J Surg Med. 2020;4(4):251-254.
DOI: 10.28982/josam.711748

Research article
Araştırma makalesi

Journal of Surgery and Medicine
e-ISSN=2602-2079

Is Pitanguy's ligament a true ligament? A prospective cohort study

Pitanguy ligamenti gerçek bir ligament midir? Bir prospektif kohort çalışma

Ali Seyed Resuli [1]

[1] **Istanbul Yeni Yüzyıl University, Faculty of Medicine, Department of ENT, Istanbul, Turkey**

ORCID ID of the author(s)
ASR: 0000-0002-4262-1302

Abstract

Aim: Facial region anatomically differs from other parts of the body by various structures it contains, for example, the superficial musculoaponeurotic system (SMAS). Among these structures, the most discussed is the dermocartilaginous ligament (DCL). There are some researchers who claim that this ligament is the continuity of the SMAS as well as those who consider it to be a separate ligament. Our aim is to determine whether the DCL, known as Pitanguy's ligament, is a true ligament based on histopathologic findings.

Methods: Open technique rhinoplasty was performed to all 52 patients with nasal obstruction and deformity complaints. During the operation, specimens were excised from the tissues thought to be the DCL in all patients for histopathological examination, which was performed by pathologists.

Results: Gross findings during the operation revealed that in most of the 52 patients, white dense fibrotic tissue, considered the DCL, was observed in the middle part of the nose. During histopathological examination, vascularized fibromuscular tissue fragments were observed in one patient and edematous connective tissue components were seen in the others.

Conclusion: Based on our results and literature research, the presence of fibrous tissue components in the intermedial crural area demonstrates that the DCL is a true ligament, but the absence of regular dense fibrous tissue components in our histopathologic findings requires further histological studies. In addition, we believe that DCL should be preserved to obtain natural and functional noses in open technic rhinoplasties.

Keywords: Dermocartilaginous ligament, Pitanguy's ligament, M. depresor septi nasi, Superficial musculoaponeurotic system, Histopathology

Öz

Amaç: Fasiyal bölgede yüzeysel musküloaponörotik sistem (SMAS) adı verilen bir yapı olması nedeniyle, fasiyal bölgenin anatomik yapısında diğer vücut bölgelerinden farklılıkları vardır. Bu yapılar arasında en çok tartışılanı dermokartilajinöz ligamenttir (DCL). Bu ligamentin farklı bir ligament olduğunu düşünenlerin yanı sıra SMAS'ın devamlılığı olduğunu iddia eden bazı araştırmacılar da vardır. Bu çalışmadaki amacımız, Pitanguy'un ligamenti olarak bilinen DCL'nin histopatolojik bulgulardan sonra gerçek bir ligament olup olmadığını ortaya koymaktır.

Yöntemler: Burun tıkanıklığı ve deformite şikâyeti olan 52 hastanın hepsine açık teknik rinoplasti operasyonu uygulandı. Tüm hastalarda operasyon sırasında DCL olduğu düşünülen dokulardan histopatolojik inceleme için örnekler alındı. Histopatolojik incelemeler patologlar tarafından yapıldı.

Bulgular: Operasyon sırasında izlenen gross bulgularda 52 hastanın çoğunda bunun orta kesiminde DCL olduğu düşünülen beyaz dens fibrozis görüldü. Bir hastanın histopatolojik sonucunda vaskülarize fibromusküler doku fragmanları tespit edilmiş olup diğer hastaların spesmenlerinde ödemli bağ doku elemanları görülmüştür.

Sonuç: Elde ettiğimiz sonuçlara göre ve literatür ile karşılaştırıldığında gross bulgularda intermediyal krural alanda fibröz doku komponentlerinin varlığı DCL'nin gerçek bir ligament olduğunu gösterse de histopatolojik sonuçlarımızda düzenli sıkı bağ dokusu elemanlarının olmaması daha ileri histolojik çalışmaların yapılması gerektiğini ortaya koymaktadır. Ayrıca açık teknik rinoplastilerde doğal ve fonksiyonel burunlar elde edebilmek için DCL'in korunması gerektiğine inanmaktayız.

