second year post-operative evaluation of the patient revealed that the adduction function of the fifth finger had not returned and that clawing deformity in the fifth finger persisted. The grip force in the right/left hand was measured at 48/40 kg and pinch force at 13/9 kg consecutively.

## Discussion

Upon entering the Guyon canal in the palmar area the ulnar nerve splits into the superficial sensory branch and the deep motor branch 4 to 20 mm distal to the radial stiloïd. The superficial sensory branch further splits distally to create the common digital nerve of the fourth web and ulnar digital nerve of the fifth finger. The deep motor branch submerges and veers towards the radial side at the hook of the hamate and is engulfed in areolar and fatty tissue at this site. The deep motor branch further branches to innervate the hypothenar, third and fourth lumbrical and all interosseous muscles as well as the deep end of the M. adductor pollicis ve M. flexor pollicis brevis muscle.<sup>[6,7]</sup> Severance of isolated deep motor branch of the ulnar nerve due to penetrative injuries to the area distal to the Guyon canal is observed only infrequently and therefore may be overlooked since extrinsic muscle function and sensory performance of the fourth and fifth fingers are

often normal in such cases.<sup>[1,2]</sup> Thus, it is imperative that a motor exam accompany a sensory exam in these cases. If left untreated, severance of isolated deep motor branch of the ulnar nerve leads to a loss in interosseous muscle function and atrophy, however, if the injury is distal to the level in which the nerve branches into the hypothenar muscles, the hypothenar muscle functions remain unaffected. Two types of test have been suggested in the literature to detect the severance of isolated deep motor branch of the ulnar nerve. The first is the crisscross finger test developed by Earle and is best suited for the evaluation of the ulnar nerve motor branch. This test proceeds by crisscrossing the third finger over the second in order to evaluate the first palmar and second dorsal interosseus muscle functions. The second test is an evaluation of the first dorsal interosseous muscle strength which involves the abduction of the second finger and the palpation of muscle mass of the first web space.<sup>[3]</sup> A systematic evaluation and repair of the deep motor branches of the ulnar nerve would prevent the majority of negative consequences to the hand. The crucial point here is the fact that the motor branches run deep and are concealed within soft tissue. Consequently, unless the surgeon examining the area exercises caution and inspects the motor branches via lifting the sensory branches, injuries to the motor branches can easily be overlooked.

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