Cosmetic Surgery Times®
Where the Exchange on Aesthetic Perspective Begins
JANUARY 2004 • Vol. 7, No. 1

Revised anatomy of CSM alleviates need for cosmetic repair

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Munster, Ind. — *Gray's Anatomy* and *Anatomy for the Surgeon* have been physicians' resources for decades, but new research being done may redefine some of the basics doctors have long taken for granted — leading to more appealing cosmetic results, and likewise the avoidance of suboptimal outcomes and the need for cosmetic repair.

Less than optimal results during an endoscopic brow lift have been attributed to inadequate resection of the corrugator supercilii muscles (CSM). Complications following Botox injections can also be traced to problems with the CSM. A recent study (pub. Archives of Facial Plastic Surgery, 2003;5:412-415) may lead to a new understanding of the muscles in the forehead, helping cosmetic surgeons achieve better results in rejuvenating the forehead.

Jung I. Park, M.D., Ph.D., department of surgery, Northwest Center for Medical Education, and a voluntary clinical assistant professor at Indiana's School of Medicine, and his colleagues conducted cadaver studies to investigate the anatomy of CSM.

Results of brow lifts endoscopic could be more successful with a better understanding of the anatomy of the muscles of the forehead.

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> JUNG I. PARK
> M.D., Ph.D.

Dr. Park says the investigation started because he believed information about the anatomy of the forehead was lacking, as he did endoscopic brow lifts.

Anatomy for the Surgeon has a picture showing the origin of the CSM as a small circle between the eyebrow and nose. It's been shown as a slim, slender muscle. Other textbooks don't even have a description of the CSM, but they do have a picture that shows just a little portion of the muscle.

"I started out trying to clear my concept of the muscle, so the next time I did surgery I would have a clearer concept. Even if I couldn't see the whole picture on a particular patient, I would know to what extent I could dissect it."

The study looked at eight cadaver foreheads — four men and four women.

Reference points were marked on the cadaver faces to indicate the medial canthus, the supraorbital notch/foramen, and the lateral canthus, then vertical lines were drawn through the midline (M), the medial canthus (MC), the supraorbital notch/foramen (SO), and the lateral canthus bilaterally. Horizontal lines were then drawn through the medial canthus (MCH), the supraorbital notch/foreman (SOH), and above the supraorbital notch/foramen (2CM, 3CM).

Trapdoor-type flaps were developed in the subgaleal plane and the bone origins of the CSM were identified.

Dr. Park, who is boarded by both the AAFPRS and the AACS, says that is when he started discovering how the real muscle differed from the commonly published versions.

"During my dissection, I found that the muscle had a broad-based origin from near the midline to the supraorbital notch. The muscle then extended all the way to the lateral one-third of the eyebrow. Additionally, the height of the muscle is much higher than previously believed."

The measurements from all of the cadaver CSMs were averaged and researchers found that the origin of the CSM is a wide base, measuring 0.98 by 2.52 cm on the right side and 1.04 by 2.35 cm on the left. The lateral extent of the CSM insertions was 4.27 cm from the

midline on the right, and 4.50 cm on the left.

Dr. Park says the muscle's make-up is also different from what was previously thought.

"The muscle goes, not as one bulk, but as sheets of muscle compacted together. It runs in a somewhat slanted fashion, then it is blended to the eyebrow muscle and skin, and extends much farther out than what most people thought, or what most people described."

According to Dr. Park, the reason he found the differences was because he approached the dissection in a non-traditional manner.

"When the anatomists and everybody else were dissecting the muscle, it was universally routine to peel off the skin, peel off the fat, then find the muscle from the top. But the uniqueness of this muscle is that as it goes out, it blends in with two other muscles, so that when dissecting from the top, the anatomists may not have had a good idea as to which muscle is which.

"It's like looking for a needle within a particular pile of needles. It's hard to find a needle on its own, but if you locate the string attached to the needle and follow it down, then you find the needle for sure." Dr. Park's 'string' was finding the origin of the CSM.

"I approached it differently. Nobody dissects the anatomy from the bone up. Everybody dissects skin first. The bone is the last thing you see and dissect. What you see from the surface, in this instance, is all blurred, especially when you don't have a real intention of dissecting that particular muscle."

That's what Dr. Park says happened with most anatomists. "The traditional researchers, especially in the old days, had absolutely no idea what cosmetic surgery was. The early surgeons had absolutely no desire, no idea of searching for that muscle with any intensity. Despite their very careful dissection, they saw the muscle, but without getting to the bottom of it."

The results of the study should give doctors a better understanding of what they need to do to adequately resect the CSM during the endoscopic brow lift. Dr. Park says the benefits could be even more important during Botox treatments.

The new anatomical knowledge is expected to aid in the success of Botox treatments by allowing injection into exact areas and in smaller amounts.

"When you inject Botox, it works by diffusion — when you inject one spot, it goes all directions to the same degree. When Botox is injected at the peripheral portions of the muscle, the Botox can end up 70 percent in the muscle and 30 percent outside of the muscle, for example, either wasting expensive Botox, or causing an undesirable, unintended effect to the surrounding muscles.

"Now, if you put the Botox in the center of the real muscle based on my study, it will diffuse in all directions and be very efficient, cost effective. Better yet, when you inject in the center, you don't allow excess toxin to go down below the eyebrow to where the muscle is that controls the eyelid.

"One of the most frequent complications from Botox injections is developing a ptosis. The levator muscle is very delicate, and when it is affected by Botox, it takes several weeks before the eye opens again. This can be prevented if you inject the Botox in the right places in smaller amounts. Then it will diffuse just right."

Dr. Park says that knowing the exact anatomy of the corrugator supercilii muscle results in a better execution of the procedure. **CST**

The anatomy of the corrugator supercilii proved to be critical.

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