

Exploring The Efficacy Of A Novel Platysma Muscle Flap In Rat Models For Advancing Facial Paralysis Reconstruction Research

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BACKGROUND

Successful reanimation of the eye following facial paralysis has posed a longstanding challenge for several decades, with a definitive resolution remaining elusive. The reconstruction of the orbicularis oculi muscle constitutes a difficulty as its delicate, thin muscle fibers barely resemble any other muscle in the human body.¹ One of the few similar muscles includes the platysma muscle.¹ Although a platysma muscle flap has been described before, its clinical utilization remains limited, highlighting opportunities for enhancement.² The aim of this study was to investigate the anatomy of the platysma muscle in rats and to establish a novel platysma flap model.

OBJECTIVES

- Descriptive analysis of the platysma and its supplying vessel and nerve in rats
- Establishment of a platysma flap model for future reconstructive research

METHODS

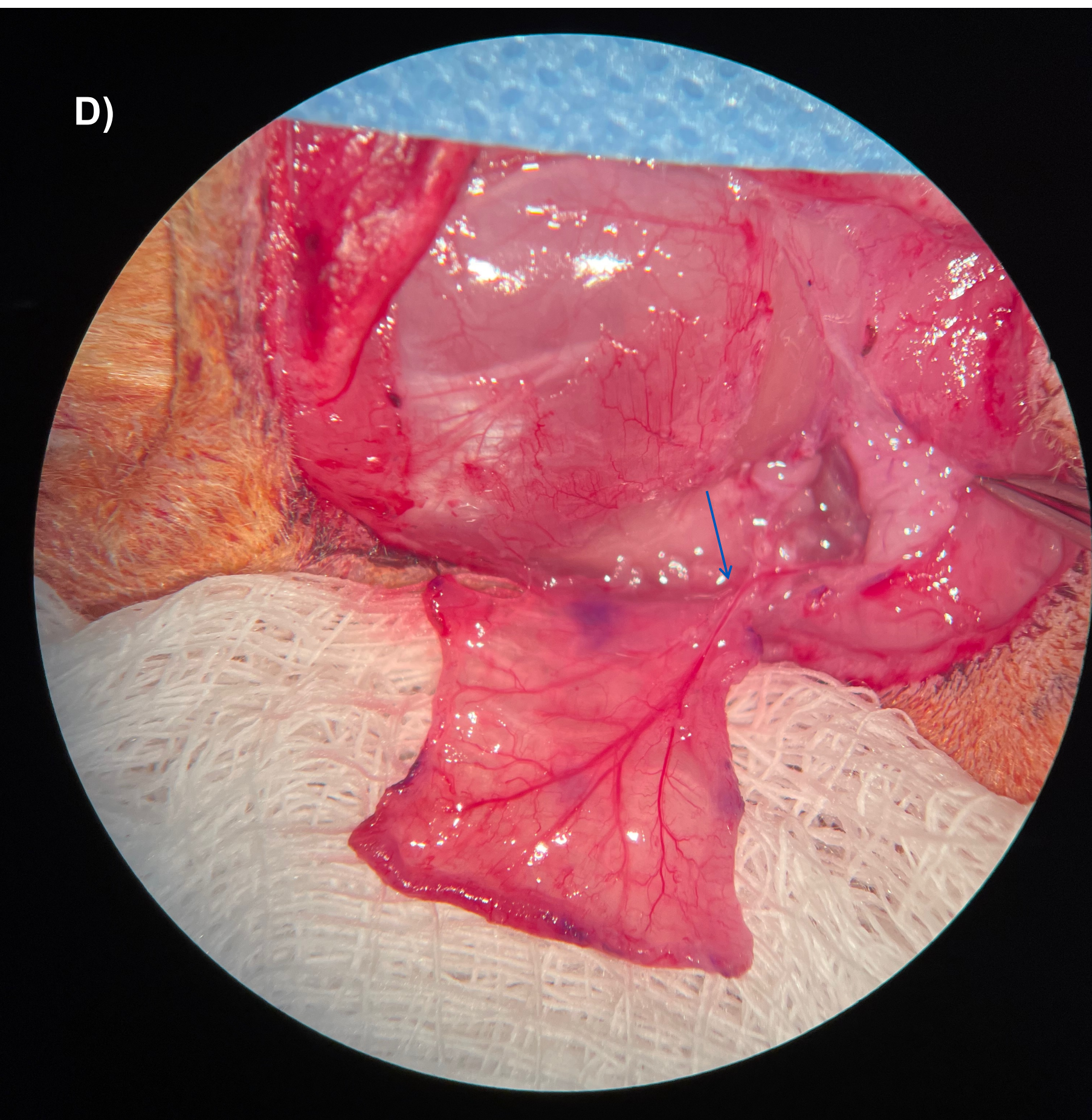
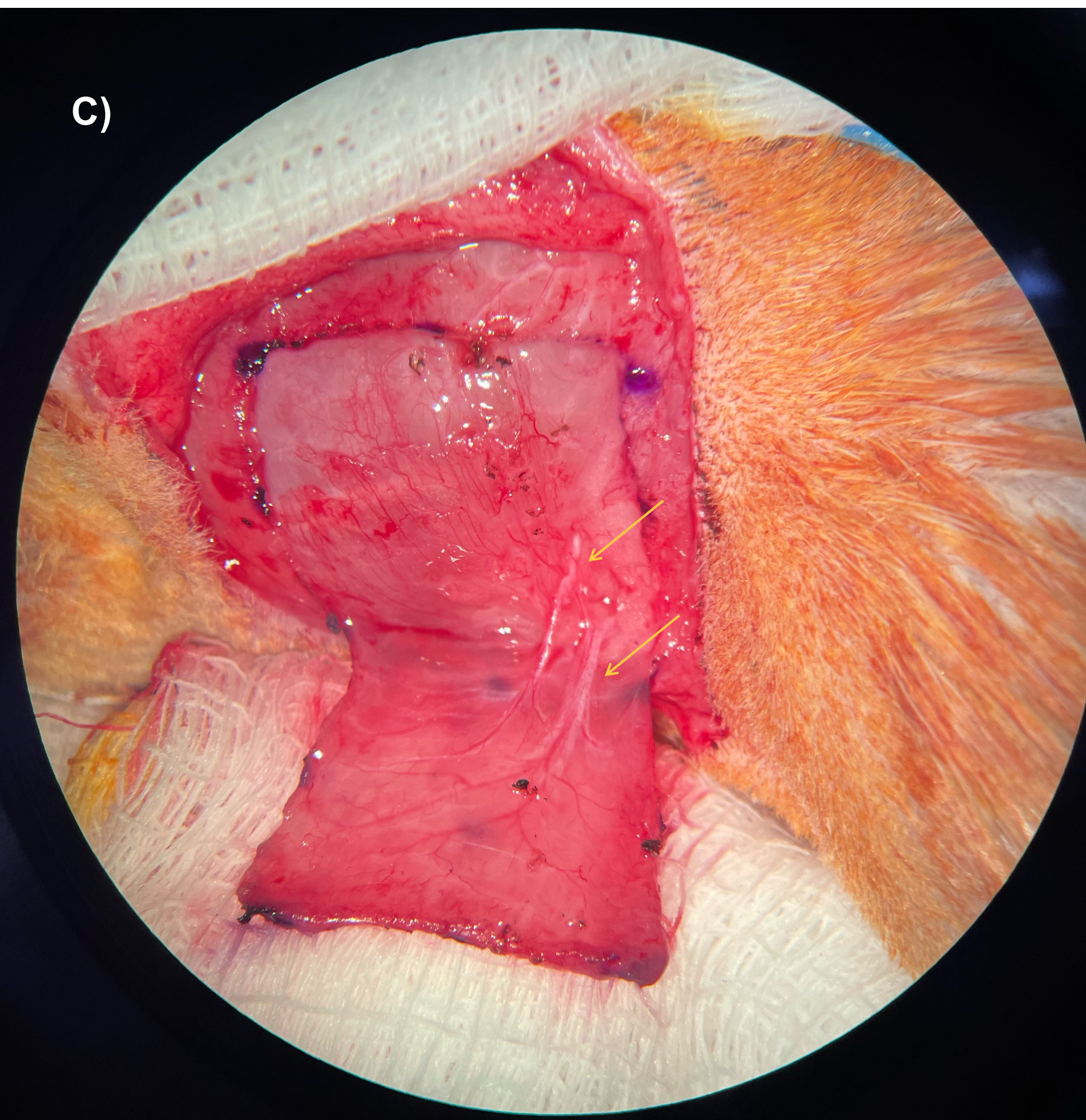
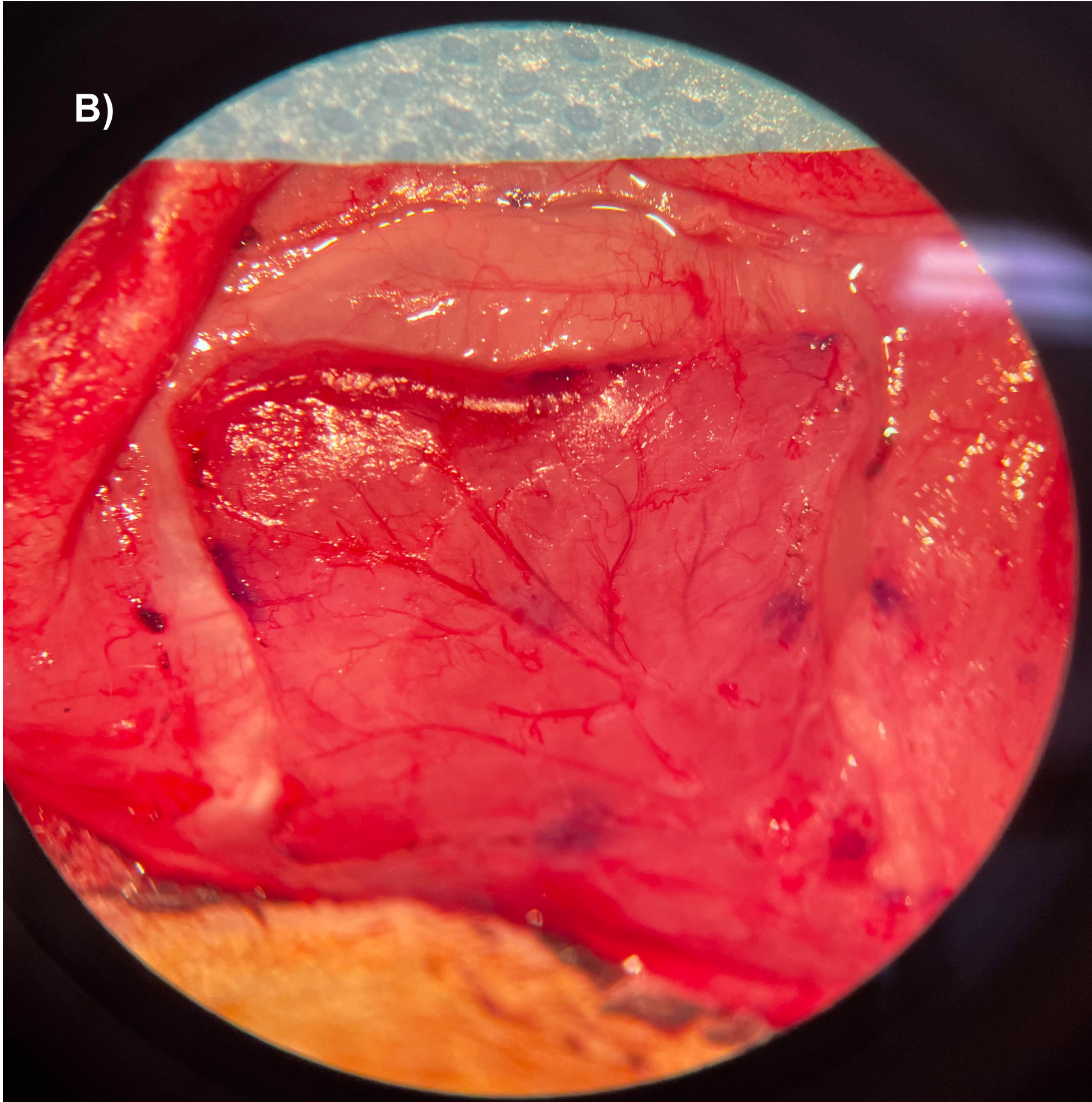
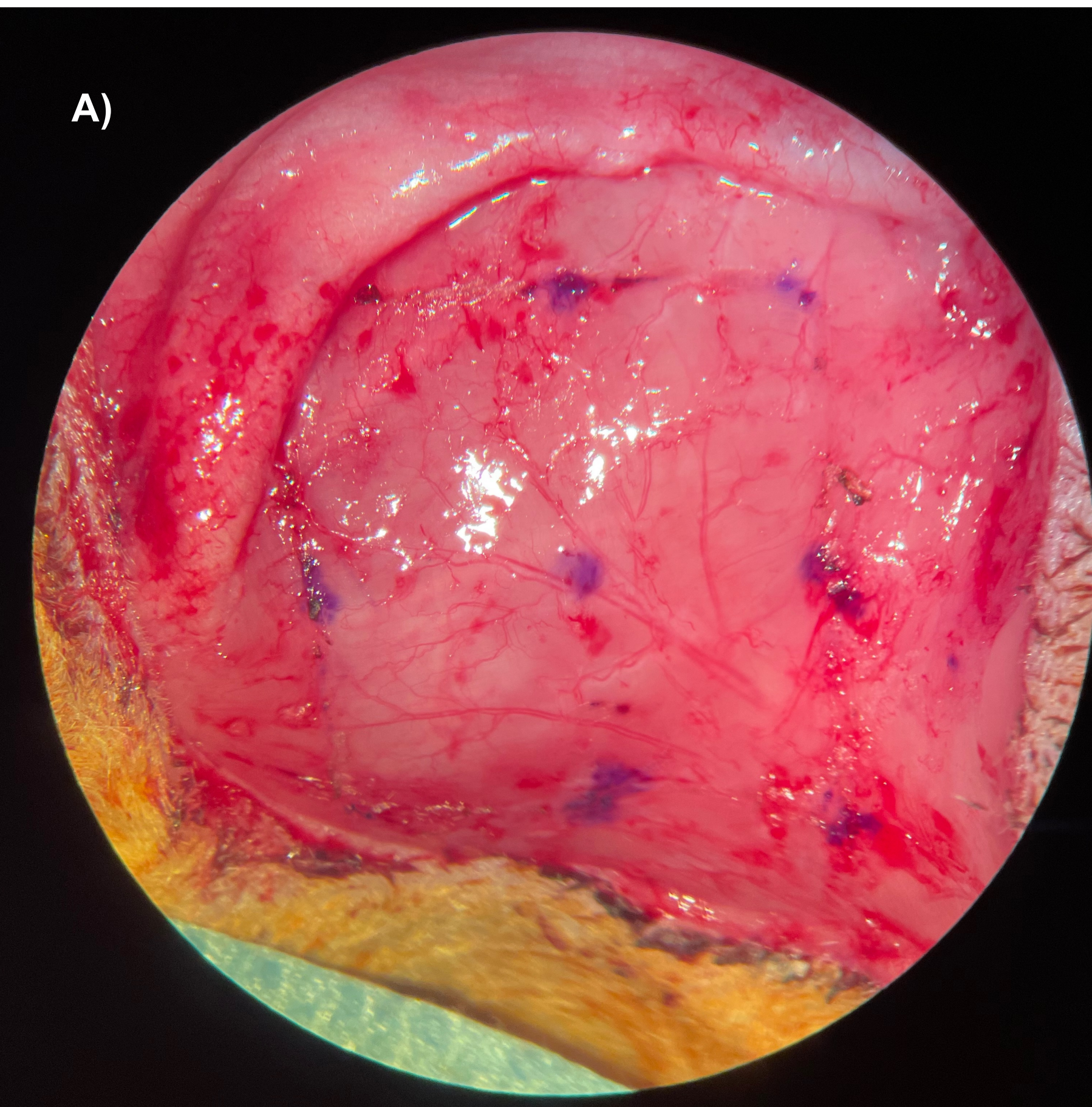
This anatomic study included 42 male Sprague Dawley rats, weighing between 240-380g. A 1.5 x 1.5 cm large platysma flap was designed, supplied by the cervical branch of the facial nerve and its accommodating vessel. Measurements were made of the distribution and quantity of cervical branches. The location and diameter of the neuro-vascular bundle was documented thoroughly. The muscle flap and the nerve branch were harvested for histologic analysis. To investigate muscle morphology and the distribution of neuromuscular junctions, immunohistochemistry and immunofluorescence stainings were utilized. The cervical branches were epoxy embedded and stained with toluidine blue for analysis of the axon count.

