Ridge at the medial rectus muscle insertion: A new anatomical landmark

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Background and Aim: Rectus muscle insertions are usually linear or slight curved with the anterior convexity. While operating squint surgeries, we found a presence of ridge-like structure at the medial rectus insertion. None of the other rectus muscle insertions had such structure. Materials and Methods: Patients undergoing squint surgery were included in the study. All the patients had negative forced duction test for all the gazes and had comitant strabismus. The patients underwent surgery through the fornix route. All the squint surgeries were primary. None of the patients undergoing resurgery were included in the study. The ridge seen is actually an elevated curved structure and shows discontinuation of the actual medial rectus insertion. The measurements were taken from the superior and inferior end of the medial rectus muscle insertion. Results: In a total of 76 medial rectus surgery (for recession or resection), we found the ridge was present in 68 (89.5%) of cases. The ridge was located at an average distance of 6.33 ± 1.5 mm inferior and 3.82 ± 0.9 mm superior to the superior and inferior point of medial rectus insertion, respectively. Conclusion: We describe the presence, morphology, and measurements of a ridge as an anatomical landmark at medial rectus insertion.

Key words: Linear muscle insertion, medial rectus, muscle insertion, rectus muscle insertion

Medial rectus is attached at 5.5 mm from the limbus.¹,² The insertion is normally a straight or a concave one with the most common type being a straight insertion in recent studies. The morphological appearance of the insertion is believed to be similar to other muscles.

We did a study to document an anatomical landmark that is a small ridge-like elevation in the lower half the medial rectus muscle.

Materials and Methods
All the patients undergoing medial rectus surgery were included in the study. The study included both the esotropia and exotropia surgeries. The muscle was dissected in the standard way through the intermedial fornix in all the cases. Once the muscle was secured with 6-0 Vicryl, it was cut and the insertion was examined for any ridge, and the measurements were taken from the superior end of the insertion and the inferior end of the insertion and recorded. The ridge seen is actually an elevated curved structure and shows discontinuation of the actual insertion [Fig. 1a and b].

We also looked for the ridge on the lateral rectus muscle insertions but found them to be linear.

Results
In a total of 76 medial rectus surgery (for recession or resection), we found the ridge was present in 68 (89.5%) cases. All the patients had negative forced duction test for all the gazes and had comitant strabismus. The mean age was 22.3 ± 12.6 years. Forty-two (55.3%) eyes were operated in patient who underwent surgery for esotropia that is medial rectus resection was done, and the rest 34 (44.7%) eyes were operated for esotropia in thirty patients, and here, medial rectus recession was done. Out of the 42 esotropia patients, the muscle ridge was seen in 36 (85.7%) eyes, and for the thirty esotropic patients, the muscle ridge was seen in 32 eyes (94.1%) out of 34 eyes. The muscle ridge was seen more commonly in esotropia than in exotropia. The mean length of insertion was 11.1 mm.

The measurements were taken from the superior and inferior end of the medial rectus muscle insertion. The ridge was located at an average distance of 6.33 ± 1.5 mm inferior and 3.82 ± 0.9 mm superior to the superior and inferior point of medial rectus insertion, respectively. This would be approximately two-third distance from superior end of insertion.

Discussion
It is important to have knowledge of the proper anatomic characteristics of the various extraocular muscles. The muscle insertion and its anatomy are important for the understanding the physiology of eye movements and for the operating surgeons.²,³ The most common shape of medial rectus insertion is linear or straight type. However, there are almost 46% eyes where the medial rectus muscle might show some variation.¹
It is known that the insertion of medial rectus muscle is 5.5 mm from the limbus. Although a large number of studies have been done for the measurement of distance none of the study comments on the morphological aspect of the insertion of medial rectus. Apt described in detail about the width of the muscle insertion but a presence of discontinuation or a ridge-like projection has never been described. Ruskell et al. described the differences in the medial rectus insertion compared to other recti muscle insertion and found that the number of smooth muscle cells and fat was higher at the insertion of the medial rectus. This smooth muscle according to him is nonfunctional. He also suggested that the smooth muscle may be part of a redundant third eyelid either lacking a capacity to contract or contracting ineffectively. The muscle width in our study was 11.1 mm for the medial rectus, and the presence of muscle ridge was at an average distance of 6.33 ± 1.5 mm inferior and 3.82 ± 0.9 mm superior to the superior and inferior point of medial rectus insertion, respectively. At present, this is just important anatomical landmark whose function is unknown. It would require a histopathological and electron microscopical view of this particular ridge that is the part of the medial rectus insertion. An interesting study on various rectus muscle insertions revealed that the part of the muscle insertion actually has a very short or a nonexistent tendon in most of the rectus muscle insertions. There was no detailed description of any such ridge in the cadavers, whereas we saw this particular ridge in patients undergoing squint surgery. The authors have mentioned that the global fibers would insert more remotely to the globe than the orbital fibers.

Sevel studied the fetus and embryo rectus muscles at various stages and proposed the development of lateral and medial rectus muscle from superior and inferior mesenchymal complex [Fig. 2a and b]. The authors describe two embryonic (not anatomical) origins of these two rectus muscles. Since the discontinuation is observed only in the medial rectus, we believe the medial rectus has a fused insertion with a minimal discontinuation at the two-third point from the superior end of medial rectus insertion. This particular discontinuation could be the ridge that we have observed clinically. Further, this may also be a reason for medial rectus having dual supply and the lateral rectus just having a single anterior ciliary artery.

Kushner and Morton described variation in medial rectus muscle insertion during surgery for infantile esotropia. One of the distinct formations/variation was the scalloped formation which had a small notch and occurred in 48 eyes of the total 160 eyes operated upon. The notch could be similar to the ridge we have described.

**Conclusion**

We have demonstrated a new anatomical landmark at the medial rectus insertion site. This muscle ridge is located at around two-third distance from the superior part of the medial rectus insertion. We hypothesize that the medial rectus originating from the superior and inferior mesenchyme does not fuse completely even at the insertion leaving a small discontinuation. This ridge may have a functional importance, or may be a remnant or may explain physiological aspects of ocular motility more clearly but that would require further research.

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**Conflicts of interest**

There are no conflicts of interest.

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