

# Head and Neck Reconstructions with Prolene Mesh

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**Key Words:** Prolene Mesh, Alloplastic Materials

## Abstract

Independently of their composition, alloplastic materials when introduced into the organism cause an acute inflammatory reaction followed by a chronic process.

The authors studied the introduction of a strip of prolene mesh in "U" type rats and then by light microscopy accompanied the reactions which occurred on days 5, 10, 14, 24, 30 and 40, so that observation was possible from the acute inflammatory process until the implants' integration.

They report the satisfactory outcome of the use of the mesh in 3 clinical cases; indicated in 2 for suspension and in 1 for support.

Mention is made that the prolene mesh obeys all the criteria laid down by Scale for the ideal implant, except for causing an inflammatory reaction, which is acute initially, followed by repair with resolution and integration of the implant.

They conclude citing the advantages of the mesh: the good results obtained, histological evidence of integration, absence of scars in other sites, and it is a good option for suspension of ptosed structures, as well as for tissue support.

## Introduction

The utilization of alloplastic materials (i.e. silicone prostheses, polypropylene mesh etc.) in plastic surgery has been widely accepted. Whatever the nature of the material employed, some inflammatory reaction is bound to occur.

Therefore, there is no such thing as an inert inclusion. A fact which that we become aware of the inflammatory process involved in each case<sup>9</sup>.

In situations in which tissue suspension or a gain in tissue consistency is necessary, prolene mesh is employed.

Both the prolene and Marlex meshes are composed of polypropylene. However, the former is knit with 2 stitches making it rigid in all directions, where as the Marlex is a mesh, knit with a single stitch which is rigid in one direction and stretchable in the other<sup>8</sup>.

The thesis of the present article is a detailed study of the reactions to implantation of prolene mesh in rats, followed by clinical applications.

## Review of the Literature

The use of devices for facial suspension are mentioned in chronological order as follows:

Blair, 1926 - Proposes the use of fascia lata strips fixed to the commissure of the lips and to the temporal aponeurosis in a case of facial paralysis. The method was also employed by Gillies (1934) and Freeman who accomplished a 2 stage procedure.

Bunnell, 1937 and McLaughlin, 1952 - Utilized the fascia lata with minor modifications to suspend the face. McLaughlin fixed one of the extremities of the fascia to the coronoid process.

Ragnell, 1958 - Used the extensor tendon of the foot to unite the aponeurotic loop surrounding the lip to the fragment of the coronoid process.

Ashley - Associated a masseter muscle flap to

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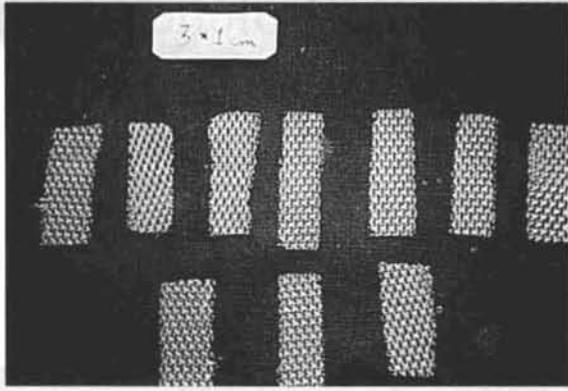


Fig. 1 - 3 x 1 cm strips of prolene mesh employed in the study.  
Fig. 1 - Fitas de tela de prolene de 3 x 1 cm utilizadas no estudo.

McLaughlin's technique.

Trevisani & colleagues, 1982 - Suspended the ear with a strip of Marlex mesh, in a patient with neurofibromatosis.

Strelzow & colleagues, 1982 - Case reports of facial paralysis reconstructed with polypropylene mesh with good results in 3 patients.

### Material and Methods

Ten "U" type rats were utilized for the study. A 3x1 cm strip of prolene mesh was introduced into the animals' backs (Figs. 1,2,3) to be removed on days 5,10,17,24,30 and 40 (Fig. 4).

