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Lateral Cervical Flap a Good Access for Radical Neck Dissection

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1. Introduction

An important and vital area of the head & neck entail the coverage of defects throughout the head and neck area. These defects usually covered by flaps, during the last 6 decades since the introduction of tube pedicle flap till the early sixty of the last century (Macgregor 1960) advocated his temporal fascial flap for coverage of intra oral defect after radical cancer surgery, this flap was a great advancement of radical surgery in the oro facial region. Advocation of flaps represent an artistic and fully acceptable of the nose, cheek, tongue, floor of the mouth, chin and neck.1,2,3

We know that blood supply was important for survival of flaps and we have to pay attention to the distinct arterial and venous supply of any flap. Axial flaps such as musculocutaneous flaps, fascio cutaneous flaps and micro vascular free flaps were introduced in the decades of 1970, these flaps were rapidly used to greater number with clinical application in head and neck area and the concept of <delay> of flaps has been a banded and no more accepted as a method for reconstruction of the oro facial region.

Flaps in general can be designed to be of an adequate dimensions and knowledge of its vascular supply and to be assured of a consistut satisfactory and acceptable result. Many flaps been advocated that differ not only in their design, type of flaps based on the blood supply is concerned. A number of soft tissue flaps have been used to reconstruct the oro facial region after ablative surgery, also random flaps been used successfully such as delto pectoral and cervico pectoral flaps but with limitation on use of these flaps in old people due to atherosclerosis. The aim is to repair the defect created by resection of tumor or a defect of post traumatic missile injuries of the face to restore function and provide an acceptable cosmetic feature. 3, 4,6,8,9

2. Indication of Lateral Cervical Flap

1. Design of the flap and its elevation superiorly making a good access to resection of the mandible, supra omohyoid neck dissection, modified radical neck dissection and classical radical neck dissection, since other techniques forming a band of scar extended along the neck at the site of radical neck dissection

2. It's an excellent flap for reconstruction of the tongue, floor of the mouth, alveolus and cheek after radical cancer surgery of oro facial region
3. It is a superior flap for reconstruction of the chin and sub mental area in cases with post traumatic missile injuries of the lower third of the face.
4. Platysma muscle flap is an excellent flap for reconstruction of atrophied masseter muscle in cases of mild first arch dysplasia syndrome and also used to invest the chondro-osseous graft for reconstruction of the TMJ and condyle

3. Anatomy of the flap

The lateral cervical flap (LCV) comprises skin, fascia and platysma muscle. Success in utilizing the LCV depends on thorough understanding on its anatomy and vascular supply. The clavicle forms the lower boundary of the lateral neck, the mandible, the superior border along with the mastoid process of the temporal bone and superior nuchal line of the occipital bone. It extends posterior to the anterior border of trapezius muscle and is divided obliquely by the sternocleidomastoid muscle into the anterior and posterior triangles of the neck.

The major structures of the neck are surrounded by the investing layer of deep fascia which encloses the sternocleidomastoid and trapezius muscles forms the roof of posterior triangle. The deep investing fascia is pierced by the cutaneous branches of the cervical plexus, the external jugular vein and small cutaneous arteries. The superficial cervical fascia is not a separate layer but a zone of loose connective tissue between the dermis and deep fascia and is continuous with both. This fascia covers the platysma muscle and contains a considerable amount of fat tissue. In many places the deep part of the superficial fascia contains muscle fibers. These muscle fibers are striated and are similar to the muscles of facial expression. Immediately below and deep to the superficial fascia is a layer of deep fascia.

The platysma muscle represent the lower part of expression muscles; it originates from the deep fascia that covers the upper part of pectoralis major and deltoid muscles it passes upward into the neck as thin muscular layer or sheet embedded in the deepest layer of superficial fascia and reaches to the lower border of the mandible. The posterior fibers enter the face and blend with the muscles of the lower lip and lip commissure. In this region the inferior labial artery and terminal branches to the cheek supply the muscle fibers of platysma. Below the chin the anterior fibers interlace and blend with the muscle fibers of the opposite side. The motor nerve is the cervical branches of facial nerve and the sensory supply comes from the cutaneous nerves of the overlying skin.

Superiorly the LCV is supplied by the superficial branches of occipital and posterior auricular arteries. The major arterial supply of the platysma muscles comes from sub mental artery a branch from facial or faciolingual arteries. Additional blood supply comes to platysma muscle from inferior labial artery and from other terminal branches of external carotid arteries. The venous drainage of this area via the external jugular vein laterally and via anterior jugular vein medially.

The occipital artery originates from the posterior aspect of the external carotid artery deep to the lower border of the posterior belly of digastric muscle and runs to the occipital groove of the temporal bone. In most cases it pierces the fascia between the attachment of sternocleidomastoid and trapezius muscles or passes through muscle fibers of sternocleidomastoid muscle to sub cutaneous tissue in its terminal superficial branches. It

supplies the muscles of the neck and back of the head and the arteries of scalp anastomose freely with each other and with the opposite side.

