DOI: 10.7860/JCDR/2021/50027.15105

Review Article

Anatomy Section

Architecture of the Musculus Uvulae- A Review

L DAISY[1], S SURRAJ[2], C MRUDULA[3], P RAO SUSHMA[4]

ABSTRACT

The architecture of the musculus uvulae is a subject of, especially with regard to its crucial role in maintaining the morphology of the cleft palate, and its involvement in surgical procedures of palate repair. Its functional role in the closure of the velum and elevation of the same leading to voice changes are also an element of debate. The fate and orientation of its muscle fibres and its reinforcement with other related muscles of the palate raise concerns with regard to its functional role. Its positioning in the soft palate would give us an insight on the exact role played by this muscle in velopharyngeal closure. Its nerve supply also remains shrouded by various theories without conclusive evidence. Hence, this review aims to highlight its morphological role for the same.

Keywords: Cleft palate, Palate repair, Soft palate, Velopharyngeal closure

INTRODUCTION

The musculus uvulae that forms the bulk of the soft palate, has until recent years, been studied with neglect both functionally and morphologically as it is a muscle that is by far the least understood with regard to its architecture within the soft palate. Its architecture and taut role within the palate has been recently observed, in adult cadaveric oral specimens and also within the foetuses [1,2]. The musculus uvulae is less understood in terms of its morphology and architecture and there are a few studies supporting it [1-7], with regard to its exact fibre orientation. In this article, an attempt has been made by the authors to delineate the exact architecture of the musculus uvulae from the existing literature so that future studies can be done.

ARCHITECTURE OF THE MUSCULUS UVULAE

This paired muscle situated in the midline of the soft palate is found to be attached in the front to the flattened band of the tensor tympani and behind to the uvular base along the medial velum but devoid of any attachment to the mural pharyngeal surface [1,8]. Though lying on the nasal side contralateral to the muscles of the velum, its sectional area is maximum transversely inside the liberal portion of the velar taste buds (behind the aponeurosis) overlying the majority of the levator sling [2]. Additional fibers were observed by Langdon HL and Klueber K that was initially believed to be a part of the musculus uvulae, whorling on the oral side of the musculature of the palate transversely [6], while Kuehn DP et al., and Azzam NA and Kuehn DP reported no such fibres and identified a plane of fascia demarcating the musculus uvulae from the levator along its full length [4,5]. The distinctive feature about the origin of this muscle is that the musculus uvulae originate from the palatal aponeurosis instead of the surface directly. The speciality of this aponeurosis is that it takes a deviant turn to split itself into two distinct laminae in and around the muscle anteriorly, but with the greater and maximum part of the thickness of this unique aponeurosis concentrated on the major nasal surface of the muscle. This aponeurosis then distinctly takes a tapering hit and thins down posteriorly with some sparing of its own fibres. The musculus uvulae may be a unique muscle in the sense that it wasn't seen to blend with any of the opposite palatal muscles as thought to be, but instead it was found to be readily lifted away from them [2,8-11]. It had been the sole muscle to succeed in the uvula, its major bulk being the greatest within the third quarter of the palate where it overlies the posterior part of the levator sling at the dimple area. For now, it's believed to be surrounded by a substantial amount of glandular tissue, the majority of which is usually adequate to that of the muscle. At the level of this glandular region it lies within a trench formed by the levator muscles where the latter are relatively firm on the brink of the oral mucosa. This trench likes appearance was present consistently and was quite striking in its depth also [2].

FUNCTIONAL ROLE

These findings suggest that its action is to contribute to the eminence formed by the levator palati by its extensions towards the medial velum [1,12]. It may even have an extensor effect on the nasal aspect of the velum, displacing it toward the posterior pharyngeal wall. Both of those actions would serve to maximise midline velopharyngeal contact [1]. One clinical application of this anatomic information is that the muscle should be preserved within the dissection, performed during internal velar repair. Furthermore, it should be recognised that the musculus uvulae is frequently divided and incorrect reorientation whenever double opposing repair procedures are adopted [1,10,13-17].

THEORIES OF INNERVATION

A few studies which have considered the innervation of the musculus uvulae suggest that it's not solely supplied by the direct pharyngeal plexus, as are the opposite intra-palatal muscles, but instead it is supplied indirectly by the same plexus via the lesser palatine nerve [2]. However, Boorman JG and Sommerlad BC found the lesser palatine nerve to be the sole nerve to supply the musculus uvulae in cadavers, and later confirmed this observation in human foetuses as well [2]. However, one differed their opinion to that of Boorman JG and Sommerlad BC after conducting a developmental study of human embryos and postulated that the pharyngeal plexus may only have an innervational role in human foetuses and not in adults where the lesser palatine nerve nerve takes a dominant role [1,2].

