

A long-term histological research on human frontalis muscle flap specimens from recurrent blepharoptosis patients

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Received: 2023-08-25 Accepted: 2023-12-28

DOI:10.18240/ijo.2024.06.23

Citation: Zhou L, Yan YC, Fan JC. A long-term histological research on human frontalis muscle flap specimens from recurrent blepharoptosis patients. *Int J Ophthalmol* 2024;17(6):1161-1163

Dear Editor,

We present two patients with recurrent severe blepharoptosis after frontalis muscle (FM) flap suspension. Here we describe long-term histological changes of the FM flaps observed in revision surgeries.

FM flap suspension is widely applied in treating severe ptosis with poor levator function (<4 mm), and its effect is relatively stable and lasting^[1]. FM flap suspension is reliable and recurrent cases are observed only occasionally. Since long-term research about FM flap is rare, we investigated tissue samples of revision surgery flaps which could reflect trends of morphological changes within the functioning FM flaps to some extent.

The primary and revision surgeries of the reported cases were performed by the same surgeon. FM flap specimens were obtained as follows: 1) The incision was made at the position of the scar left by the primary surgery; 2) Upward separation was performed to expose the FM flap and remove the scar tissue; 3) The FM flap was pulled down, and re-fixed to the tarsus achieving an immediate postoperative effect of slight overcorrection. The level of upper eyelid was fixed 2-3 mm higher than the superior margin of pupils. 4) The

terminal-redundant FM flap tissue was excised and stored in paraformaldehyde immediately; 5) The whole obtained samples were embedded in paraffin, and 5 μm sections were stained with Masson trichrome stain. The slides were evaluated by light microscopy.

The study was approved by the Institutional Review Board (IRB)/Ethics Committee of Plastic Surgery Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, and all methods were performed in accordance with the ethical approval and with the Declaration of Helsinki. Informed consents including the permission to reproduce images were obtained from both patients enrolled.

For better comparison, the terminal-redundant tissue of the newly formed FM was excised for paraffin section, which would reflect the normal structure of frontalis and its aponeurosis. The specimen came from a 5-year-old male patient admitted with congenital left severe blepharoptosis and poor levator function. In the photograph of Masson trichrome stain, the adipose tissue and connective tissue had clear boundaries with muscular tissue, and few mutual infiltrations were observed (Figure 1). The myofibers were packed tightly and orderly.

Case 1 A 24-year-old male patient once diagnosed with blepharophimosis-ptosis-epicanthus inversus syndrome at his initial visit, was performed bilateral FM flap suspension surgery 7 years ago. Before the revision surgery, bilateral margin-reflex distance 1 (MRD1) are less than 1 mm, and levator function of both eyelids were 0. The light microscopic observation of the FM flap samples (Figure 2A, 2C) showed that red regions (muscle tissues) interlaced with blue regions (collagen fibers). Muscular tissue distributed in disorder, and sections of muscular fibers were observed irregular in shape and smaller in comparison with the newly formed flap (Figure 1).

Case 2 A 26-year-old female patient was performed unilateral FM flap suspension surgery 15 years ago. She was diagnosed with unilateral simple congenital ptosis at the first visit. The MRD1 of his left eyelid was <0 and the levator function were measured 0 before the revision surgery. The light microscopic observation (Figure 3A) showed that there were a lot of

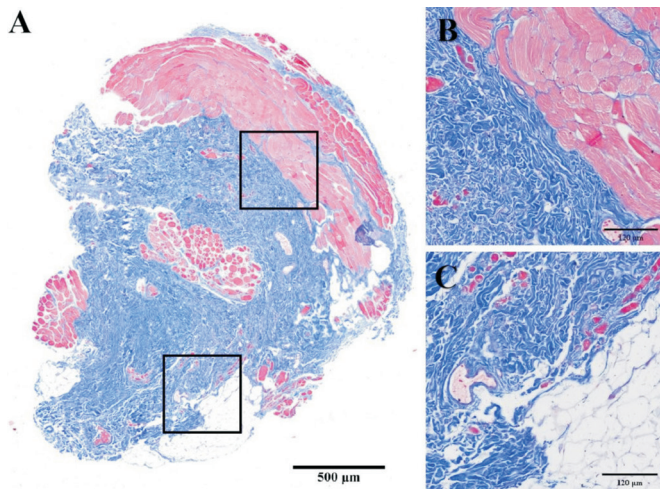


Figure 1 Electronic scan photograph of newly formed FM flap Muscle tissue, connective tissue, and adipose tissue distributed concentratedly, and no wide mutual infiltration of these two kinds of tissue was observed (Masson trichrome stain). B, C were the detail micrographs of the A (Masson trichrome stain). FM: Frontalis muscle.