Posterior auricular artery is a small branch of the external carotid artery, arises at the level of superior margin of the digastrics muscle or sharing a common trunk with the occipital artery. It ascend between the auricular cartilage and the mastoid process and divide into auricular and occipital branches and both arteries anastomose freely.^{1,2}

4. Operative technique and design of flap

The LCV which includes skin, fascia and muscle can safely be elevated as superiorly based flap with rich blood supply coming from superficial branch of occipital arteries, the posterior auricular artery and sub mental branch of facial artery. Damage to the sub mental branch during elevation of the flap has little effect on viability of the flap.

Two parallel vertical incisions are made one start just below the mastoid region and the other begins below the lower border of the mandible and 2cm anterior to the masseter muscle, both vertical incisions extend down to the clavicle, the free part of the flap which include skin, fascia and muscle is elevated and passed through a tunnel under the angle of the mandible into the mouth. The flap can be used for reconstruction of the tongue after hemiglossotomy or alveolus after radical resection of the mandible or reconstruction the floor of the mouth or reconstruction of the cheek after radical cancer surgery of the cheek. The flap can be used for reconstruction of sub mental region and chin following post traumatic missile injuries of the orofacial region there is no need for tunnel to be used.^{1,2} Fig 1

5. Experimental studies

Experimental studies done by the author in 8 growing rabbits 3 months of age and approximately of 1.6Kg body weight. They were divided into 2 groups; 4 each group and these further subdivided into 2 left and 2 right sided. Each group of 4 subjected to different operation. The first group had hemiglossotomy done on 2 animals each side and in the second group of 4, a piece of skin excised from sub mental area of about 6cm diameter excised on 2 sides of the animals. Surgical procedures via full thickness LCF incisions on each side of the rabbit neck were done. Flap was immediately transferred for reconstruction of the tongue on 4 rabbits, 2 each side and also the flap was used for reconstruction of sub mental area immediately after creation of defect in the second group of 4 rabbits 2 left and 2 right.¹

This procedure was done under ketamine hydrochloride sedation (Vitalar) 50mg/kg of body weight with infiltration of the tongue and sub mental area by local anesthesia (Lignocaine hydrochloride 2% with adrenaline 1/80000). All animals returned to their cages and were allowed to take their normal usual diet.

The result of this experiment, all animals showed no restriction of mouth opening nor difficulties in mastication and by the end of experiment after 3 months, all animals showed good health and the tongue examined after reconstruction by LCF showed excellent healing with smooth tongue due to desquamation of the skin flap to meet the requirement of functional demand of the masticatory process for the hard food of the rabbits with no evidence of hair growing in the tongue after reconstruction of the defect by LCF. While in the second group the LCV were used for reconstruction of sub mental area the LCF showed growing hair in the area that been reconstructed by LCF. This study proved high viability of LCF. Fig 2