The resected tissue (skin, panniculus carnosus,

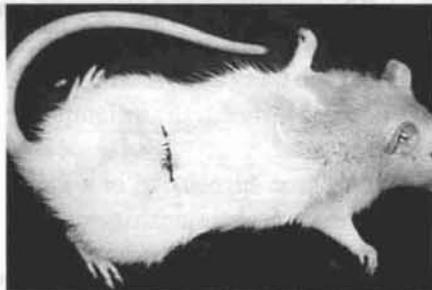


Fig. 2 - Marking of the incision with methylene blue for insertion of the mesh.  
Fig. 2 - Demarcação com azul de metileno no local da incisão para introdução da tela de prolene.

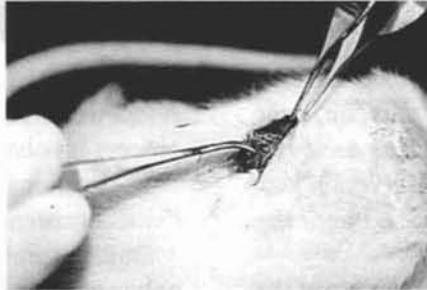


Fig. 3 - Insertion of the mesh into the animal's back between the panniculus carnosus and the muscles.  
Fig. 3 - Introdução da tela de prolene no dorso do animal entre o pânículo carnosus e a musculatura.



Fig. 4 - Tissue specimen, including skin, panniculus, mesh and muscles removed from the rat's back.  
Fig. 4 - Demonstração da retirada tecidual do dorso do rato, compreendendo pele, pânículo carnosus, tela e musculatura.



Fig. 5 - Notice the presense of fibrin, permeated by inflammatory infiltrate (both mono and polymorphonuclear), edema and hemorrhagic infiltration (HE 10 x 10).  
- At the level of the mesh implant.  
Fig. 5 - Observa-se presença de fibrina, permeada por infiltrado inflamatório (mono e polimorfonuclear), edema e infiltração hemorrágica (HE 10x10) - Em nível de implante da tela.



Fig. 6 - Vascular proliferation and congestion lymphoplasmocytis infiltrate hemorrhage and edema. Focal area of foreign body giant cell reaction at the level of implantation of the mesh. (HE 10 x 10).  
Fig. 6 - Verifica-se proliferação e congestão vascular, infiltrado linfoplasmocitário e hemorrágico, edema. Área focal de reação giganteocelular do tipo corpo estranho (HE 10 x 10). Em nível de implante da tela.

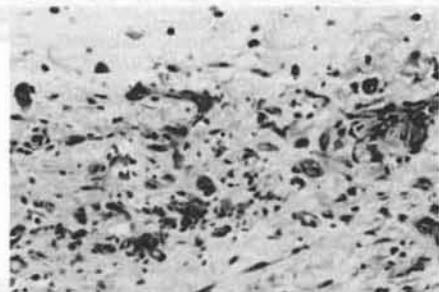
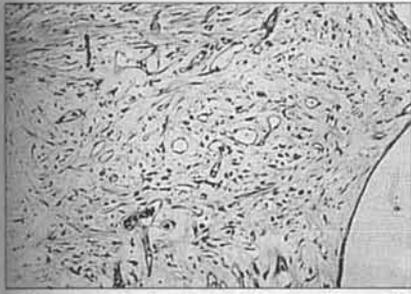


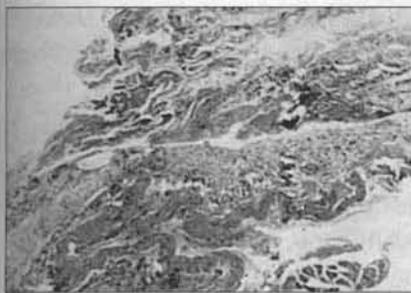
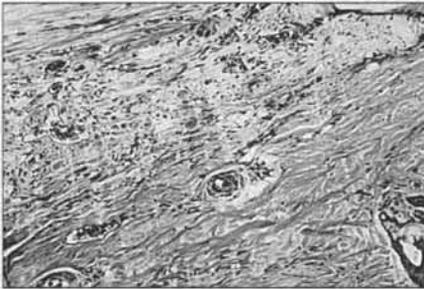
Fig. 7 - Edema and proliferation of fibroblasts at the level of implantation of the mesh (HE 20 x 10).  
Fig. 7 - Edema e proliferação fibroblástica (HE 20 x 10). Em nível de implante da tela.



