

CONTOUR RECONSTRUCTION OF FACIAL DEFECT WITH SPLIT STERNOCLEIDOMASTOID MUSCULAR FLAP FOLLOWING PAROTIDECTOMY

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Various muscular flaps are used in oral and maxillofacial reconstructive surgery for the defects caused by tumor resection and trauma or for the correction of head and neck deformities. The sternocleidomastoid(SCM) muscle may be widely used as a muscular or myocutaneous flap in these lesion. The authors used SCM muscular flap for the expected parotid defect following benign tumor related conservative parotidectomy in three cases. We expected that prevention of post-operative facial deformity, reduction of dead-space and protection of denuded facial nerve etc. is lead by SCM muscular flap. But the total SCM flap can lead to some complications such as "flat neck deformity", limitation of neck movement and overcontouring of parotid defect. Therefore, the authors used split pedicled SCM muscular flap and it lead good favorable results of post-operative functional and esthetic problems.

I. INTRODUCTION

Various muscular flaps are used in maxillofacial reconstructive surgery for the defects caused by tumor resection and trauma or for the correction of head and neck deformities. The sternocleidomastoid muscle is widely used as a safe and useful muscular and myocutaneous flap for the primary or secondary facial reconstruction.

The sternocleidomastoid muscle can be used to prevent postoperative facial deformity of parotid area following parotidectomy and to prevent resected defect from possible infection at the dead space and to protect the superficially exposed facial nerve. The complications such as overcontouring of parotid area, head and neck deformity and restriction in neck movement can be arised following whole sternocleidomastoid muscular flap operation. To supplement these advantages and to minimize disadvantages, modified split pedicled partial sternocleidomastoid muscular flap can be used and the authors have achieved satisfactory results.

II. CASES

Three patients who have visited our department with

the clinical diagnosis of parotid gland tumor during the period from Nov. 1989 to June 1990, had received conservative parotidectomy and immediate reconstruction of the parotid defects using the pedicled partial split sternocleidomastoid muscular flap. A incision was made preauricular and submandibular area utilizing one of the skin creases(Fig 1). The superficial lobe of parotid gland anterior and inferior to the ear was exposed by sharp dissection under the subcutaneous tissue until the anterior edge of the gland was approached. The tympanomastoid fissure and triangular process(pointer) of external auditory cartilage are excellent guides for directly finding the trunk of facial nerve anterior to the stylomastoid foramen. The facial nerve always lies 6~8mm medial to the end of the tympanomastoid fissure. The search for the trunk of the facial nerve and its branch was done with an electric nerve stimulator. The individual segment of the parotid gland can be removed without damage of the facial nerve during searching for the branches(superficial lobectomy) (Fig 2). In 1st and 3rd case, the tumor was located in the deep lobe, so we performed complete excision of the deep pole of parotid gland after

facial nerve isolation(deep parotidectomy). And then for cosmetic reasons, deep operative defect on the parotid area created following parotidectomy, was filled out by a split partial sternocleidomastoid muscular flap. The flap is fanned out over both main branches of the facial nerve and fixed in place with vicryl suture materials(Fig 3). After muscular flap transposition, fibrin adhesive was applied on the operation field for supportive care of



Fig. 1. Preoperative drawing of the anatomic landmarks (facial nerve, sternocleidomastoid muscular flap) and incision line(Case 3).



Fig. 2. The picture shows the facial nerve after superficial parotidectomy.



Fig. 3. The split pedicled partial sternocleidomastoid muscular flap transposition.



Fig. 4. The patient has the movable mass on the parotid area(Case 1).

wound closure and healing process. One of the patients has the lesion on the right side and the other 2 had it on the left. We performed preoperatively salivary gland scan and ultrasonography of all cases and sialograms in two cases. The scans were reported normal function of the parotid gland and sialograms show typical "Ball in Hand" appearance(Fig 5, 8, 10). All three cases were clinically diagnosed as pleomorphic adenoma based on their clinical features but postoperatively pathologic diagnoses were reported that 2 cases of three are pleomorphic adenoma and the other case is neurofibroma(Table 1, 2). In the case of neurofibroma, considering a transient loss of taste sensation postoperatively for about 2 months, the tumor was suspected to have been related to the innervation of auriculotemporal nerve. In the postoperative evaluation, all three cases were free from clinical signs and symptoms of facial nerve or accessory nerve damage, and no Frey's syndrome and no restriction of neck movements were observed and notwithstanding satisfactory facial contour could be achieved(Table 3, Fig 4, 6, 7, 9, 11).