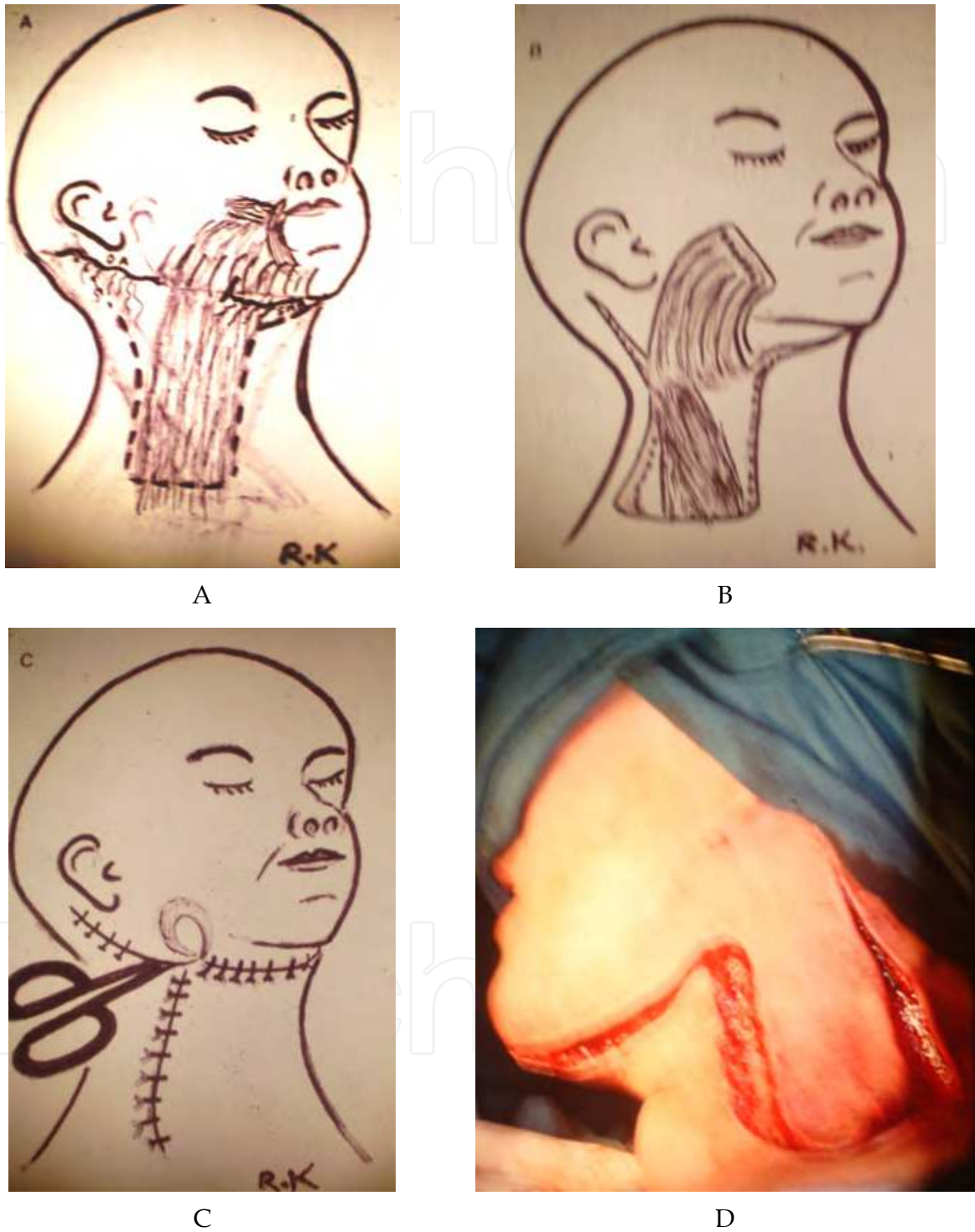


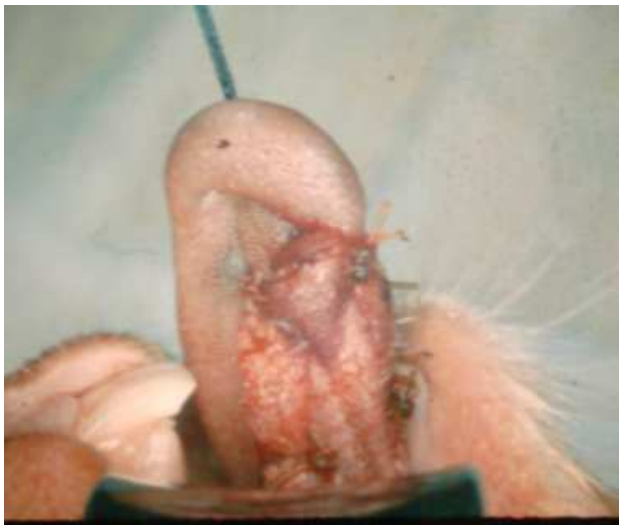
Fig. 1. Diagrams showing, A-Design of lateral cervical flap, B-Elevation of LCF, C-Insertion of LCF, D-Incision of LCF



A



B



C



D

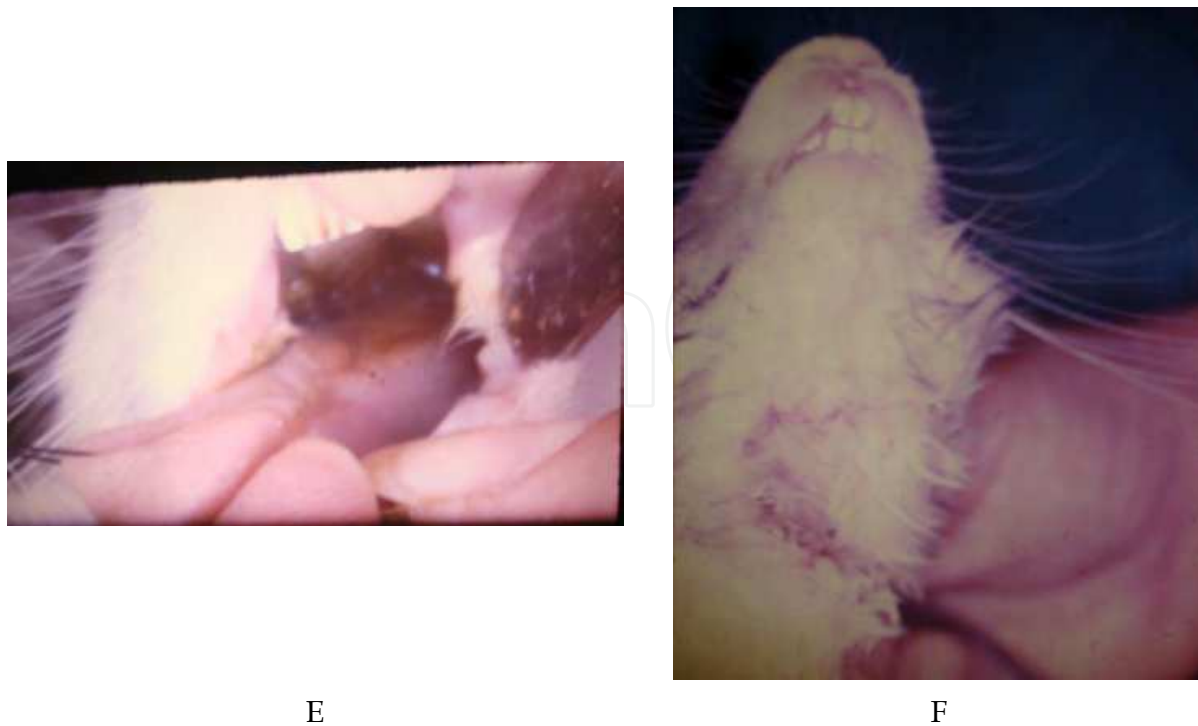


Fig. 2. Experimental studies. A-Design of incision of LCF in rabbit, B-Elevation of LCF in the neck of rabbit, C-LCF used for reconstruction of the tongue rabbit after hemiglossactomy, D-LCF used for reconstruction of sub mental region in a rabbit, E-Post operative after 3 months showing excellent healing of the tongue of a rabbit with desquamations of the flap, F-Post operative photograph showing good healing of the flap in sub mental area with growing hair in the reconstructed area