*Fig. 8 - Late stage of the inflammatory process, evidence of slight mononuclear infiltrate besides fibroblastic and vascular*

*proliferation at the level of the implant of the mesh. (HE 10 x 10). Fig. 8 - Fase tardia do processo inflamatório, evidenciando leve infiltrado mononuclear além de proliferação fibroblástica e vascular (HE 10 x 10). Em nível de implante da*

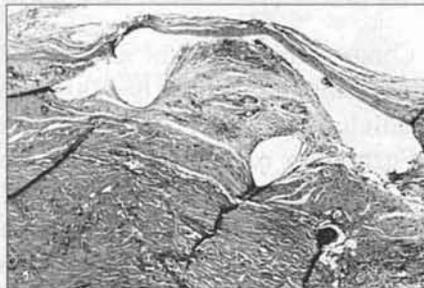
*Fig. 9 - Notice the reduction in edema, the disorganization of the collagen fibers, at the level of implantation of the mesh. (HE 4 x 10). Fig. 9 - Observa-se diminuição do edema, notando-se fibras colágenas em várias direções (HE 4 x 10). Em nível de implante da tela.*



*Fig. 10 - Late evolutionary stage. There is vascular and fibroblastic proliferation and reduction of edema, at the level of the implanted*

*mesh (HE 4 x 10). - Fig. 10 - Estágio evolutivo em fase tardia. Há proliferação fibroblástica, vascular e diminuição do edema (HE 4 x 10). Em nível de implante de tela.*

*Fig. 11 - Area corresponding to implantation of the mesh with organized scar, at the level of implantation of the mesh (HE 10 x 10). Fig. 11 - Área correspondente a implantação da tela com cicatriz organizada (HE 10 x 10). Em nível de implante de tela.*



mesh and muscles) were fixed in 10% buffered formalin and the paraffin block sectioned (5 $\mu$ ) and stained with hematoxylin-eosin (HE).

The tissue reactions were studied by light microscopy so as to obtain standards for the clinical use of prolene mesh.

### Microscopic Study

5<sup>th</sup> Day - An acute inflammatory reaction characterized by edema and capillary dilatation was observed in the dermis; capillary dilatation, swollen endothelium, both mono- and polymorphonuclear infiltration, and deposits of fibrin in the panniculus carnosus; edema and mixed infiltrate in the muscles. Whereas, in the surface in contact with the mesh, the connective tissue was loose, infiltrated with red blood cells, lymphocytes, plasmocytes, neutrophils, edema, fibrin and numerous polymorphonuclear cells (Fig. 5).

10<sup>th</sup> Day - In certain areas, granulation tissue is present in the early stage, while in others, proliferation of collagen fibers is already noted (Figs. 6,7).

17<sup>th</sup> Day - Initial stage of organization of the healing process with the connective tissue being retracted. Edema is decreasing in the dermis and the myxoid connective tissue is proliferating with slight mononuclear infiltration and vascular neoformation in the deep tissues (Fig. 8).

24<sup>th</sup> Day - Scar with decrease of edema, contraction and collagen formation: slight vascular congestion and deeper down, connective tissue with dilated vessels, varying in diameter with evidence of anastomoses, appearance of bundles of collagen fibers in various direction (Fig. 9).

30<sup>th</sup> Day - Organized scar: loose connective tissue with areas of (denser) collagen throughout. Presence of dilated vessels besides slight mononuclear inflammatory infiltrate (Fig. 10).

40<sup>th</sup> Day - Organized scar, practically contracted: development of the anterior process (Fig. 11).



*Fig. 12a - Anterior aspect of neurofibromatosis - facial ptosis.  
Fig. 12a - Neurofibromatose - ptose facial - vista anterior.*



*Fig. 12b - Lateral aspect of neurofibromatosis - facial ptosis.  
Fig. 12b - Neurofibromatose - ptose facial - vista lateral.*



*Fig. 12c - Frontal aspect, three months post-implantation of the mesh and resection of skin.  
Fig. 12c - Pós-operatório de três meses de implante da tela de prolene e ressecção de pele - vista frontal.*



*Fig. 12d - Lateral aspect, three months post-implantation.  
Fig. 12d - Pós-operatório de três meses - vista lateral.*

### Clinical Cases:

Case 1 - Patient with neurofibromatosis with marked ptosis of the right hemiface (Figs. 12 a,b,c,d).

