# Outcome of using the spinal accessory nerve for functional muscle innervation in facial paralysis reconstruction: The first two cases in Vietnam and literature review

Bui Mai Anh, Vu Trung Truc

Viet Duc University Hospital

**Corresponding author:**
Bui Mai Anh,
*Viet Duc University Hospital*
40 Trang Thi, Hoan Kiem, Ha Noi
Mobile: +84 904 218 389
Email: drbuimaianh@gmail.com

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## Abstract

Facial nerve injuries with various causes, such as after trauma, tumor dissection, radiotherapy, etc., resulting the patient's functional, aesthetic, and psychological sequelae. For many decades, plastic surgeons have introduced numerous different nerve sources to overcome the above sequelae, such as contralateral facial nerve, the hypoglosal nerve, the masseter nerve, and the spinal accessory nerve (CN XI). There were various advantages and disadvantages of donor nerves sources. However, the use of ipsilateral donor nerve is said to have many benefits. In this report, we would like to present preliminary results of using the CN XI source in treatment of subacute and chronic VII nerve injury. These were the first two cases of successful surgery using this nerve source in Vietnam.

*Keywords:* Facial nerve injury, facial paralysis, nerve transfer, spinal accessory nerve.

## Introduction

The function of facial muscles is essential in communication, expressed through spoken language or facial expressions, so facial nerve injury can lead to loss of live interaction with the active social environment (1). Surgery for the reinnervation of the facial nerve has always been a challenge for surgeons. The selection of the donor nerve and the appropriate method are significant for successfully restoring facial nerve. For decades, plastic surgeons have proposed many different nerve sources to overcome the above sequelae, such as the contralateral facial nerve, hypoglossal nerve, masseteric nerve, and spinal accessory nerve. The donor nerve sources have different advantages and disadvantages; however, using ipsilateral neural sources has many advantages. The spinal accessory nerve is one of the cranial nerves (CN), a mixed nerve containing sensory and motor nerve fibers. The motor part governs the sternocleidomastoid and trapezius muscles; the sensory part governs the skin of the neck (2). Using the CN XI in treating facial paralysis has also been mentioned in the literature since 1879 by DroNBik, but the author only used a bundle of fibers. In 1978, Hirsh reported a series of clinical cases of an end-to-end anastomose CN XI with the main facial trunk with encouraging results (3). However, in the literature, surgeons have used this nerve source less in treating facial paralysis; the CN XI source is mainly used in treating brachial plexus lesions. In 2013, Chuang et al. reported using the CN XI as a nerve source in treating facial palsy with 90% good results and no deficit of nerve donor function (4). There have been reports of using the CN XI for facial paralysis with different uses (5). This report will present the preliminary results of

using CN XI to treat immediate and chronic CN VII injuries. These are the first two successful cases in Vietnam using this nerve source.

## Patients and methods

A case study without control group conducted on 02 patients with facial nerve injury, graded 5 and 6 degree according to the House-Brackmann Facial Nerve Grading System (H.B 2.0 grading system).

***Surgical method:***

Blair incision modification: extending anteriorly to the ear then inferiorly to the lateral neck

Dissect to the anterior border of sternocleidomastoid muscle.

Identify CN XI which is inferior to sternocleidomastoid muscle. Then, select the distal nerve entering sternocleidomastoid muscle, and preserve the branch entering the trapezius.

Cut the distal end of the branch entering the sternocleidomastoid muscle to prepare the donating nerve.

*Intermediate duration stage of facial nerve injury (3 weeks - 24 months):*

Dissect to find the main trunk of CN VII, then cutting at its proximal stump.

Anastomose end-to-end between CN VII and CN XI via nylon microsurture size 10/0.

*Chronic stage of facial nerve injury (more than 24 months):*

Harvest the gracilis muscle flap and prepare the obturator nerve

Transfer the gracilis muscle flap to the face

Anastomose end-to-end between CN XI and obturator nerve via nylon microsurture size 10/0.