6. Clinical result

This study including 75 patients and these patients were follow-up for 3-6 years, 37 were males and 38 females with a median age of 46 years (range 3-81 years). They were treated in the Maxillofacial unite, Hospital of Specialized Surgery, Medical City, Baghdad during a period of 6 years, sixty-one patients with oral squamous cell carcinoma including 25 cases with well differentiated squamous cell carcinoma, 24 cases with moderately differentiated squamous cell carcinoma and 12 cases of poorly differentiated squamous cell carcinoma. These cases were studied for the proliferative activity of squamous cell carcinoma by AgNOR staining and electron microscopy, also in 24 patients with oral carcinoma an expression of Bcl2 proto-oncogene in tumor tissue and the oral mucosa of the same patients were used as control. In 23 cases of oral carcinoma, the LCF was used an excess for supraomohyoid neck dissection and 10 cases of posttraumatic missile injuries of orofacial region and 4 cases platysma muscle flap were used for reconstruction of atrophied masseter muscle.

7. Study of proliferative activity of oral carcinoma

Study of the proliferative activity of squamous cell carcinoma by using an electron microscope (EM) which is an important tool used in cancer research and ultra structural pathology of most malignant tumors. This EM can be used alone or with other technique like

nuclear organizer regions (AgNOR) in oral carcinoma. AgNOR are a set of proteins associated with DNA segments (loop called rDNA) that transcribe to ribosome RNA. These proteins are defined as markers of <active> ribosomal genes responsible for protein synthesis.⁵

The nuclear organizer regions are segment of ribosomal DNA located on the short arm of the five acrocentric chromosome 2,11,13 in the nucleoli of cells, previous studies neither of AgNOR as indicators of precise proliferation status have resulted in ambiguity.

The silver nuclear organizer region impregnation technique can be used for studying the number, size and shape neither of NOR in a fast and simple way not only in fresh frozen sections but also in formalin fixed paraffin embedded material. The amounts of silver deposit in the cells reflect the amount of NORs involved in protein synthesis related to proliferative activity of the cell.

This study evaluated the role of AgNOR for assessment the proliferative activity and the cytopathological changes in poorly differentiated oral squamous cell carcinoma by EM.

8. Study of anti apoptotic gene of oral carcinoma by using Bcl2 oncogene

The cellular compartment in tissue is maintained by a finally orchestrated balance between input (Proliferation) and output (Differentiation and Apoptosis) processes. Abnormalities in these mechanisms lead to cancer.¹⁰

Bcl2 was first described in follicular lymphoma that beret 14:18(q32,q21) translocation. This structural chromosomal aberration leads to over production of Bcl2 messenger RNA and protein Bcl2 is localized at outer mitochondrial and nuclear membrane as well as in endoplasmic reticulum. Bcl2 proto-oncogene belong to family of apoptosis. The action of Bcl2 oncoprotein is to inhibit apoptosis and is expressed by many tumors including carcinoma of the breast, cervix and head and neck.¹⁰

9. Application of LCF

In 23 cases of oral carcinoma the LCV was used as an excess for radical supra omohyoid neck dissection, 10 cases of post traumatic missile injuries and 4 cases of platysma muscle was used for reconstruction of atrophied masseter muscles in mild hemi facial microsomia

10. Result

The study result of proliferative activity of the cells by using AgNOR staining and EM. All sections were stained with AgNOR stain for examination of the proliferative activity of the squamous cell carcinoma and biopsies also were performed for another 6 cases, 3 with normal oral mucosa and 3 cases with normal striated muscle from the oral cavity of patients with oral squamous cell carcinoma to serve as control.

Statically studies of AgNOR scores were classified into 3 scores. The P value of score I of analysis variance (ANOVA) test was 0.0001, score II (ANOVA) test was 0.0001 and score III (ANOVA) test was 0.06. Both score 1 and score 2 were highly significant and score 3 was significant.⁵

11. Electron microscopy study

EM showed tumor cells with irregular shape and size, with remarkable divisions of nuclei and chromatin clumps emarginated toward nuclear membrane. Some cases showed

chromatin condensed in one pole of nucleus, few mitochondria with dilated crista and abundant rough endoplasmic reticulum were observed and few apoptotic changes were noticed.⁷

These findings showed a high proliferation in poorly differentiated squamous cell carcinoma and the amount of AgNOR in this type of tumor was a prognostic factor and represents unfavorable prognostic features in squamous cell carcinoma.

The study result of anti-apoptotic gene of oral carcinoma by using Bcl2 oncogene, we found the expression of Bcl2 proto-oncogene in tumor tissue derived from 24 patients with malignant oral carcinoma and normal mucosa from same patients served as control and showed a cytoplasmic pattern of Bcl2 immunoreactivity in basal cell layer. Fourteen of 24 cases represent (58.3%) of oral carcinoma and 4 adenocystic carcinoma expressed positive Bcl2 oncogene.