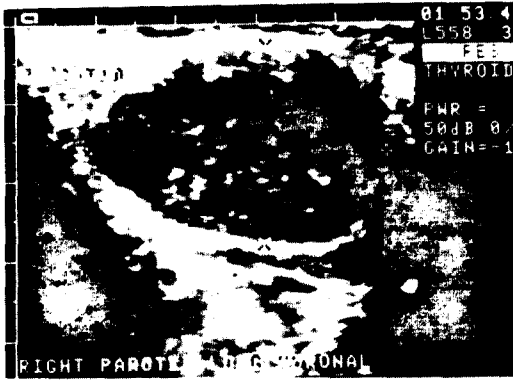


Fig. 5. Preoperative diagnostic ultrasonogram. It shows the 3.5×2.5cm size mass(Case 1).

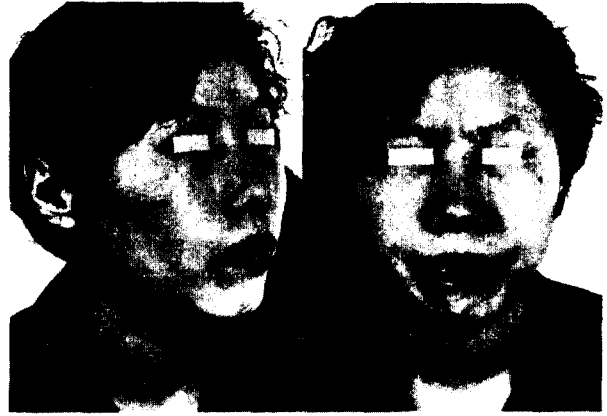


Fig. 6. Postoperative view shows the normal neck line and normal parotid contour, 3 months after operation (Case 1).

Fig. 7. Postoperative activity of facial expression movement is good and symmetric, 3 months after operation (Case 1).

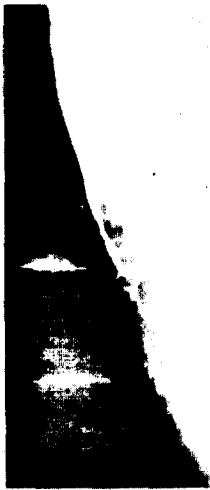


Fig. 8. Preoperative sialogram shows the 'Ball in Hand' appearance and reduced parotid ductalization(Case 2).



Fig. 9-A. Postoperative clinical view, it shows normal neck line and normal contour of parotid area, 3 months postoperatively(Case 2).



Fig. 9-B. Postoperative facial expression is good and symmetric, 3 months postoperatively(Case 2).

Table 1. Diagnoses of Cases

Case No.	Age	Sex	Clinical Dx	Post -Op Bx Report
1	24	F	Pleomorphic adenoma	Pleomorphic adenoma
2	19	M	Pleomorphic adenoma	Pleomorphic adenoma
3	32	M	Pleomorphic adenoma	Neurofibroma

Table 2. Operative Finding

Case No.	Location of Tumor	Operation	Size of Tumor	Shape of Tumor
1	Rt. Lower part of deep L	Deep P, ETL	3.5×3×2cm	Oval
2	Lt. Mid-lower portion of superficial L	Superficial P	1.5×2×1.5cm	Oval
3	Lt. Mid-anterior portion of deep L	Deep P, ETL	2×3×2cm	Multinodular

* L=Lobe, P=Parotidectomy, ETL=Except the temporal portion of supeficial lobe

Table 3. Postoperative Evaluation

Case No.	Facial Contour	Facial Expression	Shoulder & Neck Movement	Sign & Symptom of Frey's Syndrome	Other Complication
1	Excellent	Good & Symmetry	W.N.L.	Negative	No
2	Excellent	Good & Symmetry	W.N.L.	Negative	No
3	Good	Good & Symmetry	W.N.L.	Negative	Transient Taste loss