Anahtar kelimeler: Dermokartilajinöz ligament, Pitanguy'un ligamenti, M. depresor septi nasi, Yüzeysel musküloaponörotik sistem, Histopatoloji

Corresponding author/Sorumlu yazar:
Ali Seyed Resuli
Address/Adres: İstanbul Yeni Yüzyıl Üniversitesi, Tıp Fakültesi, Kulak Burun Boğaz Anabilim Dalı, İstanbul, Türkiye
e-Mail: a.s.resul@hotmail.com

Ethics Committee Approval: The study was approved by Yeni Yuzyil University Ethical Committee (12/24/2018-042). All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.
Etik Kurul Onayı: Bu çalışma Yeni Yüzyıl Üniversitesi Etik Kurulu (24.12.2018-042) tarafından onaylanmıştır. İnsan katılımcıların katıldığı çalışmalardaki tüm prosedürler, 1964 Helsinki Deklarasyonu ve daha sonra yapılan değişiklikler uyarınca gerçekleştirilmiştir.

Conflict of Interest: No conflict of interest was declared by the authors.
Çıkar Çatışması: Yazarlar çıkar çatışması bildirmemişlerdir.

Financial Disclosure: The authors declared that this study has received no financial support.
Finansal Destek: Yazarlar bu çalışma için finansal destek almadıklarını beyan etmişlerdir.

Published: 4/11/2020
Yayın Tarihi: 11.04.2020

How to cite/Atıf için: Resuli AS. Is Pitanguy's ligament a true ligament? A prospective cohort study. J Surg Med. 2020;4(4):251-254.

Introduction

The facial region differs from other areas of the body. The soft tissue between the skin and osseocartilaginous skeleton in the face consists of four layers: Superficial fatty layer, superficial musculoaponeurotic system (SMAS), deep fatty layer and perichondrium or periosteum layer [1]. The SMAS contains a superficial fatty layer, a fibromuscular layer, a deep fatty layer, a longitudinal fibrous sheet and an intercrural ligament [1, 2]. The deep fatty layer, composed of loose areolar fat tissue, separates the fibromuscular layer from the pericondrium-periostium, allows SMAS mobility and contributes to facial expressions [1]. There are no fibrous reticulated structures in this tissue layer which form a surgical dissection plan [2]. The SMAS allows the distribution of forces resulting from contractions of multiple muscles. The fibrous component of the SMAS is usually in two layers, consisting of superficial and deep fascia for each nasal muscle. Thus, the nasal muscles and their facia function as a single unit. Each nasal muscle and their fascia are interconnected by a nasal SMAS component and their movements are balanced by the SMAS. This complex structure with nasal muscles and ligaments formed by the SMAS aids in phonation, respiration and formation and control of the facial mimic movements [3]. The SMAS extends superiorly to the galea aponeurotica at the rhinion level, inferiorly joins the M. procerus fascia and caudally connects with interdomal cross fibers at the nasal dorsum. It also forms the dermocartilaginous ligament (DCL) described by Pitanguy in the supratip region, passes through the intermedial crural area, combining with the M. depresor septi nasi [4]. This structure described by Pitanguy has been presented by some researchers as an extension of the SMAS rather than a true ligament [5,6]. The aim of this study is to investigate whether the DCL is a true ligament by revealing the histological features of this structure.

Materials and methods

This prospective cohort study was conducted between 2018 and 2019 at the Otorhinolaryngology Department of Istanbul Yeni Yuzyil University and Bahat Hospital. Fifty-two patients who underwent open technique rhinoplasty by a single surgeon for nasal obstruction and deformity were included. Approval of Yeni Yuzyil University Ethical Committee (24.12.2018/042) and written informed consents were obtained from the patients after full explanation of the procedure. The principles of the Declaration of Helsinki and Guidelines for Good Clinical Practices were adhered to during the study.

Open technique rhinoplasty operation was conducted under general anesthesia, beginning with a transcolumellar V incision, which was extended by staying in the subcutaneous tissue until the medial crura was reached. Care was taken not to damage the tissues filling the space between the medial crura and to preserve the soft tissue in the columellar flap. The perichondrium of the middle crura was cut with sharp tip scissors. Elevation was continued through the subperichondrial plane with the help of septal mucosal elevator. The dissection was extended into the interdomal region, keeping the perichondrium of the two middle crura in the flap. The perichondrium was then cut at the caudal edge of the lower lateral cartilage and included in the skin flap. After the dissection of the lateral crura was completed, the central fibromuscular tissue stretching under the skin flap was reached. The tissue considered to be the dermocartilaginous ligament was marked and identified as Pitanguy's ligament. After the DCL was elevated from the intercrural region, a tissue of approximately 4x3 mm in size was removed, placed into solution, and sent to histopathological analysis.

