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Surgical technique

A novel technique for harvesting tendon grafts: Cheap, simple, and reliable

Une nouvelle technique pour prélever des greffons tendineux: économique, simple et fiable

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ABSTRACT

Tendon grafts often need to be harvested for tendon repair in complex hand surgeries. A tendon stripper is an instrument designed for tendon harvesting. In this study, a metal aspiration cannula was used like a stripper, in a simple and reliable way. With this technique, palmaris longus, plantaris and partial flexor carpi ulnaris tendon grafts were harvested from 11 patients. No problems were encountered in terms of graft quality, donor site or damage to adjacent anatomic structures. The quality of the harvested tendons was quite good, without any damage to the paratenon. Scars at the donor sites ranged between 1–2 cm, and they all recovered quite well aesthetically. While tendon repair does not require very specific surgical tools, a tendon stripper and endoscopy tools with are needed for harvesting tendon grafts. This is problematic in small, poorly equipped hospitals, where tendon surgery is performed with simple tools. This study demonstrates that tendon grafts can be harvested with a metal aspiration cannula, thus making it easier to perform tendon repair without specific surgical tools.

Mots clés :
Ténoplastie
Greffe tendineuse
Canule d'aspiration
Stripper de tendon

RÉSUMÉ

Prélever des greffons tendineux est souvent nécessaire pour la réparation de tendon dans la chirurgie complexe de la main. Le stripper de tendon est un instrument souvent modifié, conçu pour le prélèvement de tendons. Dans cette étude, une canule d'aspiration métallique a été utilisée de façon simple et fiable comme stripper de tendon. Avec cette technique ont été prélevés des tendons de palmaris longus, plantaris et flexor carpi ulnaris (partiel) chez 11 patients. Aucun problème n'a été rencontré s'agissant de la qualité du greffon, du site donneur ou de dégâts sur les structures anatomiques adjacentes. Les plaies sur les sites donneurs mesuraient entre 1 à 2 cm et avaient toutes assez bien cicatrisé esthétiquement. Alors que la réparation du tendon ne nécessite pas d'outils chirurgicaux très spécifiques, un stripper de tendon et des outils spécifiques à l'endoscopie sont nécessaires pour le prélèvement de greffons. Ceci pose des problèmes dans les petits centres mal équipés, où la chirurgie des tendons doit être pratiquée avec des outils simples, lorsque les greffes de tendons sont requises. Cette étude a démontré que le prélèvement de greffons de tendon avec cette technique, et donc la réparation de tendon, peut être facilement pratiquée sans instruments chirurgicaux spécifiques.

1. Introduction

Tendon injury is an important aspect of hand injuries. Primary repair can suffice for simple tendon lacerations while multiple or complicated wounds may require several sessions and tendon grafts. Similarly, congenital anomalies, rheumatic disorders and tendon surgery performed following nerve damage may require the use of tendon grafts [1–3]. All tendons in the body can be harvested as potential grafts when their use as a graft is more beneficial to the individual [4–6].

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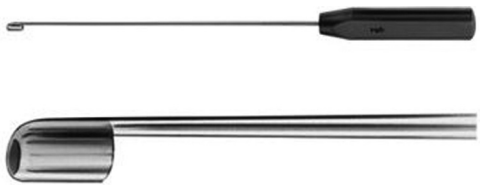

Fig. 1. Tendon stripper.

In this study, a simple, easily accessible, reliable, cheap technique leaving minimal scars is presented for harvesting tendon grafts. For this technique, metal aspirator tips that can be found in most operating rooms were used as a tendon stripper (Fig. 1).

2. Patients and method

2.1. Surgical technique

The tendon region to be harvested is cleaned and prepared according to standard surgical procedures. Local or regional blocks provide adequate anesthesia for this procedure. After making a 1 cm incision on the skin covering the distal portion of the tendon, blind subcutaneous dissection is done until the tendon is reached. The tendon can be incised in full thickness or in partial width transversely depending on graft requirements. Proximally angled cannulas make manipulations easier during the procedure. The tendon's distal end is identified with 2/0 non-absorbable suture; the two suture ends are left long and free. Then, the sutures are passed through the cannula from distal to proximal, taken out on the other side, and slowly pulled so that the tendon enters the cannula without any compression (Fig. 2). A metal aspiration cannula with a diameter 1 or 2 mm wider than the tendon diameter is selected (Fig. 3). The metal end is slowly advanced by slithering it over the tendon. The proximal angled part of the cannula helps to ensure the motion axis is the same as the tendon axis. It also facilitates manipulation when passing through anatomical protrusions, indentations or obstacles. This avoids damage, suppression or strain of adjacent tissues by the cannula. The cannula length can be measured to calculate tendon graft dimensions, or the length can be selected according to the graft dimensions required. In this manner, the tendon length to harvest can be measured easily. After confirming that a sufficient length exists in the aspirator, the cannula is angled towards the skin and its exit point is determined from above the skin.

Fig. 3. The aspirator diameter is slightly larger than the tendon diameter during the tendon harvesting.

