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ID:

Histologic Changes Following Continuous Wave And Micropulse Transscleral Cyclophotocoagulation: A Randomized Comparative Study

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Feedback and Support

Purpose/Relevance:

To report the macroscopic and microscopic histological changes of cadaver eyes treated with micropulse transscleral cyclophotocoagulation (MPTCP) compared to conventional continuous wave transscleral cyclophotocoagulation (CWTCP).

Methods:

Twelve halves of globe from 3 pairs of adult cadaver eyes were randomly assigned to non-treated control, CWTCP, single MPTCP treatment, or double MPTCP treatments. Four-micron thick histological slides, with 100 micron intervals, were stained with hematoxylin and eosin. Presence and absence of 4 unique histologic changes were scored as split between the non-pigmented and pigmented ciliary process epithelium, separation of pigmented ciliary process epithelium from the stroma, coagulation of collagen and destruction of ciliary process stroma, and destruction of ciliary process epithelium. Fisher's exact tests and logistic regression analysis were used to assess the relationship between the histological lesions and treatment conditions.

Results:

A total of 498 slides were analyzed. The laser scars in all treated specimens were placed in the pars plana. Significant differences between treatment groups for

epithelium destruction ($P < 0.001$), separation ($P < 0.001$), and stromal coagulation ($P < 0.001$) features were observed, while splitting between the non-pigmented and pigmented epithelium occurred at similar rates amongst the three experimental groups and control. ($P = 0.188$). Logistic regression modeling showed the CWTCP-treated specimens were significantly more likely to experience separation of the pigmented epithelium from the stroma ($P = 0.02$), coagulation of collagen and destruction of ciliary process stroma ($P = 0.002$), and full-thickness destruction of ciliary process epithelium ($P = 0.03$). Single MPTCP treatment and double MPTCP treatment specimens experienced all histological outcomes in similar frequency to the control. Destruction of the ciliary process epithelium was observed exclusively in CWTCP-treated sections.

Discussion:

In this paper, we studied the macroscopic and microscopic histological features of MPTCP and compared it with conventional CWTCP and tissue without any treatment in human cadaver eyes. We found that macroscopically, all CWTCP and micropulse TCP scars were located at the pars plana instead of the pars plicata. Microscopically, CWTCP induced significant destruction of ciliary processes across multiple histological domains, whereas MPTCP did not. No significant difference in histological outcomes between either MPTCP treatment group and the control group or the MPTCP1 and MPTCP2 group compared to each other were observed.

This is the first study to assess the histological effects of MPTCP treatment applied to cadaveric eyes and to compare MPTCP treatment with conventional CWTCP. We found that CWTCP is associated with variable destruction of the ciliary processes across multiple dimensions, whereas MPTCP did not damage the ciliary processes significantly. Understanding the histology behind MPTCP treatments will help ophthalmologists and engineers better understand its safety profile and possibly spur improvement and development of novel and noninvasive treatments for glaucoma management.

Conclusion:

MPTCP and CWTCP treatment produces histologic changes in cadaver eyes that are significantly more pronounced in CWTCP-treated eyes. These findings may explain the increased rate of adverse effects following CWTCP treatment compared to MPTCP in living eyes.

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Category:

Surgery