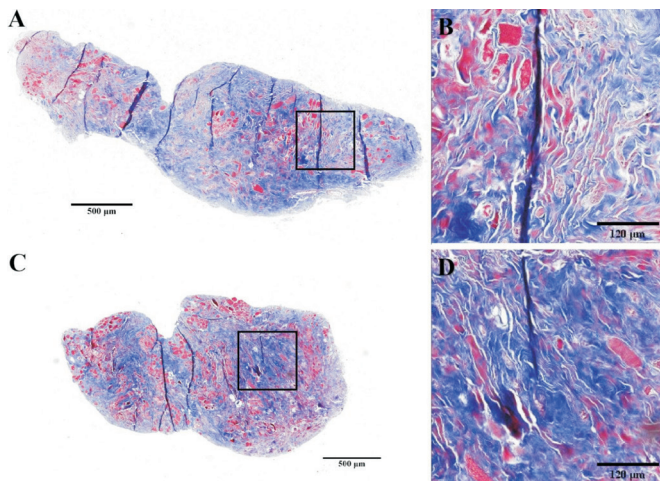


Figure 2 Electronic scan photograph of FM flap samples acquired form case 1 A, C: Micrographs exhibited the FM flap samples excised from the right and left eyelid. B, D were the detail micrographs of black boxes in A, C, respectively. FM tissue infiltrated with collagenous fibers was observed (Masson trichrome stain). FM: Frontalis muscle.

transparent circles (adipose tissue). Sparsely distributed muscular tissue was surrounded by collagen fiber, and the remaining myofibers were in loose arrangement and irregular shape (Figure 3B, 3C).

The advantages of FM flap suspension have been fully discussed, such as the relatively stable operative effect, and no risk in foreign-body reaction^[2]. Since its first introduction by Song *et al*^[3], numerous scholars have presented their measures to reduce postoperative complications. Histological changes of FM flaps 6mo after surgeries has been investigated using the animal model (miniature pigs). There, muscle fibers of the FM flaps were distributed evenly without obvious collagen fiber infiltration; the latter was co-appearing only during

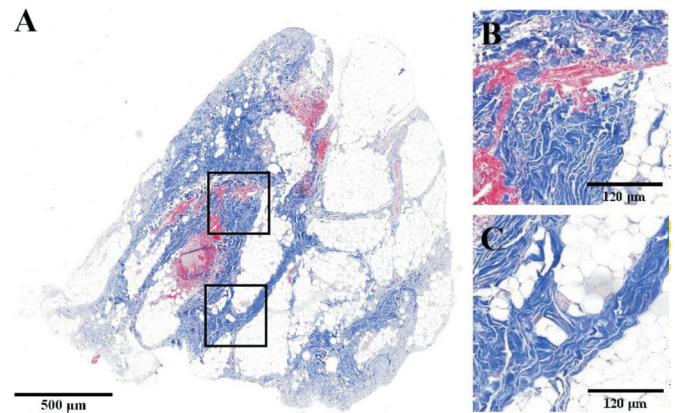


Figure 3 Electronic scan photograph of FM flap samples acquired form case 2 A: Photomicrograph showed that the remarkable infiltration of adipose tissue and collagen fibers. Little FM tissue left. B, C: Detail micrographs of black boxes in A (Masson trichrome stain). FM: Frontalis muscle.

inflammatory reaction^[4]. To the authors' knowledge, long-term histological studies about postoperative FM flaps are scarce till now. The relevant research may explain the phenomenon of recurrent.

In the present study, patients' follow-up periods are 7 and 18y respectively after the primary surgeries. The specimens of both patients exhibited disrupted musculature, which demonstrated that the contraction force of FM flaps might be impaired. Increased amount of collagen fibers were also observed in all specimens. These changes might be caused by neuralgic amyotrophy^[5], and once happened inflammatory reaction^[4]. Consequently, we propose the hypothesis that the role that FM flap plays in the recurrent case is more like a sling material than a functional muscle with time lapse. Interestingly, adipose tissue was observed in the specimen of the second patient. The accumulation of fat next to the muscle tissue might indicate a degenerative change affecting the quality of muscle tissue^[6], and leading to a deficiency of not only contraction force but also mechanical strength.

The influence of degenerative changes in some of FM flaps might be caused by surgical trauma, personal metabolic variation, functional exercise, or other^[7], and would attribute to the recurrence of ptosis. Long-term postoperative follow-up and histological studies are still needed to better understand and improve this classical surgical method.

ACKNOWLEDGEMENTS

Conflicts of Interest: Zhou L, None; Yan YC, None; Fan JC, None.

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