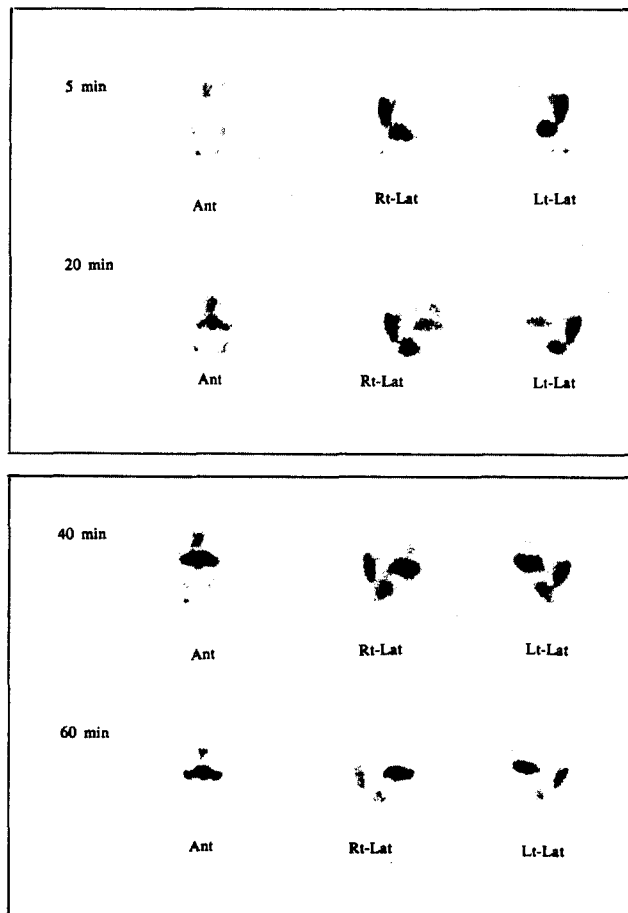


Fig. 10. Preoperative salivary gland scan show the normal function of the major salivary glands(Case 3).



Fig. 11-A. Postoperative clinical view shows normal neck line and normal contour of parotid area at the time of 3 months postoperatively(Case 3).



Fig. 11-B. Postoperative facial expression is good and symmetric(Case 3).

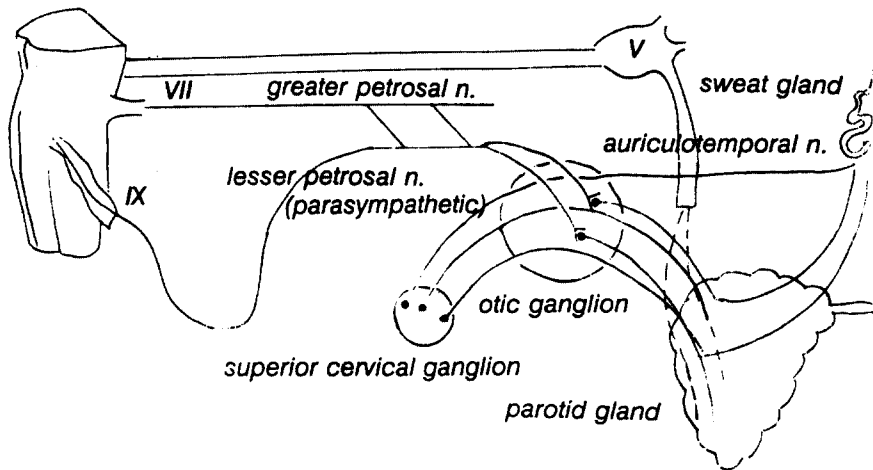


Fig. 12. Pathophysiology of Frey's syndrome.

Abnormal anastomotic regeneration of postganglionic parasympathetic fiber from the otic ganglion with sympathetic fibers from the superior cervical ganglion contained the auriculotemporal nerve may innervate the sweat glands after parotidectomy. Gustatory stimuli can then produce flushing and increased sweating of the overlying skin.