RESULTS

Successful elevation of the platysma flap was achieved in all 42 rats. The 0.63 mm (+/- 1) thick platysma flap was carefully separated from the skin and a 1.5 x 1.5 cm large square was excised, parallel to the muscle fiber direction. The middle of the flap was positioned superficial to the masseter muscle and the posterior edge was positioned superior to the margin of the mandible. The neuro-vascular pedicle, consisting of 2 (+/- 1) cervical branches and 1 vessel (+/- 0.6), was observed to course from posterior and enter the flap approximately in the lower posterior corner of the flap. The vascular pedicle had a diameter of 0.46 mm (+/- 0.1) and split into two smaller branches after entering the flap. The average length of the pedicle was 0.7cm. (+/- 0.11). Two major cervical branches were identified with a diameter of approximately 0.58 mm (+/- 0.1) and 0.59 mm (+/- 0.1). The neuro-vascular pedicle was located within the flap in all dissections. Flap elevation was feasible without interrupting the vascular supply of the muscle.

FIGURE 1

A) A 1.5x1.5cm large flap was marked on the platysma muscle, superior to the masseter muscle with the posterior edge lying superior to the margin of the mandible. B) The platysma flap was elevated without injuring the supplying neuro-vascular pedicle. C) Two major cervical branches (yellow arrows) were identified innervating the platysma flap. D) The supplying vessel (blue arrow) of the platysma flap was found to have a diameter of approximately 0.46 mm. Elevation was feasible without interrupting the vascular supply of the flap.



DISCUSSION

- One limitation of this platysma flap model is the small size of the vascular pedicle. An anastomosis of this size might be challenging, which is why we recommend to use it as a pedicled flap.
- As there are multiple cervical branches that innervated the platysma, this model is not ideal to investigate end-to-end nerve repair techniques.

CONCLUSIONS

- Elevation of a 1.5x1.5 cm large platysma flap in rats is feasible without interrupting its vascular supply.
- Our study established a novel rat model for platysma flap reconstruction, elucidating its anatomical and neurovascular features.
- Consistent anatomy of the innervating cervical branch and vascular pedicle were found within the 1.5 x 1.5 cm flap, making it a useful tool for denervation/reinnervation and/or devascularization/revascularization studies.
- This novel platysma flap model will pave the way for exploring alternative reconstruction techniques in preclinical animal models, facilitating the potential use of this flap in future facial reanimation procedures.

REFERENCES

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