Histopathological analysis of 52 specimens excised from the DCL was performed by pathologists. The tissues were immediately fixed in 10% formalin for 24 hours. After decalcification in 5% hydrochloric acid, the specimens were embedded in paraffin, serially sectioned, and stained with Masson trichrome and Hematoxylin & Eosin stains. Then, microsections were observed under light microscopy.

Statistical analysis

The analysis was performed using SPSS Statistics 20 software. The data were reported as mean (standard deviation) (SD).

Results

Gross findings

In most patients, following the dissection of the lateral crura, as central fibromuscular tissue was reached, a group of dense fibrotic bands passing through the intermedial crural region were visualized in the middle part of the nose, and recognized as the DCL, also known as Pitanguy's ligament. The ligament was surrounded by subcutaneous tissue (Figure 1).

Histopathologic findings

Histopathological analysis of the specimens of 52 patients (38 males, 14 females, with an overall mean age of 26.8 (4.23) years) was conducted. We herein present two samples: In Specimen 1, the tissue was excised from the junction of the ligament and muscle. All other specimens were excised from the region anatomically compatible with DCL. The findings of specimen 1 (2%) was the most interesting in terms of revealing the ligament histology. In the specimens of the other 51 (98%) patients, the histopathological findings were similar to those of Specimen 2, as explained below:

Specimen 1

Macroscopic findings: The specimen consists of cream-colored soft tissue that measures 0.6x0.4x0.2 cm in aggregate.

Microscopic findings: Fibromuscular tissues rich in stromal vascular fractions were observed during the examination of microsections (Figure 2).

Pathological diagnosis: Vascularized fibromuscular tissue fragment

Specimen 2

Macroscopic findings: The specimen consists of cream-colored soft tissue which measures 0.7x0.6x0.5 cm in aggregate.

Microscopic findings: Fibrosis, mature adipocytes, sparse inflammatory cell infiltration, dilated vascular structures were observed in the edematous stroma during the examination of microsections (Figure 3).

Pathological diagnosis: Edematous connective tissue

Figure 1: Dermocartilaginous ligament (Pitanguy's ligament)

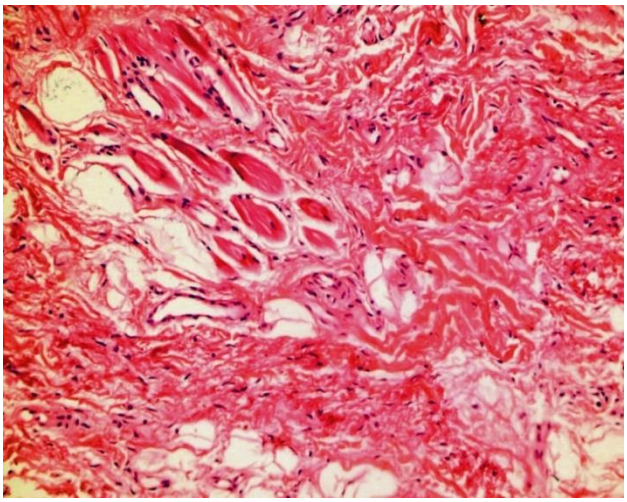

Figure 2: Microscopic image of Specimen 1 (Hematoxylin and eosin staining X40)

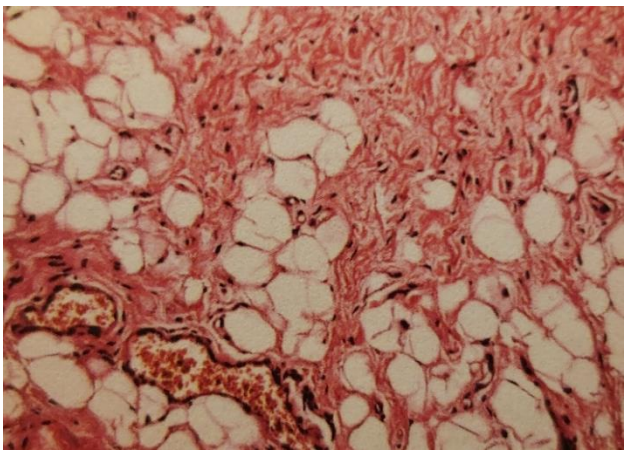

Figure 3: Microscopic image of Specimen 2 (Hematoxylin and eosin staining X40)

Discussion

Recently, septorhinoplasty operations have increased considerably. In addition to the aesthetic appearance, it has become important to consider the ligaments and soft tissues of the nose in terms of functional results. If these structures are not given the necessary attention, the appearance, and functions of the nose (breathing, participation in facial expressions and speech) will be insufficient. One of the most important structures in the nose is the nasal dermocartilaginous ligament described by Pitanguy [7-12], functions of which include:

- Contributing to depressing nasal tip,
- Contributing to elevating the middle part of the upper lip during laughing,
- Contributing to lowering the dorsal border of columella, nasal type and nostril,
- Contributing to the mobilization of the nasal type during speech and laughing
- Contributing to the expansion of the nostril stretching the membranous septum of the nose at the beginning of the inspiration.