Case 2 - Patient with right facial paralysis complaining of constant drooling and food loss (Figs. 13a,b,c,d,e,f).

Case 3 - Patient undergoing resection of a large tumor involving the entire lower lip. Initially, reconstruction was accomplished with a scalp flap. Since the latter was unsuccessful, a deltoid-pectoral flap with prolene mesh was implanted in its extremity for reconstruction of the lower lip (Figs. 14 a-h).

### Discussion

The study in rats demonstrated that during the first 5 days after insertion of the mesh, an intense acute inflammatory process occurs with the participation of polymorphonuclear cells and fibrin deposits and on the 10<sup>th</sup> day, when collagen fibers appear, the implant is considered integrated.

On the 24<sup>th</sup> day, collagen fibers in various directions are revealed. Cameron & Taylor<sup>3</sup>, also observed this with Marlex mesh in which they found circularly disposed, and disorganized collagen fibers. However, these authors mention a better disposition of the collagen fibers using carbon mesh.

Starting on day 30, the scar is considered organized.

Strelzow & colleagues<sup>11</sup>, mention the possibility of rejection of alliplastic materials. We do not agree with this because what really happens concerning the implants, is an acute inflammatory process followed by a chronic inflammation with resolution. When speaking of rejection, the immunological reaction should be considered, which is defined genetically as the rejection by the organism of another person's or species' tissue<sup>9</sup>.

Contamination with the animal's skin occurred in 2 cases promoting a foreign body giant cell reaction which paralleled the organization process.

Formation of microabscesses occurred in only one case.

Concerning our clinical cases, the prolene mesh has proved to be an interesting material because no major complications occurred and because of the satisfactory results achieved.

According to Scales<sup>9</sup>, the ideal conditions for inclusion materials are defined as follows:



Fig. 13a - Preoperative, anterior aspect. The patient cannot close his right eye.

Fig. 13a - Pré-operatório - vista anterior - Paciente não faz oclusão do olho direito.



Fig. 13b - Preoperative - The lip is pulled toward the healthy side when contracting the facial muscles.

Fig. 13b - Pré-operatório - O lábio é repuxado para o lado sadio ao contrair a musculatura da face.



Fig. 13c - At operation, demonstrating the undermining of the skin of the right hemiface for insertion of the mesh, which is anchored to the lip commissure and the temporal fascia.

Fig. 13c - No ato cirúrgico, demonstra-se o descolamento da pele da hemiface direita para colocação da tela, a qual é fixada à comissura labial e ao fáschia temporal.

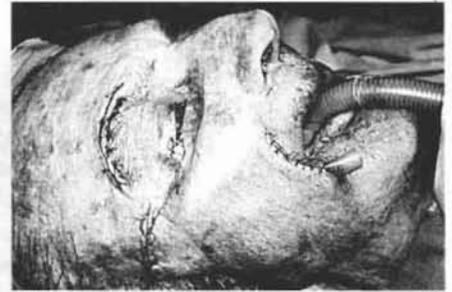


Fig. 13d - Immediate preoperative period. Also notice the suture of the right eyelid where the skin was resected.

Fig. 3d - Pós-operatório imediato. Observa-se também sutura em supercílio direito onde se realizou ressecção de pele.

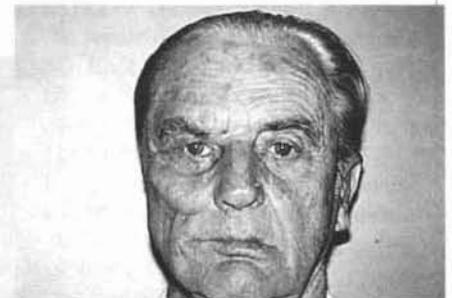


Fig. 13e - 40 days p.o. with the patient at rest. Better positioning of the commissure of the right lip.

Fig. 13e - Pós-operatório de 40 dias em repouso, com melhor posicionamento da comissura labial direita.



Fig. 13f - 40 days p.o., patient contracting the facial muscles. Notice the smaller displacement of the commissure of the right lip in direction to the healthy hemiface.

Fig. 13f - Pós-operatório de 40 dias, paciente realizando contração da musculatura facial. Observa-se menor deslocamento da comissura labial direita em direção à hemiface sadia.

