Lateral Canthal Support System in Japanese

By

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Summary: The present study aimed to elucidate microscopically the precise structure of the generally termed ‘lateral canthal tendon’ (LCT). Specimens from 9 post-mortem lower eyelids of 6 Japanese aged from 72 to 91 years old at death were fixed in 10% buffered formalin, and microscopically examined. Specimens were excised as exenterated samples including an area 5 mm wider than the orbital aperture. The removed contents were further incised longitudinally on the central eyelid and also incised parallel to the upper eyelid margin on the site 3 mm from its margin. After the preparation of microscopical examination, sections of all 9 eyelids were stained with Hematoxylin and Eosin. We found that the structure generally termed LCT consisted of two definitive different layers microscopically. The superficial layer was only an orbital septum (septal band). It was mainly constituted of thick fibers between adipose-rich tissues. The deep layer continued from the tarsus and projected posteriorly; which was a ligament (tarsoligamentous band). This tissue was constituted by thin, minute fibers with little adipose tissues. The structure generally termed LCT is not a tendon but a complex constitution of an orbital septum and a ligament; which we named, in a mass, ‘lateral canthal bands’, cooperatively supporting the lateral canthus.

The lateral canthus is supported by the lateral retinaculum as a whole¹. The tarsus is supported by a tissue generally termed ‘lateral canthal tendon’ (LCT)¹⁻³, which is one of the constitutive components of the lateral retinaculum. This tendon was formerly thought to be a ligament⁴⁻⁷. Later, this structure was regarded as a tendon of the pretarsal part of the orbicularis oculi muscle⁸. However, another study⁹ stated that the part attaching to the tarsus was a ligament, with its posterior portion being contiguous with a musculotendinous extension of the pretarsal orbicularis oculi muscle. Thereafter, Gioia et al.¹¹ described the detailed anatomy of the generally termed LCT. They reported that slips of the pretarsal orbicularis oculi muscle were seen to pass posteriorly to the orbital septum and intermingled with connective tissues of the LCT, and attachment of the lateral canthal angle to the orbital rim was a combined tendon-ligament connecting the pretarsal orbicularis oculi muscle and the tarsal plates to the orbital tubercle¹⁰. However, microscopical observations of the tendon and ligament were not obvious since they did not show totally clear tissue photographs. Additionally, Knize¹¹ advocated that the anterior part of the LCT (that they called the superficial LCT) was the thickening of the orbital septum and supported the lateral canthus. As exemplified above, views on the exact definition of LCT are still not completely unified.

In this study, we microscopically examined the structure generally termed LCT, and showed that the structure was microscopically constituted of two definitive different layers, each respectively corresponding to an orbital septum and a ligament. In addition, since the definition of the term ‘lateral
canthal tendon is obscure, we defined it on the basis of present anatomical findings.

Materials and Methods

Specimens from 9 post-mortem lower eyelids of 6 Japanese aged from 72 to 91 years old at death were fixed in 10% buffered formalin, and microscopically examined. All cadavers were registered with Aichi Medical University, and proper consent and approval were obtained prior to use. Methods for securing human tissues were humane and complied with the tenets of the Declaration of Helsinki.

Since we routinely dissected orbital tissues after detaching the skin from the orbicularis oculi muscle, 7 lateral canthal specimens were first removed without skin, but 2 specimens were taken with full thickness layers as exenterated specimens to observe the full thickness of the lateral canthus.

An area of 5 mm wider than the orbital aperture was first removed using a binocular loupe (high resolution prismatic (HRP) × 3.5, 420 mm/16 inches, Heine, Herrsching, Germany). After an incision into the peristium of the complete circumference of the orbit, posterior subperiosteal detachment was performed. The lateral orbital wall was removed to about 3 cm from the orbital rim and then, retrobulbar contents were excised with a sharp scalpel parallel to the coronal section. The removed contents were further incised longitudinally on the central eyelid and also incised parallel to the upper eyelid margin on the site 3 mm from its margin. Specimens were dehydrated and embedded in paraffin, and cut into 7-μm-thickness sagittal sections. Then, sections of all 9 eyelids were stained with Hematoxylin and Eosin.

Results

The tissue generally termed LCT microscopically consisted of definitive superficial and deep layers (Figs. 1A, B).

The superficial layer was constituted of the orbital septum, which was located in front of adipose tissues (Eisler's pocket). In the Fig. 1A, although the layer seems to continue to the pretarsal part of the orbicularis oculi muscle, the layer did not show the tendinous features. This layer, which pointed toward the orbital rim, mainly consisted of thick fibers between adipose-rich tissues (Fig. 2A).