Well-differentiated squamous cell carcinoma (G1) showed absence of immunoreactivity and with no statistically significant correlation could be demonstrated between Bcl2 immunoreactivity and the age and sex of the patients or tumor size and lymph node metastasis. We did find a direct correlation between Bcl2 immunoreactivity in moderately differentiated squamous cell carcinoma (G2) tumor and poorly differentiated tumor (G3) and was statistically significant ($P < 0.05$). Patients with absence or low (scores 0 or 1), Bcl2 immunoreactive tumor manifested poorer overall survival rate in comparison with patients with moderate or high (scores 2 and 3) Bcl2 expression but the differences were not statistically significant.

Tumors showed 3 different expressions of Bcl2 (weak, moderate and strong positive) compared to mucosa of same patient effected by these tumors.¹⁰

No correlation was found between the histopathology of the tumors, mucosal expression and degree of Bcl2 expression. We do propose from these findings the over-expression of Bcl2 proto-oncogene acts as strong anti-apoptotic mechanisms in both squamous cell carcinoma and adenocystic carcinoma and act as an important molecular event on oral carcinoma to make this tumor resistant to radiotherapy and chemotherapy.¹⁰

12. Reconstruction by LCF divided into 4 techniques

12.1 The use of LCF as an access for radical neck dissection and resection of intra oral tumors without using the LCF for reconstruction

In this technique raising the LCF as routine for management of intra oral cancer and the flap acting as stand by for reconstruction, but in some cases reconstruction can be achieved by local flap such as tongue flap, cheek flap or nasolabial flap. Elevation of LCF was required for supra hyoid neck dissection.^{1,2,3,4}

12.2 The use of LCV for reconstruction of the oral cavity after radical cancer surgery

The LCV was used in 23 cases of oral carcinoma. Six cases with squamous cell carcinoma involving the lower alveolar bone with extension to the floor of the mouth, these cases were treated by radical resection of the tumor and floor of the mouth and supra hyoid neck dissection, before any surgical procedure an ultra sonography been used for detection of any deposit in the cervical lymph nodes in operable cases, eight cases with carcinoma of the tongue was treated by hemiglossectomy with supra hyoid neck dissection, 6 cases with extensive squamous cell carcinoma of the cheek were treated by radical excision of the cheek and radical resection of the alveolus of the mandible with supra hyoid neck dissection.⁴

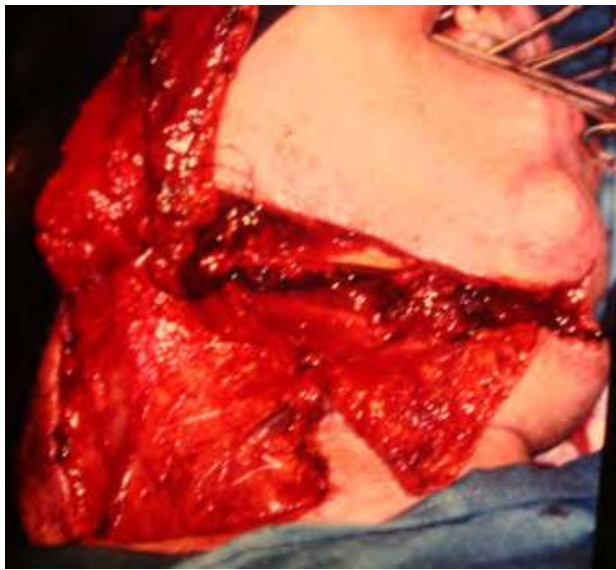
cases were involving the floor of the mouth and treated by wide radical excision of the floor with supra hyoid neck dissection. All cancer cases were treated by radical surgery and supra omo hyoid neck dissection with adjuvant chemotherapeutic regimens (5-Flourauracil 10 mg/m²+ bleomycien 10 U/m²+carboplatien 400mg/m²) of 3 courses and fallowed by DXT and follow up of these cases was between 3-8 years.1,2,3,4,Fig 3,4,5



A



B



C



D



Fig. 3. Reconstruction of the cheek by LCF. A-Man of 60 years with ca of the right cheek, B-Extensive squamous cell carcinoma of the right cheek, C-LCF flap elevated after supra omohyoid neck dissection and radical excision of cheek tumor, D-Closure of the neck after LCF been used for reconstruction of the cheek, E-LCF used for reconstruction of the cheek, F-One year after reconstruction of the cheek by LCF, G-Excellent healing of the neck and without showing any vertical band of scar as seen by other technique

Flaps in these cases had an excellent results, in total of 27 cases were diagnosed at stage I,10 cases at stage II,12 at stage III and 12 at stage IV. Twelve patients survived with tumor size of T1 and T2 and the histopathological diagnosis was well differentiated squamous cell carcinoma with no nodal metastasis so far. Most of the patients were lost to follow-up due to instability of the country.