In 1965, the presence of DCL in blacks and bulbous noses was revealed by Pitanguy in his article with the following statement: "Subperichondrial exposure made possible the observation of the presence of a ligament, uniting the derma of the upper third of the nose to the junction of the crux medialis, penetrating anteroposteriorly to help the formation of the fibrous septum." [4]. By 1995, Pitanguy et al. [13] had emphasized the effect of this ligament on the balance of the dorsal tip structures, and even proposed the classification of the ligament by thickness. In 2001, Pitanguy [14] also stressed the role of DCL and proposed the transection of the ligament to increase tip rotation, eliminating tip dependency and preventing bulbosity.

Some researchers claim that this structure, rather than a complete ligament, is the extension of the medial layer of the SMAS, extending from the nasal dermis of supratip to M. depressor septi nasi in the subcolumellar region [5-7].

The results of an anatomical and clinical study, performed by Hwang et al. [15] on adult cadavers and 123 patients, reported that the DCL was the ligament of M. depressor septi nasi based on histological examination. It was also stated that nasal tips were elevated after the resection of the DCL and nasolabial angles increased in 123 patients, thus revealing that depressor septi nasi muscle depressed the nasal tip by DCL.

There are two classes of connective tissue proper: loose and dense. Loose connective tissue is the most common type of connective tissue that fills the muscle cells, supports epithelial tissue, and forms layers of lymphatic and vessels. Fibroblasts, macrophages, collagen, elastic, and reticular fibers can be observed in this connective tissue. Dense connective tissue takes on the role of resistance and protection. It contains the same cells as loose connective tissue but there are fewer cells and more collagen fibers. Dense connective tissue is also divided into regular dense connective tissue and irregular dense connective tissue. In dense regular connective tissue, collagen fibers are arranged in bundles without a definite orientation, as in the dermis. In regular dense connective tissue, fibroblasts are arranged in a straight orientation to resist forces from the same direction. They show great resistance to traction forces [16]. The most prominent example of regular dense connective tissue is the ligaments, which consist of dense fibrous bundles of collagenous fibers, spindle-shaped cells known as fibrocytes and various connective tissue components. Ligaments are also divided into two groups, as those rich in collagenous fibers and those rich in elastic fibrils [17]. The results of the cadaver studies by Han et al. [18] revealed that the DCL is composed of thin, intertwined collagenous fibers which do not show a regular orientation. According to them, although the ligament comprises mostly collagen fibers, few elastic fibers are also visible. Even if several amorphous connective tissue elements were seen, muscle fibrils and chondrocytes were absent. Park et al. [19] also reported similar results with Han et al. In the findings of Pitanguy, muscle fibers and chondrocytes were shown at the region of the DCL. This may be due to the presence of M. depressor septi or M. nasalis transversa in the sections, or the insertion of the muscle cells to the tendon. Besides, Pitanguy defined the DCL as the

connective tissue in the deep layers of the skin. Letourneau and Daniel argue that the DCL is formed by condensation of the parallel collagen fibers in the SMAS layer [20]. In the studies conducted by Saban et al. [5] and Cakir et al. [6], no fibrous structure was found between the middle crurae in histological examination. In our results, the presence of fibrous structures in the specimens excised from the intermedial crural area considered as the DCL and the gross findings showing the presence of the DCL demonstrate that the DCL is a true ligament as explained by Pitanguy. However, regular dense connective tissue and its components are not seen in our histological examinations and many studies in the literature do not define this structure as a ligament. Therefore, further anatomical and histological studies are needed to determine whether the DCL is a true ligament.

Limitations

The main limitation of the study was the absence of regular dense fibrous tissue components in our histopathologic findings, which reveals the need for further histological studies. Other shortcomings included the fact that biopsy was not obtained from multiple parts of DCL and the small number of patients. In future studies, we plan to increase the number of patients, investigate patients who underwent open rhinoplasty, and to add electromyographic Evaluation of M. depressor septi nasi examination to the research protocol.

