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Fresh tympanic membrane perforations heal without significant loss of strength

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Purpose: Assessment of the strength of the tympanic membrane recently after an acute perforation has healed and assessment of the scar structure. Background: In previous studies efforts have been made to enhance the healing process of tympanic membrane perforations. The strength of the healed perforation has been tested with moiré interferometry in gerbils, but in no other species.

Material and methods: A laser myringotomy was made on ten Sprague-Dawley rats and ten CBA mice, and strength assessments were made after two or four weeks with moiré interferometry for strength measurement. Light and electron microscopy were performed after measurements.

Results: Sprague-Dawley rats: the stress-strain curve of the rat tympanic membrane displays an "S"-shape. The mean peak displacement at pressure loads of + and of – 350 daPa did not differ significantly in the ears with healed perforations as compared to the untouched tympanic membranes. Morphological assays showed a five-fold increased thickness at the site of the perforation due to invaded fibroblasts and extra cellular matrix at 2 and 4 weeks post myringotomy. The scar formation was predominant on the middle ear side of the lamina propria. CBA mice: the moiré interferometry method was not easily applicable due to technical difficulties in preparing the specimen.

Conclusion: Moiré interferometry was successfully done in the rat, while not in mouse. The strength of the spontaneously healed tympanic membrane after myringotomy was not significantly impaired due to a relatively thick scar formation. Thus, a recently closed perforation will probably tolerate the challenge by pressure gradient in every day life. Myringoplasty surgery performed with fascia underlay appears to be well in accordance with the way nature heals a tympanic membrane perforation: fibrous tissue medial to the remnant of the lamina propria.