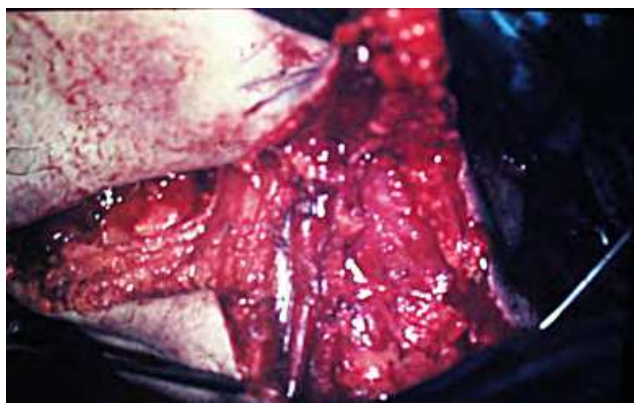
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A



B



C



D



E



F



G



H

Fig. 4. Reconstruction of the alveolus of the mandible. A-A smoker Man of 60 years with Ca alveolus, B-Extensive squamous cell carcinoma of the alveolus, C-LCF elevated and the anatomy of the neck after supra omohyoid neck dissection and radical resection of the tumor of the mandible, D-Radical resection of the mandible and supra hyoid neck dissection content as showed in the specimen, E-Closure of the neck after LCF been used for reconstruction of the alveolus intra orally, F-Excellent healing of intra oral defect and alveolus of the mandible after 5 years, G-Post operative photograph after 5 years, H-Lateral side of the neck after LCF used with no vertical band of scars or recurrence masses of lymph nodes

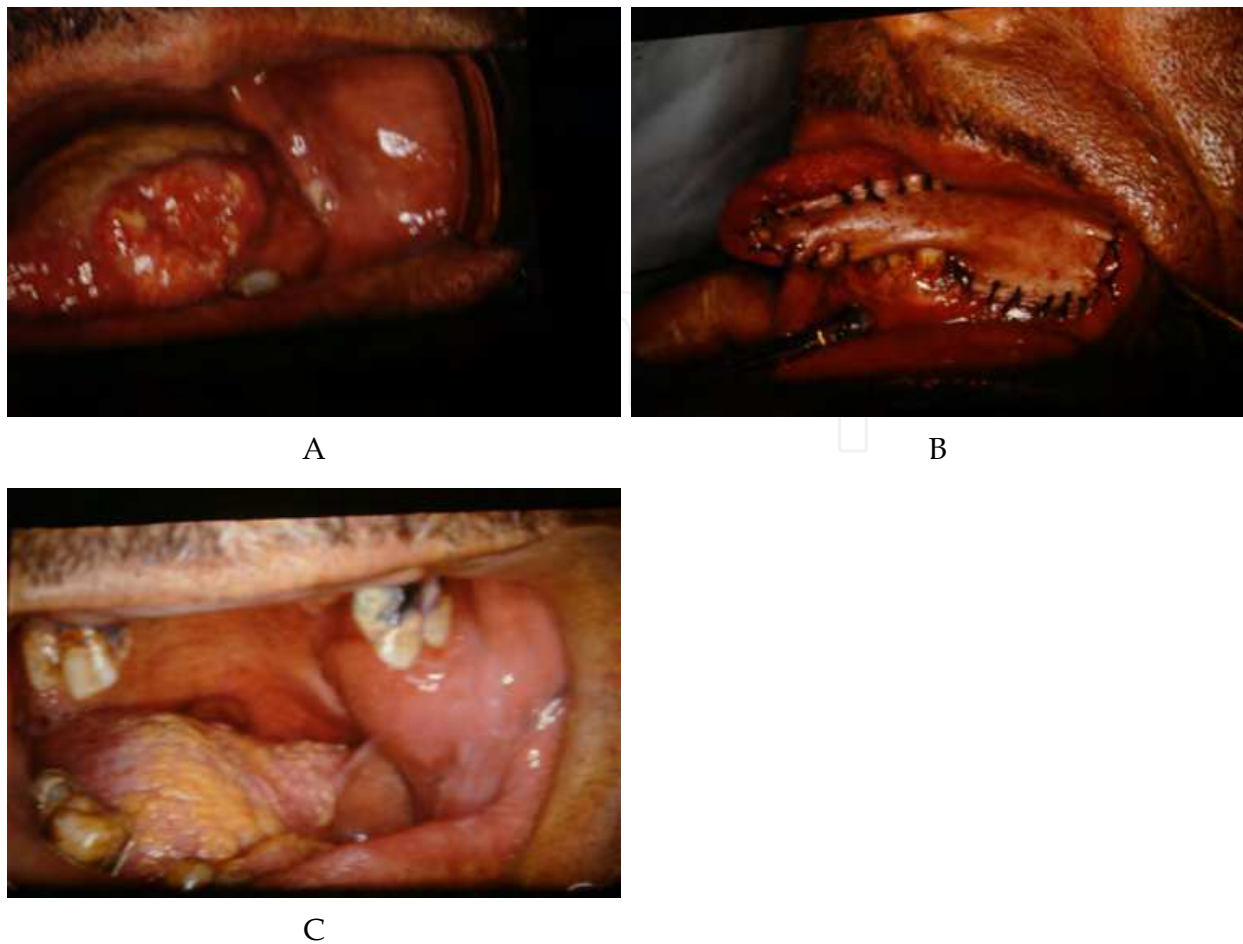


Fig. 5. Reconstruction of the tongue by LCF. A-Squamous cell carcinoma of the lateral side of the tongue, B-Immediate reconstruction of the tongue by LCF after hemiglosactomy, C- Three years post operative photograph showing excellent reconstruction of the tongue after hemiglosactomy