A 2-mm-wide skin incision is made exactly above the cannula's tip and the tendon is exposed. The tendon is incised transversely with a #11 scalpel blade and drawn out by pulling from the cannula back end. There is usually no bleeding because blunt dissection is made on the tendon sides and with a cannula around the same width as the tendon. After the tendon graft is removed from inside the cannula, the aspirator is connected to the cannula for verification purposes, and the cannula is slowly withdrawn and removed under reduced pressure. The donor site is bandaged with a compression dressing to further reduce the already low risk of bleeding. There is no need to suture the 2 mm skin slit through which the tendon was incised. The donor site is repaired with a single suture on the distal portion of the 1 cm slit.

Providing the tendon dimensions are greater than the aspiration cannula's length, like in the plantaris tendon, the tendon is not incised after it is spotted through the second slit, but retracted outwards. The suture and the tendon it is attached to are again passed through the metal channel, and the cannula is advanced to the musculotendinous junction (Fig. 4). At this stage, the cannula is angled towards the lateral axis, and the graft is slightly withdrawn

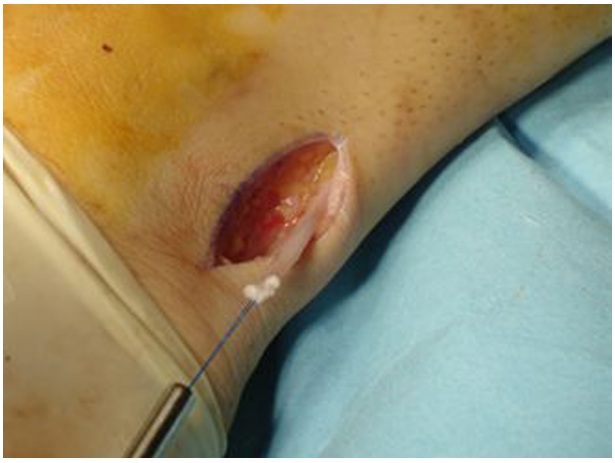

Fig. 2. Identifying the tendon's distal end with a suture.

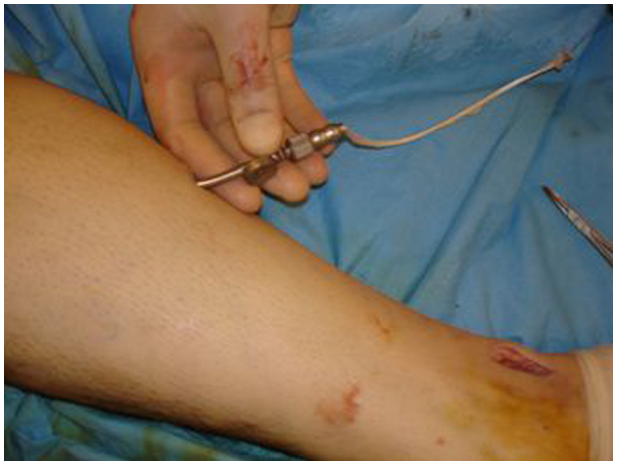

Fig. 4. Length of the graft to be harvested can be extended with a second incision.

from behind the cannula, thus easily separating the tendon from muscle and harvesting a maximum length graft (Fig. 5).

2.2. Patients

When we could not use a tendon stripper at our clinic, a tendon graft of the desired dimensions was harvested using the aspiration cannula. After witnessing how fast and reliable this technique proved to be, it was used to harvest tendon grafts on 11 other patients in need of tendon grafts at different times. It was used on 4 patients with complex hand injuries who had inadequate tendon graft donor sites to harvest plantaris (Pl) tendon grafts, on another 3 patients to harvest palmaris longus (PL) + Pl, on another 3 patients to harvest Pl grafts for the second session of a staged tendon graft repair, and another patient to harvest partial flexor carpi ulnaris (FCU) graft to use in flexor tenoplasty as he did not have any other donor site.

3. Results

In all cases, undamaged grafts were removed with their paratenon (Fig. 6). Bleeding, infection, or adjacent tissue injury was not encountered in any patients in the short term. There were no aesthetic or functional problems in the long term, except one patient (the patient with FCU partial graft) who experienced slight ecchymosis.

4. Discussion

Various techniques are currently being used for harvesting tendon grafts [7,8]. It is ideal to harvest the tendon graft using open surgery or with the help of endoscopy in order to avoid potential injury to the harvested tendon or other complications [4,7,9,10]. However, since open surgery causes an additional surgery scar, graft harvesting is generally done from the injury area; other methods can be used that leave less scar. Endoscopic methods, on the other hand, require additional surgical and technological equipment that are not always available in surgery facilities and are generally quite expensive [9,10]. When open surgery is not optimal and endoscopic support is not available, grafts are harvested by tendon strippers after performing one or multiple skin incisions along the tendon line.