Conclusion

We believe that the Pitanguy's ligament is the ligament of the M. depressor septi nasi. Preservation of this ligament in open rhinoplasty will contribute to the functions of M. depressor septi nasi and allow the nasal tip to participate in facial mimic movements.

Acknowledgments

The author would like to thank; Bahat Medical Center Group's Hospitals chief physician Dr. Hamza Bahat, pathologist Dr. Nedim Polat, İstanbul University, Cerrahpaşa Medical Faculty, Department of ENT and İstanbul Yeni Yüzyıl University, Department of ENT.

References

1. Letourneau A, Daniel RK. The superficial musculoaponeurotic system of the nose. Plastic and Reconstructive Surgery. 1988;82(1):48-57.
2. Smith O, Goodman W. Open rhinoplasty: its past and future. The Journal of Otolaryngology. 1993;22(1):21-5.
3. Bruintjes TD, van Olphen AF, Hillen B, Weijs WA, T. Electromyography of the human nasal muscles. European Archives of Oto-rhino-laryngology. 1996;253(8):464-9.
4. Pitanguy I. Surgical importance of a dermocartilaginous ligament in bulbous noses. Plastic and Reconstructive Surgery. 1965;36(2):247-53.
5. Saban Y, Andretto Amodeo C, Hammou JC, Polselli R. An anatomical study of the nasal superficial musculoaponeurotic system: surgical applications in rhinoplasty. Archives of Facial Plastic Surgery. 2008;10(2):109-15. doi: 10.1001/archfaci.10.2.109.
6. Cakir B, Oreroğlu AR, Doğan T, Akan M. A complete subperichondrial dissection technique for rhinoplasty with management of the nasal ligaments. Aesthetic Surgery Journal. 2012.;32(5):564-74. doi: 10.1177/1090820X12445471.
7. Han SK, Lee DG, Kim JB, Kim WK. An anatomic study of nasal tip supporting structures. Ann Plast Surg. 2004;52(2):134-9.
8. Bruintjes TD, van Olphen AF, Hillen B, Huizing EH. A functional anatomic study of the relationship of the nasal cartilages and muscles to the nasal valve area. The Laryngoscope. 1998;108(7):1025-32.
9. Krause CJ, Pastorek N. Aesthetic Facial Surgery. 1st Ed. 1991; Philadelphia, Lippincott.
10. Clark MP1, Greenfield B, Hunt N, Hall-Craggs M, McGrouther DA. Function of the nasal muscles in normal subjects assessed by dynamic MRI and EMG: its relevance to rhinoplasty surgery. Plastic and Reconstructive Surgery. 1998;101(7):1945-55.
11. Stoddard DG, Pallanch JF, Hamilton GS. The effect of vibrissae on subjective and objective measures of nasal obstruction. American Journal of Rhinology & Allergy. 2015;29(5):373-7. doi: 10.2500/ajra.2015.29.4209.
12. Figallo EE, Acosta JA. Nose muscular dynamics: the tip trigonum. Plastic and Reconstructive Surgery. 2001;108(5):1118-26. Doi: 10.1097/00006534-200110000-00003.
13. Pitanguy I, Salgado F, Radwanski HN, Bushkin SC. The surgical importance of the dermocartilaginous ligament of the nose. Plast Reconstr Surg. 1995;95(5):790-794.
14. Pitanguy I. Revisiting the dermocartilaginous ligament. Plastic and Reconstructive Surgery. 2001;107(1):264-66.
15. Hwang K, Kim DJ, Hwang G. Relationship between depressor septi nasi muscle and dermocartilagenous ligament; anatomic study and clinical application. Journal of Craniofacial Surgery. 2006;17(2):286-90.
16. Junqueira L, Carneiro J. Basic histology: text & atlas. McGraw-Hill Professional; 2005.
17. Britannica. T.E.O.E. Ligament. 25.04.2019-10.10.2019. https://www.britannica.com/science/ligament.
18. Han S-K. Anatomy of the Dermocartilaginous Ligament of the Nose, in Advanced Aesthetic Rhinoplasty. Springer. 2013. pp. 25-32.
19. Park DJ, Han SK, Jeong SH, Kim WK. Anatomy of Pitanguy's Dermocartilaginous Ligament. J Korean Soc Plast Reconstr Surg. 2007;34(2):176-80.
20. Letourneau A, Daniel RK. The superficial musculoaponeurotic system of the nose. Plast Reconstr Surg. 1988;82(1):48-57.

This paper has been checked for language accuracy by JOSAM editors.
The National Library of Medicine (NLM) citation style guide has been used in this paper.