Support for Boorman JG and Sommerlad BC on the innervation of the musculus uvulae is provided by the nerve stimulation studies [2-6,14-16]. This is the only such muscle within the

uvula in a diseased subject, where by running along the margin of an existing birth defect, it would produce closure results so erroneously that the entire pair of uvulae may be retorted, and it presumably is also the muscle specifically activated by lesser palatine nerve stimulation [3]. The lesser palatine nerve block, however, did not produce any change in either speech nor did the image produced by nasendoscopes dramatically increase the velopharyngeal mechanism of glottis closure during speech and also after speech. This meant a strong negative association between the activity of the musculus uvulae and normal speech within the non-cleft subject [3-5]. It provides further evidence that the action of other muscles (mainly the levators) alone can create the traditional convexity of the nasal surface of the palate during velopharyngeal closure. The evidences given by current literature states that the levator veli palatini and the musculus uvulae are the chief muscles responsible for palatopharyngeal closure during speech in a normal individual under normal circumstances [3-6,11-14].

Electromyographic reports suggest that the patterns of myographic spike activity in the musculus uvulae and the levator veli palatini muscle were similar in all palatal task movements except speech [4]. The significance of the presence of the musculus uvulae along the medial aspect of the velum lies in the fact that the filling function of this muscle with regard to the space between the raised velum and the posterior pharyngeal wall is boosted [4]. In addition, this muscle may serve to modify the taut nature of the tissue adjacent to the insertion of the levator veli palatini and to produce extension of the velum [4].

POSITIONAL INFLUENCE

The position and course of the musculus uvulae, as reported by various workers [1-5], agrees with previous work by Kuhn DP et al., and Azzam NA and Kuehn DP [4,5]. The majority of glandular tissue within the palate generally has been noted as beneficial to velar closure as also has been the case with that of the surrounding muscles in the vicinity of the musculus uvulae within the area of the eminence [1-4]. It might seem that this glandular tissue comprises a substantial part of the majority, on the nasal aspect of the levator sling [2]. The trough formed by levators in this area, on which this tissue bulk lies, has not previously been reported. The rationale could also be that in other studies palate specimens were deliberately flattened before serial section, while certain other studies specifically focused on the efforts made to repair the tissues within the normal position as nearly as possible. Contraction of the levator muscles might be expected to decrease the depth of the palatine aponeurosis, or eliminate, this trough, throwing the overlying glandular and musculus uvulae bulk into prominence, creating the nasal convexity or ridge, and this effect was observed within the cadaver simulation model [3-5,7-11].

Gross anatomical dissection studies and histological staining studies on sectioned soft palates focusing on the morphology of the musculus uvulae indicated that the musculus uvulae is not only paired as previously described in most anatomy texts but also is arranged as discrete bundles and the peculiar feature of every bundle is that it takes an origin deviating away from the median plane in such a way that it moves away from the tendinous palatal aponeurosis behind the hard palate and just before the insertion of the levator veli palatini muscle [5]. Both the bundles meet in a place facing the muscular sling of the levator and travel along the back portion of the soft palate terminating as two discrete fascicles which inter-divide and insert between the mucous glands and corium of the uvula proper and its mucosal basement [5,17]. Because of its location and size, it seems as though the contraction of this musculus uvulae would add bulk to the back surface of the raised soft palate thereby aiding in closure of the velopharyngeal doorway during speech and deglutition [5].

HISTOLOGY AND INTERNAL ARCHITECTURE

Histologically stained sections of early fetal human soft palate specimens showed a structural relationship between the longitudinal fibromuscular component of the soft palate and musculus uvulae and its raphe [6]. Musculus uvulae begin on par with the palatine aponeurosis near the origin of the second quadrant of the velum, follows a sigmoid course, and terminates near the uvular base. Sometimes, an occasional loop of muscle may arise from the bony palate, arch downwards, and then recurve back into the uvular muscle [6,8-11]. Such a complex relationship therefore exists between the raphe in the velum and several palatal muscles. Small fascicles of the uvular muscle also begin as branches from the midline band an entwine it near its crest. These branches may aid in shaping the velar back surface regionally with respect to the levator bulk to reinforce and strengthen the mural surface of the pharynx behind and thus enhance the efficiency of the sealing process of velopharyngeal wall [6]. The musculus uvulae muscle functions to shorten the uvula. Contraction of the musculus uvulae muscle on the same side pulls up the uvula ipsilaterally [7,10].

CONCLUSION(S)

The musculus uvulae not only provides a bulk leverage to the soft palate but also stabilises it by its sealing effect that is quite unique to this muscle owing to the fact that the origin of this muscle is aided by a velar aponeurotic grip as well. The splitting of this muscle into two lamina with the posterior one being thinner and its reinforcement by extra muscle loops also contributes to the above function.

Authors contribution: LD- preparation and initial write-up of the manuscript, SS- idea of the manuscript and final write-up of the manuscript, CM- suggestions and modifications to the body of the manuscript, PRS- citation insertions, and arrangement of references.

REFERENCES

[1] Huang MH, Lee ST, Rajendran K. Structure of the musculus uvulae: Functional and surgical implications of an anatomic study. Cleft Palate Craniofac J. 1997;34(6):466-74. Doi: 10.1597/1545-156919970340466sotmuf2.3.co2. PMID: 9431463.