3. Reconstruction by LCF of peri oral tissue in cases with post traumatic missile injuries

In 10 cases LCF was used for reconstruction of the lip and sub-mental area after excision of scars in the region to advance the chin and sub mental area upward and to make a room for reconstruction of the lost part of the mandible by bone graft from the iliac crest as a good donor area for bone grafting to get good bulk, rigidity, shape and good amount of cancellous bone. Reconstruction of the lip by fan rotation flap also the flap been used for reconstruction of large missing part of the lip. The results of these cases were quiet good. 1,3,4

4. The use of platysma muscle flap for reconstruction of atrophied masseter muscle

In this technique platysma muscle was used by the author for reconstruction of the atrophied masseter muscle in cases with mild hemi facial micro somia or first arch dysplasia syndrome, 4 cases were treated by this technique and the result quiet good.

Complications of LCV:

1. Oro cutaneous fistula:

The complication of LCF in reconstruction of intra oral defect is the oro cutaneous fistula, which represent a tunnel for introducing the flap proper of LCV to the oral cavity for reconstruction of the cheek, floor of the mouth, tongue or alveolus, this fistula usually closed within 6 weeks and the orifice of the tunnel usually closed by iodoform pak to prevent saliva and fluid leakage. This situation is very un pleasant to the patient but we have to assure the patient about this matter and only a temporary situation. To enhance healing and closure of the fistula we usually de squamate the skin of the fistula. These fistula occurred in all cases with intra oral defect and required reconstruction by LCF and been used in 23 cases.

2. Flap necrosis:

Necrosis was reported by the author in the terminal part of the LCV specially in the floor of the mouth and the tongue due to accumulation of food and fluid, these cases was controlled by Lavage with improvement of oral hygien.this condition was reported in 4 cases and healed very quickly after 2 weeks.

3. Infection:

Infection reported in 3 cases due to food debries.These condition was treated by Lavage and proper dis infecting mouth wash and proper anti biotic.

Evolution of Lateral Cervical Flap (LCF):

It is thought that LCV an excellent flap introduced by the author and advocated before 2 decades for reconstruction of the floor of the oral cavity, the tongue, alveolus of the lower jaw and the cheek. , 1These sites the most common for involvement by oral cancer. The work published in 1994 as a preliminary report, 2. Reconstruction of these anatomical sites was a problem for many surgeons and for many years during the last 4 decades in the last century. Tube pedicle flap was the most popular and probably the only flap used for reconstruction ,the objection about tube pedicle is a long surgical procedure required many steps during transfer as secondary stage from the abdomen before been used for orofacial region reconstruction, the procedure takes many months till reconstruction, the color of skin of the abdomen does not match the color of skin of orofacial and the whole procedure with<delay technique> no more accepted for reconstruction of the face. Introduction of temporal flap by McGregor in the early 1960s did a great contribution to science and a great advance to cancer surgery of the head and neck.Disadvantage of this technique is a 2 stage operation and flap transfer and successful reconstruction of the oral cavity were annoying to the patients because of growing hair in the mouth. The author did shaving the hair to please his patients and the area look rather bulky with deformity of the forehead.Many other good flaps advocated before and during that time such as deltoid pectoral flap of Bakamijian and Ariyan with his pectorals major myocutaneous flap. All these flaps showed good result in reconstruction of the oral cavity, but the disadvantages about deltoid pectoral flap, being a random flap and not recommended for older people because of atherosclerosis of the blood vessels and a 2 stage operation, a pectorals major flap required a long distance transfer and the size of the tissue is limited and not suitable for large defect reconstruction in the oral cavity and recommended for intra oral or extra oral small defect, also the color of the chest does not match the color of the face

Free flap surgery is an excellent flap like forearm flap advocated by the Chinese surgeons in the early seventies of the last century for reconstruction of the orofacial regions, but this procedure required skill and highly trained in micro vascular anastomosis and it is a time consuming procedure and the skin transferred does not match the skin of orofacial region in addition the possibilities of failure due to thrombosis of the vessels.^{1,2,3,4}

The superiority of LCF proved to be an excellent axial flap and an excellent technique for reconstruction of perioral and oral cavity both in radical cancer surgery of the mouth and for reconstruction of sub mental area in post traumatic missile injuries of the face as a one stage operation,³ and further to that the skin of the side of the neck match the texture and color of the face with quick healing due to high vascularity of the flap. The thickness of the flap is well tolerated by the oral cavity and no hair growing from the flap.