(cited from Rankow, R.M., Polayes, I.M. : Diseases of the Salivary Glands, W.B. Saunders Company, 281, 1980)

III. DISCUSSION

Since the first use of myocutaneous flap for the head and neck reconstruction by Tanis¹⁾ in 1896, myocuta-

neous flap and muscular flap from various muscles have been used for facial reconstruction with Owens²⁾ first trial of sternocleidomastoid muscular flap in 1955, and with Aryan's³⁾ study of the vascular anatomy of sternoc-

leidomastoid muscle which was published as 'vascular territory' in 1979. In 1978 Siemssen⁴⁾ split the sternal head and the clavicular head of the sternocleidomastoid muscle for facial reconstruction to prevent shoulder and neck deformities and to preserve sternocleidomastoid muscle during the sternocleidomastoid muscular flap procedure. In 1985 Marx R.E. et al⁵⁾ have presented the indications of muscular flap and myocutaneous flap with case report of 16 sternocleidomastoid muscular flap and myocutaneous flap as followings.

* Muscular flap indication

- 1) The obliteration of dead space about bone graft.
- 2) The enclosure of bone graft in vascularized muscle sheath when the recipient tissue is otherwise poorly vascularized.
- 3) The provision of soft tissue contour to the angle region of the mandible.
- 4) The provision of a thickness of soft tissue for the placement of a bone graft.

* Myocutaneous flap indication

- 1) The provision of an epithelial lining for mucosal defects.
- 2) The creation of a cover flap with epithelium in the closure of orocutaneous fistulas.
- 3) The provision of additional tissue in the neck to assist in closure after placement of bone grafts.
- 4) The release of certain scar contractures in the sub-mandibular and parasymphysis regions.

The sternocleidomastoid muscle has its origin at the mastoid process of temporal bone and its insertion at the clavicular bone and sternum and rotates the chin to the contralateral side during neck rotation by its muscular contraction. Its superior portion is innervated by spinal accessory nerve and supplied by occipital artery, its inferior portion supplied by thyrocervical trunk (transverse cervical artery) and its middle portion supplied by superior thyroid, inferior thyroid, carotid a., and small branches, and so classified as type II by classification of Mathe and Nahai.^{6,7,8)}

Lason D. and Helmuth⁹⁾ experienced 12 cases of sternocleidomastoid muscular and myocutaneous flap and published various clinical limitations of sternocleidomastoid muscular flap. According to them the arc of rotation is limited by the innervation of spinal accessory nerve and by the base of the flap that becomes bulky in the cases of patients with short neck or obesity. Thus extreme asymmetry of the shoulder and neck area is seen postoperatively and this needs revision later which will cause the high risk of damaging spinal accessory nerve. Following intraoral reconstruction it is reported that 50% showed skin loss which led to the expected secondary healing. The effectiveness is decreased for safe oncologic treatment because there is a high risk of damage to the occipital artery during functional neck dissection. Herman also pointed out the fact that the donor site defect and problems arising in the protection of the vital structure are also disadvantages of the sternocleidomastoid muscular flap.^{10,11,12)}

The osteocutaneous flap of the clavicle used by Siemssen⁴⁾ was the first clinical application of split pedicled sternocleidomastoid muscular flap and thank to its independent blood supply to the sternal head and the clavicular head Alvares¹³⁾ was able to report excellent results follows its use with an aim to prevent postoperative shoulder and neck deformity and to preserve normal shoulder and neck movement. In these cases, we made the partial muscular flap using sternal part muscle. When making the flap, it is important to avoid damage of superior occipital artery and muscular branch of spinal accessory nerve. If the spinal accessory nerve is to be damaged, it leads not only discrepancies of trapezius muscle function but also denervation atrophy of the sternocleidomastoid muscle. The spinal accessory nerve is inserted deep portion of the sternocleidomastoid muscle at the level of carotid bifurcation and it innervates the sternocleidomastoid muscle by its small muscular branch and the main trunk runs to the posterior triangle of the neck and innervates the trapezius muscle. To avoid the complication of flap necrosis, the muscular flap should be designed sufficient length, width and transpositioned without tension to the parotid defect area (Fig 3).^{14,15)}

The salivation impulse of parotid gland starts from the inferior salivarius nucleus of pons and synapses at the otic ganglion to from the parasympathetic pathway which lead to the auriculotemporal nerve. Taste sensation start from the tongue, passing through the geniculated ganglion and relays to the pathway which leads to pons and cerebellum but occasionally to an accessory pathway which passes through the otic ganglion may also be found. In the case of neurofibroma(case 3), considering a transient loss of taste postoperatively, the tumor was suspected to have been related to the innervation of auriculotemporal nerve. The auriculotemporal nerve which participate in salivation initiates at the nucleus inferior salivarius and passed by otic ganglion to control the salivation of parotid gland. In general the auriculotemporal nerve does not pass through the otic ganglion but occasionally it is found to be so(accessory pathway). Considering the fact that during the operation the tumor did not seem to be related with the facial nerve and there being a transient loss of taste postoperatively, the neurofibroma is thought to have originated from the auriculotemporal nerve.^{16, 17)}