Vascular anastomose gracilis muscle pedicle to the facial artery and vein via nylon microsurture size 9/0, 10/0.

*Hospitalized patients follow up:*

Hospitalized patients follow up:

For patients with nerve transfer stay in the hospital for 4 days.

For patients with gracilis muscle transfer stay in the hospital for 7 to 10 days.

Evaluation of outcomes based on: bleeding, infection, and survival flap and Chuang's smile excursion score.

Table 1. Chuang's Smile Excursion Score (6)

| Score | Visible teeth |
|---|---|
| 0 | None of minimal central incisor |
| 1 | Full or near-full central incisor |
| 2 | Full central incisor and part off lateral incisor |
| 3 | Full central incisor, lateral incisor and canine |
| 4 | Full central incisor, lateral incisor, canine and premolar or more |

## Clinical case

**The first case study:**

A 32-year-old female patient, with complete facial nerve and trigeminal nerve's motor branches injury on the right side, after removal of acoustic neuroma. Surgery occurred 8 month after facial nerve injury. The diagnosis was intermediate duration stage of facial nerve injury , graded 6 following H.B 2.0 grading system; scored 0 following Chuang's score. (Figure 1)

The patient underwent ipsilateral CN XI transfer for the main trunk of the CN VII with an end-to-end anastomosis. The patient had an onset of facial muscle movement after four months of surgery, good movement after six months, and a spontaneous smile with closed eyes after one year. The patient scored five, according to Chuang's score after surgery. The patient's shoulder function was normal.

**The second case study:**

A 28-year-old female patient, after removal of acoustic neuroma, had facial nerve injury. The patient underwent transfer procedure between masseter nerve and nerve VII buccal branches by another surgeon. However, the patient did not marked any recovery after 2 years, and only achieved grade V following H.B 2.0 grading system and score 1 following Chuang's score. Due to the previous operation, the patient underwent singer-stage procedure using the gracilis muscle and ipsilateral XI nerve. After 3 months, there was the first gracilis muscle movement. After 1 year, the patient achieved score 4 according to Chuang's score and had a spontaneous smile. (Figure 2)


Figure 1. A, B, C: Patient before surgery. D: Picture of the end-to-end anastomose between CN XI and the main trunk of CN VII. E, F, G: Result one year postoperative: scored 4 according to Chuang's Smile Excursion Score