The deep layer continued from the tarsus and projected posteriorly. There, the tissue was constituted of thin, minute fibers (Fig. 2B). On the way, this layer surrounded lacrimal gland tissues. Less adipose tissue was seen between the fibers in the deep layer.

Discussion

The present study showed that the tissue generally termed LCT was microscopically supported by two definitive different layers (Fig. 3). A ligament is defined as ‘a band or sheet of fibrous tissue connecting two or more bones, cartilages, or other structures, or serving as support for fasciae or muscles’, or as ‘any structure resembling this though not performing the function of such’. A tendon is defined as ‘a nondistensible fibrous cord or band of variable length that is part of the muscle that connects the fleshy (contractile) part of muscle with its bony attachment or other structure’. Therefore, the tissue generally termed LCT is not a tendon.

An area of 5 mm wider than the orbital aperture was first removed using a binocular loupe (high resolution prismatic (HRP) × 3.5, 420 mm/16 inches, Heine, Herrsching, Germany). After an incision into the peristium of the complete circumference of the orbit, posterior subperiosteal detachment was performed. The lateral orbital wall was removed to about 3 cm from the orbital rim and then, retrobulbar contents were excised with a sharp scalpel parallel to the coronal section. The removed contents were further incised longitudinally on the central eyelid and also incised parallel to the upper eyelid margin on the site 3 mm from its margin. Specimens were dehydrated and embedded in paraffin, and cut into 7-μm-thickness sagittal sections. Then, sections of all 9 eyelids were stained with Hematoxylin and Eosin.

Discussion

The lateral canthal ligament has previously been regarded as an only part attaching to the tarsus. These previous studies indicated that the tendon and the ligament were different components. However, some recent reports seemed to be confused with the terminology, as they referred to the tendon and the ligament together as being the LCT. On the contrary, two other reports did not refer to them together, which seems to have stated the true anatomy of the lateral canthus. The LCT is, therefore, not an accurate term. The deep layer corresponds to a ligament, and, strictly speaking, this is the true lateral canthal ligament. In a former study, this part was accurately named the ‘tarsoligamentous band’. The superficial layer

Fig. 1A. (superior: anterior, right: lateral): Low magnification photograph of the lateral canthus. The superficial layer is the orbital septum, in front of adipose tissues (Eisler’s pocket). This layer, which pointed toward the orbital rim, mainly consisted of thick fibers between adipose-rich tissues. (Hematoxylin and Eosin staining, ×20)

Fig. 1B. (superior: anterior, right: lateral): Almost the same configuration with the Fig. 1A is shown, but the involutional changes in the orbital septum are outstanding.

Fig. 2A. High magnification photograph of area ‘1’ in Fig. 1A (septal band: orbital septum). The tissue mainly consists of thick fibers. Between the fibers, a lot of adipose tissue is seen. (Hematoxylin and Eosin staining, ×200)

Fig. 2B. High magnification photograph of area ‘2’ in Fig. 1A (tarsoligamentous band: ligament). The tissue is constituted of thin, minute fibers. Little adipose tissue is seen between the fibers. (Hematoxylin and Eosin staining, ×200)
corresponds to an orbital septum. We named this part as the ‘septal band’. We suggest, therefore, that the ‘lateral canthal bands’ are a much more accurate name compared with the generally termed LCT.

The septal band is the same structure as the superficial LCT in the Knize’s study. The orbital septum in this part is highly thickened in comparison with other parts of it. We showed, however, in a previous study both microscopically and macroscopically in a sagittal slice that the septal band was the tendon of the pretarsal part of the orbicularis oculi muscle. To be sure, although the pretarsal part of the orbicularis oculi muscle seemed to continue to the fibrous tissue (Fig. 1A), this fibrous tissue did not show the dense stratified structures typical to a tendon. In the present study, since all the samples were incised in axial sections, we could confirm the precise findings of the septal layer. The septal layer is not a tendon but an orbital septum.

We also found in this study that the septal band was much more involutional than the tarsoligamentous band (Fig. 1A, B). Involutional changes of the orbital septum may be accelerated by the continual contractions of the orbicularis oculi muscle. The tarsoligamentous band may be affected by the indirect tractional force from the orbicularis oculi muscle. The force applied to the tarsoligamentous band is, however, thought to be weaker than the one applied to the septal band, because the tarsoligamentous band basically only serves as a static support for the lateral canthus. This conjecture may explain the differences in involutional changes of these two structures.

In conclusion, we showed the tissue generally termed LCT is not a tendon but a complex structure, ‘lateral canthal bands’. The lateral canthal...
bands are constituted of two definitive different structures: an orbital septum (septal band) and a ligament (tarsoligamentous band); which cooperatively support the lateral canthus.

References