The use of sternocleidomastoid muscular flap to prevent the Frey's syndrome caused by parotidectomy has been reported by Jost, Legent and Baupelot in 1968.¹⁸⁾ The sweating of flushing syndrome in the preauricular or submandibular area by the stimulation of the taste sensation after parotidectomy has been reported by many scholars in the middle of the 18th century and this has been known as the auriculotemporal syndrome or Frey's syndrome. This is assumed to occur due to localized facial vaso-pseudomotor reflex formed by the misdirected regeneration of the parasympathetic salivary gland nerve to the sympathetic nerve of skin giving rise to a new reflex arc(Fig 12). Predicting that auriculotemporal nerve will regenerate to the skin to produce Frey's syndrome after parotidectomy is evaluated by the signs and symptoms of facial warming, flushing and sweating during eating, smoking and intake of cholinergic drugs or by the minor-starch-iodine test developed by Lassge-Hellaman the result of which is estimated as mild, moderate or severe, and so the idea of transpositioning

of the split pedicled sternocleidomastoid muscular flap was brought up to prevent nerve regeneration into skin. But according to the comparative study by Kornblunt et al.¹⁹⁾, there seemed to be no relation between sternocleidomastoid muscular flap and Frey's syndrome when comparing between 35 cases transpositioned sternocleidomastoid muscular flap and 35 cases non-transpositioned carried out after parotidectomy. It is controversial.^{18, 19, 20)}

IV. SUMMARY

The sternocleidomastoid muscle may be used as a muscular or myocutaneous flap in the oral and maxillofacial reconstruction. The sternocleidomastoid muscular flap is also used in the expected parotid defect following trauma or tumor related conservative parotidectomy for prevention of post operative facial deformity, reduction of dead space and protection of denuded facial nerve, etc. The transposition of both head of the sternocleidomastoid muscle for the reconstruction of the maxillofacial region leaves a "flat neck deformity" and limitation of neck movement. Therefore, author used split pedicled partial sternocleidomastoid muscular flap for the contour reconstruction of parotid defect after conservative parotidectomy. And then, it leads good post operative facial contour, prevention of neck deformity, post operative normal neck movement and prevention of Frey's syndrome, etc. There were favorable results in all three cases and authors report these cases with the review of literature.

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이하선 적출술 후 흉쇄유돌근을 이용한 안모결손부의 외형재건

서울대학교 치과대학 구강 악안면 외과학교실
김명진 · 김택경 · 유준영

외상이나 종양의 적출 등으로 인하여 악안면부에 발생된 결손이나 안면 경부 기형의 교정을 위하여 여러 근피판을 이용하여 악안면부 재건술이 시행되어지고 있다. 흉쇄유돌근은 안면부의 일차적 혹은 이차적 재건에 안전하고 유용한 근피판 또는 근피부피판으로 널리 사용되고 있다.

이하선부에 발생된 종양의 적출술 후 나타날 수 있는 이하선부의 안모 변형 방지를 위하여 흉쇄유돌근 근피판을 이용하여 안모 재건이나 술후 가상형성으로 발생 가능한 적출부의 감염, 반흔조직 형성과 술후 천창으로 노출되는 안면신경을 보호하는데 사용할 수 있다. 전 흉쇄유돌근 근피판이나 다른 경부 근피판 사용시 이하선부의 과잉돌출, 안면경부 기형 및 경부운동 제한 등의 부작용이 발생될 수 있다. 이러한 단점을 보완하고자 저자들은 부분 흉쇄유돌근 근피판을 형성하여 기능적 이하선 적출술 후 노근피판 전위를 통하여 이하선부 연조직 결손으로 인한 안모 변형이나 사강형성 예방 등을 만족할 만한 결과를 얻었기에 문헌고찰과 함께 보고하고자 한다.