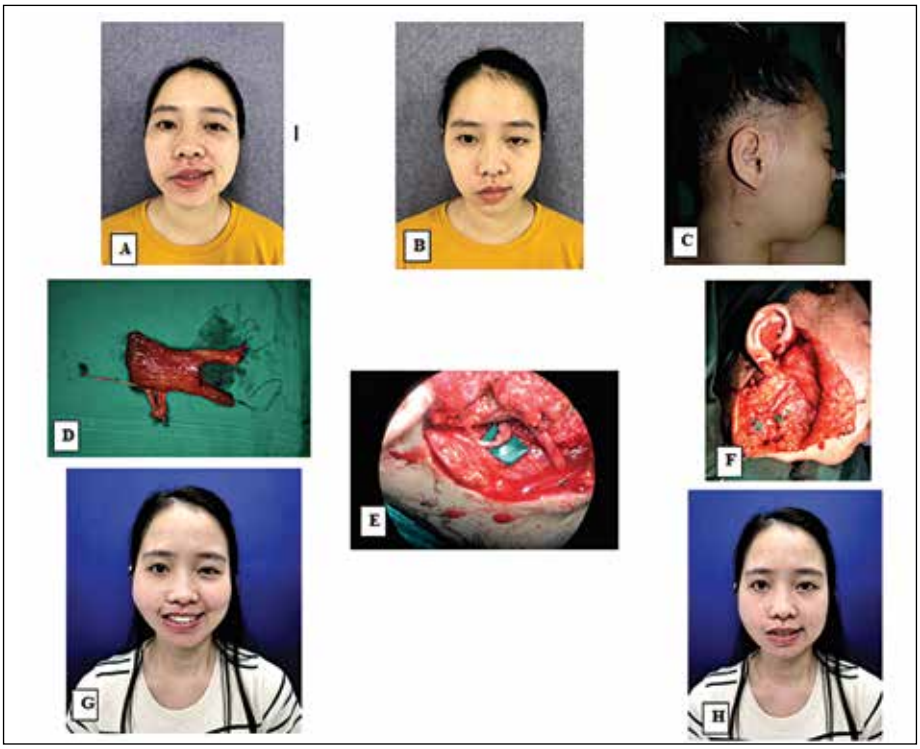


Figure 2. A, B: The patient still has facial paralysis after the first CN VII- masseter nerve transfer surgery. C: Old incision image of the first surgery. D: U-shaped the gracilis muscle. E,F: CN XI-obturator nerve anastomosis, gracilis vascular anastomosis. G,H: Patient achieved score 4 according to Chuang's score after 1 year

## Discussion

The accessory spinal nerve is commonly chosen for brachial plexus reconstruction (2). Terzis et al applied nerve graft to anastomose CN XI and obturator nerve for increasing the length in patients with M#bius syndrome (6). However, the CN XI for facial reconstruction has never been a popular option because of its difficulty in dissection, possible use in nerve graft, and donor sequelae (7). In many cases, the ipsilateral masseter nerve, which is the strongest motor branch of the V nerve, is one of the first choice (8-10). However, the masseter nerve of 02 cases in the report was injury. On the other hand, several studies about peripheral nerve rehabilitation have suggested that using ipsilateral nerve sources will rehabilitation better and faster because of shorter conduction path. Therefore, the utilization of the ipsilateral CN XI is a good choice in these cases. With the first clinical case study, ipsilateral CN XI anastomoses directly to the main trunk of VII nerve. Thus, the patient's oral and eye movements recovered quite well, and become spontaneous over time. The second patient who require functional muscle flap, also needed one-stage procedure compared with cross-face nerve graft. The recovery time after surgery of facial muscle movement and functional gracilis muscle in 02 cases using CN XI was quite fast (3-4 months). This result is similar to other authors when Chuang used the CN XI in microsurgical gracilis transfer in 36 cases with an average time of 4 months (4). This result is based on a comparative study showing that CN XI had the same recovery time as using masseter nerve, having a very high number of axons, and much faster than the contralateral VII nerve (6). In a study on the axons' number of XI nerve, the number was 1400 compared to 1000 of the main trunk of nerve VII (2), which is one of the reasons for the fast recovery time of CN XI. Especially, in a study of patient satisfaction with neurological outcomes, CN XI ranked second after contralateral nerve VII (11).

The reason surgeons are afraid to use the CN XI as the first donor nerve in the treatment of facial paralysis is the sequelae due to the shoulder's function when the trapezius' motor branches are injured, or it has crossed the connection (3) (12). However, selecting only the motor branch of the sternocleidomastoid muscle solves this problem. The results of the recent report (2, 6) show sequelae where it is thought to be lowest. Although there were only 02 patients in the report, we did not find any donor sequelae, and the patient had good shoulder movement after surgery.

There are always five recovery stages in any nerve transfer procedure, including autograft and allograft. Two patients observed stepwise recovery, and the time of rehabilitation was fast. The results show that the spontaneous smile of 02 patients after one year is also very similar to the results of other authors (4-6).

## Conclusion

Donor nerves such as the contralateral VII nerve, the masseter nerve are good choices for facial repair. However, the efficacy of using the ipsilateral CN XI to restore facial motor movement without any appropriate donor nerve has been proven to be a good alternative for facial reanimation.

**Conflict of interest:** The authors declare that they have no conflict of interest.

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