- be chemically inert;
- incapable of modification by organic liquids and tissues;
- incapable of provoking foreign body reaction or inflammation;
- incapable of producing cancer;
- incapable of producing allergic or hypersensitivity

- reactions;
- capable of resisting mechanical forces;
- capable of being manufactured in any desired shape;
- capable of being sterilized.

The mesh used by us complies with all of Sales criteria, except for the inflammatory process. The latter however, is transitory and determines the integration of



Fig. 14a - Marking of the delto-pectoral flap. The dotted line demonstrates the area to be raised and folded over itself with the mesh.

Fig. 14a - Demarcação do retalho delto-peitoral. O pontilhado demonstra a área a ser levantada e dobrada sobre si mesma com a tela.



Fig. 14e - Reintervention 15 days after autonomization of the flap with its elevation with the mesh "sandwich" in its extremity.

Fig. 14e - Reintervenção de 15 dias após a autonomização do retalho com elevação deste com a tela em sanduíche em sua extremidade.



Fig. 14b - Elevation of the distal portion of the subfascial flap. Notice the 2 strips of prolene mesh.

Fig. 14b - Elevação da porção distal do retalho subfascial. Observam-se as duas fitas de tela de prolene.



Fig. 14f - Preparation of the receptor area in projection of the lower lip to be reconstructed. Notice the detail of the flap folded to tailor the lining and covering.

Fig. 14f - Preparo da área receptora em projeção de lábio inferior a ser reconstruído. Observa-se detalhe do retalho dobrado para confecção de forro e cobertura.

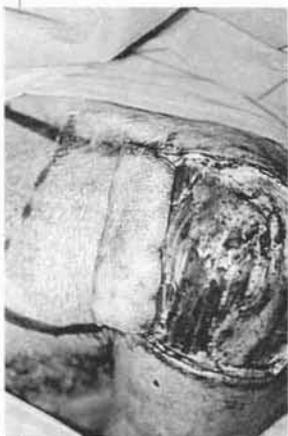


Fig. 14c - Extremity of the flap folded over itself making a "sandwich" with the mesh.

Fig. 14c - Extremidade do retalho dobrada sobre si mesma determinando um sanduíche com a tela.

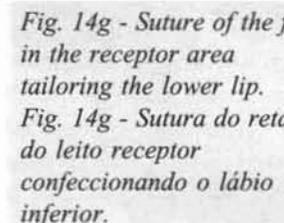


Fig. 14g - Suture of the flap in the receptor area tailoring the lower lip.

Fig. 14g - Sutura do retalho do leito receptor confeccionando o lábio inferior.



Fig. 14h - Notice the flap forming the lower lip after section of the pedicle.

Fig. 14h - Observa-se o retalho formando lábio inferior após secção do pedículo.

Fig. 14d - Resuture of the extremity of the flap in the donor area itself and autonomization of the remainder.



Fig. 14d - Ressutura da extremidade do retalho no próprio leito doador e autonomização do restante.



the implant in the host. A fact confirmed by the good clinical results obtained, together with the microscopic data observed.

In their series of 3 patients with facial palsy, Strelzow & colleagues<sup>11</sup>, mention that the static nature of the suspension, diminishes the chance both of exposure of the implant by movement and of provoking the foreign body reaction, so long as the mesh is placed between 2 healthy tissues.

Our indications for placing the mesh were for suspension in a patient with facial palsy and in one with neurofibromatosis. Both reported postoperative improvement in salivary and food continence. In our other case, the mesh was placed as a "sandwich" at the extremity of the deltoid-pectoral flap autonomized for reconstruction of the lower lip in a patient in whom other types of reconstruction had already failed. In this case, with the mesh, it was possible to tailor a flap with good consistency and in this way, prevent the passive loss of saliva.

### Conclusions

Light microscopy demonstrated that with the prolene mesh, the animal organism initially reacts with an acute inflammatory process that progresses to scar organization with total integration.

In our series, no complications with the prolene mesh occurred and satisfactory results were obtained both with suspension as well as with support.

During the period observed, the prolene mesh maintains its function of suspension using a simple operative procedure and with the added advantage of not causing other scars such as occur when fascia lata is employed.

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