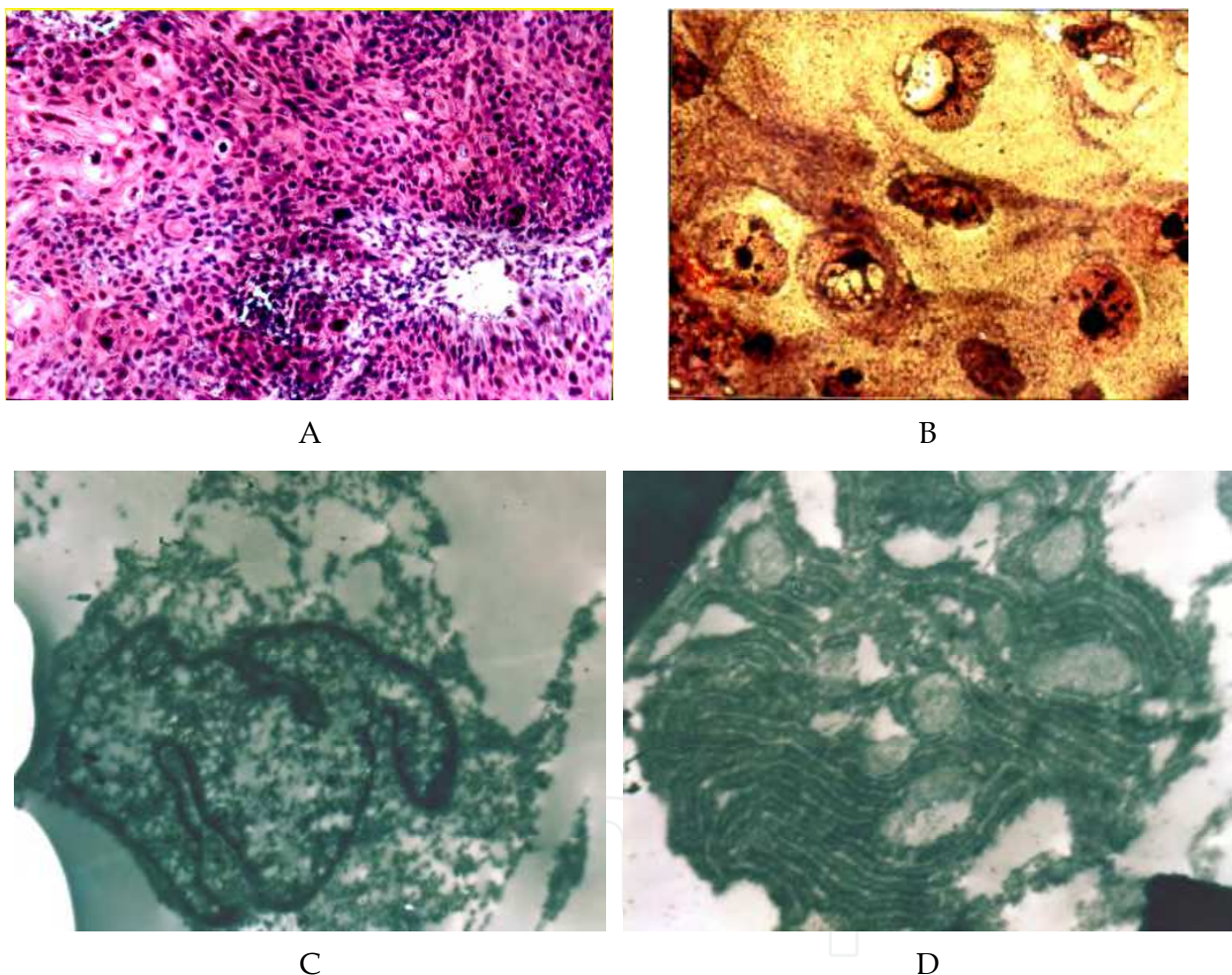


Fig. 6. Study of proliferative activity of squamous cell carcinoma. A-Poorly differentiated squamous cell carcinoma of the oral cavity (H&E X40), B-AgNOR staining of poorly differentiated squamous cell carcinoma showing the number of dot of NOR increased in the cell due to high proliferative activity of the cells, high magnification, C- High magnification of single cell of poorly differentiated squamous cell carcinoma showing nucleus of the cell divided into many nucleuses (EM X 36000), D-High magnification by electron microscopy of poorly differentiated squamous cell carcinoma showing high proliferative activity of endoplasmic reticulum with many mitochondria in between (EM X36000)

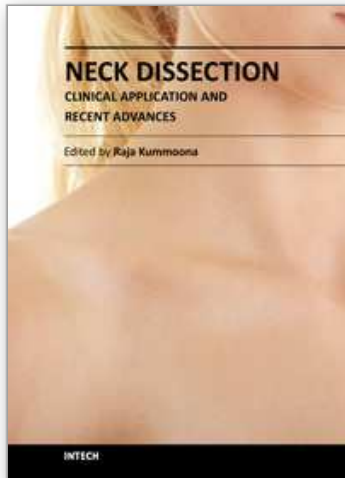
The flap design and its elevation make a good access for radical resection of the mandible with supra hyoid neck dissection and without using the flap for reconstruction, and the type of incisions used and after reconstruction does not leave a long vertical band of scar tissue extend from upper neck down to the clavicle region has been observed by the author with other techniques.

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Neck Dissection - Clinical Application and Recent Advances is a leading book in neck surgery and represents the recent work and experiences of a number of top international scientists. The book covers all techniques of neck dissection and the most recent advances in neck dissection by advocating better access to all techniques of neck dissection; e.g. Robotic surgery (de Venice) system, a technique for detection of lymph node metastasis by ultra sonography and CT scan, and a technique of therapeutic selective neck dissection in multidisciplinary treatment. This book is essential to any surgeon specializing or practicing neck surgery, including Head Neck Surgeons, Maxillofacial Surgeons, ENT Surgeons, Plastic and Reconstructive Surgeons, Craniofacial Surgeons and also to all postgraduate Medical & Dental candidates in the field.

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