[2] Boorman JG, Sommerlad BC. Musculus uvulae and levator palati: Their anatomical and functional relationship in velopharyngeal closure. Br J Plast Surg. 1985;38(3):333-38. Doi: 10.1016/0007-1226(85)90237-1. PMID: 4016419.

[3] Casey DM. Palatopharyngeal anatomy and physiology. J Prosthet Dent. 1983;49(3):371-78. Doi: 10.1016/0022-3913(83)90280-9. PMID: 6341551.

[4] Kuehn DP, Folkins JW, Linville RN. An electromyographic study of the musculus uvulae. Cleft Palate J. 1988;25(4):348-55. PMID: 3203466.

[5] Azzam NA, Kuehn DP. The morphology of musculus uvulae. Cleft Palate J. 1977;14(1):78-87. PMID: 264280.

[6] Langdon HL, Klueber K. The longitudinal fibromuscular component of the soft palate in the fifteen-week human fetus: Musculus uvulae and palatine raphe. Cleft Palate J. 1978;15(4):337-48. PMID: 281277.

[7] Helwany M, Rathee M. Anatomy, Head and Neck, Palate. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2021. PMID: 32491749.

[8] Sales SAG, Santos ML, Machado RA, Dias VO, Nascimento JE, Swerts MSO, et al. Incidence of bifid uvula and its relationship to submucous cleft palate and a family history of oral cleft in the Brazilian population. Braz J Otorhinolaryngol. 2018;84(6):687-90.

[9] Shprintzen RJ, Schwartz RH, Daniller A, Hoch L. Morphologic significance of bifid uvula. Pediatrics. 1985;75(3):553-61. PMID: 3975126.

[10] Feka P, Banon J, Leuchter I, La Scala GC. Prevalence of bifid uvula in primary school children. Int J Pediatr Otorhinolaryngol. 2019;116:88-91. Doi: 10.1016/j.ijporl.2018.10.026. Epub 2018 Oct 22. PMID: 30554716.

[11] Iriarte Ortabe JI, Piette E. La presentación aislada y sindrómica de la fisura palatina [The presentation of cleft palate in isolation or as part of a syndrome]. An Otorrinolaringol Ibero Am. 1990;17(4):405-43. PMID: 2221311.

[12] Cohen MM Jr. Syndromes with cleft lip and cleft palate. Cleft Palate J. 1978;15(4):306-28. PMID: 281275.

[13] Galvez-Cardenas KM, Varela DC. Uvula Amyloidosis. N Engl J Med. 2020;383(6):577. Doi: 10.1056/NEJMicm1915258. PMID: 32757526.

[14] Goldin M, Ji L. Uvula necrosis, an atypical presentation of sore throat. J Emerg Med. 2013;44(1):185-86. Doi: 10.1016/j.jemermed.2011.09.001. Epub 2012 Apr 9. PMID: 22494597.
[15] Salengros JC, El Founas W, Velghe-Lenelle CE, Willemse E, Sosnowski M, Andry G, et al. Uvular and tonsillar pillar mucosal necrosis as a cause of severe sore throat after orotracheal intubation. Anaesth Intensive Care. 2011;39(4):772-73. PMID: 21823405.
[16] Ylikoski J. Outpatient uvuloplasty. Otolaryngol Head Neck Surg. 1996;115(4):373. Doi: 10.1016/S0194-5998(96)70058-X. PMID: 8861896.
[17] Herford AS, Finn R. Single-stage CO2 laser assisted uvuloplasty for treatment of snoring and mild obstructive sleep apnoea. J Craniomaxillofac Surg. 2000;28(4):213-16. Doi: 10.1054/jcms.2000.0148. PMID: 11110152.

PARTICULARS OF CONTRIBUTORS:
1. Assistant Professor, Department of Oral and Maxillofacial Surgery, Indira Gandhi Institute of Dental Sciences and Research, Puducherry, India.
2. Assistant Professor, Department of Anatomy, All India Institute of Medical Sciences, Bibinagar, Telangana, India.
3. Additional Professor and Head, Department of Anatomy, All India Institute of Medical Sciences, Bibinagar, Telangana, India.
4. Senior Resident, Department of Anatomy, All India Institute of Medical Sciences, Bibinagar, Telangana, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. S Surraj,
Assistant Professor, Ground Floor, Department of Anatomy, All India Institute of Medical Sciences, Bibinagar, Nalgonda-508126, Telangana, India.
E-mail: surraj18@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Apr 21, 2020
- Manual Googling: Jun 03, 2021
- iThenticate Software: Jun 26, 2021 (12%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? NA
- Was informed consent obtained from the subjects involved in the study? NA
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Apr 20, 2021**
Date of Peer Review: **May 06, 2021**
Date of Acceptance: **Jun 07, 2021**
Date of Publishing: **Jul 01, 2021**