Tendon strippers are devices developed to minimize scar formation during graft harvest. Classical tendon strippers are comprised of a wider tip compared to the handle and a thin shaft as the carrier. When the handle is pushed forward, it protects the tendon in the middle, while pushing other tissue components away to the sides. As the handle moves forward, the remaining anatomical structures immediately fill in the gap behind the device causing increased contact of this remaining tissue with the handle if the device is moved back and forth. Many modifications of tendon strippers have been introduced to reduce complication rates; as a result, graft harvesting has become easier and faster [11,12]. Even though tendon strippers are cheaper and easier to use compared to systems with a camera, they are only readily available in centers where hand and tendon surgery are performed regularly. Although tendon repair does not require complicated surgical kits, a tendon stripper is required at a minimum if a graft needs to be harvested. Otherwise graft harvesting with open surgery might be necessary. If open surgery is not an option for a patient who needs a graft, the patient may need to be to send to a larger surgical center.

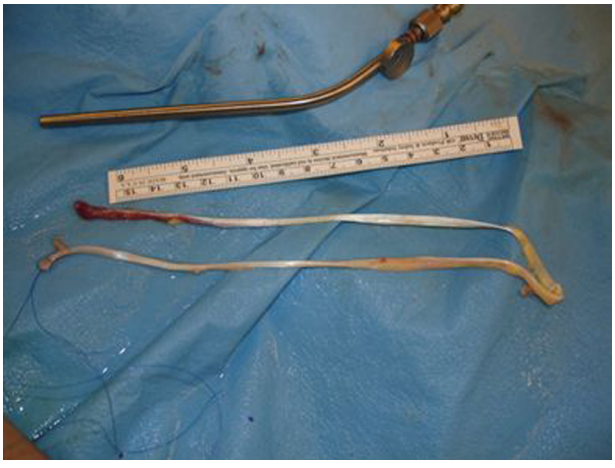

Fig. 5. Full-length plantaris tendon is withdrawn (43 cm).

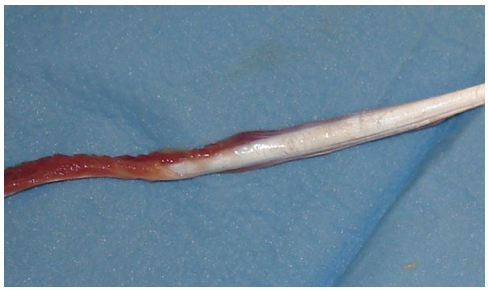

Fig. 6. Tendon graft with undamaged paratenon.

In our study, we introduced a simple technique for harvesting tendon grafts consisting of a metal aspirator tip that is present in most surgical kits. This technique can make tendon graft harvesting easier, even in the most remote healthcare facilities. In this technique, the tendon is placed inside the cannula and the graft can be harvested by slowly moving the cannula forwards along the tendon axis and making two or three small incisions on the skin without the need for advanced surgical equipment. Since the graft fits perfectly inside the cannula, the possibility of angling left or right, kinking or intrusion with neighboring tissue is considerably reduced. Slow movement of the cannula along the tendon axis allows for delicate dissection without damaging the paratenon. The result is an undamaged tendon harvested with its paratenon. Since the cannula has a diameter similar to that of the tendon, it does not push on the adjacent anatomical structures and cause translocation, which in turn reduces the risk of undesired injury. Different cannulas with differing diameters allow wider or thinner grafts to be harvested. However, it is not possible to harvest a graft wider than the cannula's diameter. Luckily, very wide tendon grafts are generally not needed in hand surgery. The plantaris tendon, palmaris longus tendon and finger flexor tendons, which are the most commonly used tendon grafts, can be harvested easily with this technique. When a partial tendon is needed, the tendon with the required diameter can be placed inside the cannula, the cannula can be leaned against the tendon and moved forward to achieve a graft of the desired size. The inclined tip or the aspirator enables the cannula to be guided by the anatomy as opposed to common tendon strippers.

As with all surgical interventions, the risk of complications cannot be ruled out when harvesting a tendon graft [13]. Delicate tissues such as nerves, arteries and muscles adjacent to the tendon harvested as a graft may be injured with surgical instruments or specific equipment such as tendon strippers during the procedure. The ideal way to reduce the risk of such

injuries is to minimally disturb the normal position of surrounding anatomical structures and to avoid damaging tissues that may get wedged in between the instruments. An aspiration cannula, when it is compatible with the diameter of the tendon being harvested, acts as a tendon sheath and prevents intrusion of other tissues between the tendon and the cannula. With the incisive edge of the cannula tip positioned towards the tendon and the relative bluntness of the cannula structure, the injury potential is reduced. In our study of 11 patients, no major complications other than ecchymosis (1 patient) was observed. This can be attributed to the advantages of the method presented. However, our small case series is quite limited for evaluating potential donor site complications.

A metal-capped aspiration cannula can be found in most institutions where surgical procedures are performed. Although many surgical instruments are disposable equipment nowadays, metal aspirator tips are still widely used after sterilization. The main advantages of the presented technique are that cannulas are readily available in different diameters that are compatible with the sizes of most tendon grafts used in hand surgery, are cheap and convenient, and are easy to steer because of their angled structure. It should also be emphasized that this technique does not require consumables and additional systems, the processing time is short, and the scars are too small to be noticed. In conclusion, we believe this technique can be considered as an alternative method for tendon graft harvesting when needed.

Disclosure of interest

The author declares that he has no competing interest.

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