

22. *The Perceptive Passavant and His Controversial Pad*

AT one time surgeons were obsessed with closing the hole of the cleft without great concern for functional velopharyngeal closure. The soft palate was considered a flap valve working like a trapdoor. In the latter half of the nineteenth century there was a Teutonic rise to power in medicine, spearheaded by Rudolf Virchow, and on the crest of this wave was the remarkably perceptive Philip Gustav Passavant of Senckenberg Hospital, Frankfurt, Germany. He wrote 23 scientific papers on such subjects as typhus, psoriasis, anal strictures, burns, tracheotomy, epispadias and cleft palate. In fact, in 1863 he published a monograph on "closure of the pharynx in speech," which postulated a theory he expounded more fully in 1869.

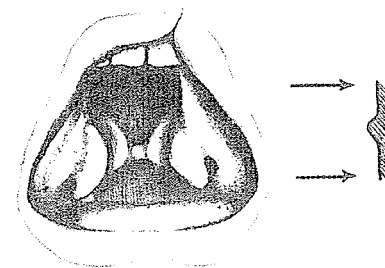
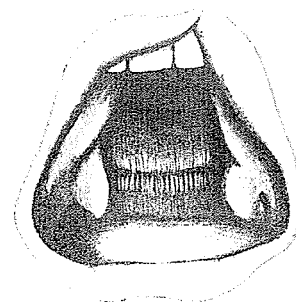
In his 1869 classic dissertation Passavant described the velum as a muscular structure opposed by another pharyngeal muscular structure which was to become known as "Passavant's pad." He noted the "forward swelling at the level of the base of the uvula," which he deduced formed a pharyngeal ridge that was "an essential condition of normal pronunciation." After dissecting both frozen and alcohol-hardened specimens to trace the origins of the superior constrictor muscle, he found the fibers running in the pharyngeal wall at the level of *his* ridge and spanning hamulus to hamulus.

Passavant described what he considered normal physiological action of the palate and pharynx:

The velum is raised, but not as far back as the back wall of the pharynx, which stays fairly still: the back wall of the pharynx approaches the velum,



Gustav Passavant



*Remarkable
for his
time.*

at the same time coming forward in a swelling at that height of the pharynx at which the approach of the side walls of the pharynx to each other also takes place. . . . This (bulging of the superior constrictor), accompanied by the raising and pushing back of the velum, causes the closing of the palate-flap which is essential for intelligible speech. This sentence is the most essential content of the whole of my earlier work. . . . There are then, in my opinion, two ways in which the palate closes: the first is necessary for speech and is caused by the activity of the levatores palati and the upper pharynx constrictor, or rather perhaps, the part of this muscle known as pterygo-pharyngeus, arising from the hamulus: the second is that occurring in swallowing, choking, vomiting, etc., here, the closing is further strengthened by the contraction of the pharyngopalatini.

As noted by Calnan, Passavant's theory of nasopharyngeal closure was accepted throughout the world without question and with only an occasional minor modification by most of the early doyens of palate surgery.

Claude Bernard's rather cynical 1865 remark,

What we know may interfere with our learning of what we do not know, suggests the difficulty of exploding myths. It often takes an elephant gun to kill a "traditional" flea, but any pages devoted to this controversial pad have important information on the anatomy and physiology of the velopharyngeal mechanism.

Von Luschka, who was compiling his treatise on anatomy, at first opposed Passavant's theory that the superior constrictor caused approximation of the two halves of the uvula in a cleft palate when the patient said "ah." He later agreed that the superior constrictor muscle was partly responsible.

In 1935 and 1936 Denis Browne of London argued that the soft palate was a curtain shielding a contractile muscle ring of two overlapping slings, the levator palatini and the superior constrictor. He considered this ring similar to the anal sphincter and regarded the ridge on the posterior pharyngeal wall as being due to the palatopharyngeus muscle. In 1941 Michael Oldfield of Leeds, accepting the idea of levator and superior constrictor slings, added lateral slings of the salpingopharyngeus and pharyngopalatine muscles. George Dorrance of Philadelphia had an opportunity in 1932 to study two palates in action from above after complete destruction of the nose. In one, Passavant's cush-

ion was impressive; in the other, only rudimentary. He concluded that Passavant's theory was correct and acknowledged that the ridge was formed by the superior constrictor muscle. Wardill of Newcastle accepted Passavant's theory in 1928, suggesting that his cushion acted as a

valve seating for the upper surface of the soft palate.

In 1942 L. Stein stated that in speech, nasopharyngeal occlusion was due to elevation of the soft palate toward the

transverse fold known as Passavant's cushion, which is probably formed by the raising and folding of the pharynx wall.

He suggested that enunciation of vowels, energetically carried out during speech training, is a stimulus to greater activity of the velum and pharyngeal wall and, further, develops the muscular substratum of Passavant's "cushion," ensuring better closure of the nasopharyngeal cavity. In 1954 Hagerty and Hoffmeister used the distance between the soft palate and Passavant's ridge as an index to speech after cleft palate closure. Barrett Brown gave his usual sound analysis in 1955 but included the myth, stating:

In the repair of cleft palate one goal should be to obtain the best possible function of the soft palate. This will require pliable tissue, sufficiently long to meet the posterior wall of the pharynx (Passavant's pad) in the sphincter-like action of this region that closes the opening between the nose and throat.

BATTLE OF THE BULGE

James Calnan, professor at Post-Graduate Hospital, London, was the fair-haired favorite of Nuffield Professor Kilner during his later years. While at Oxford under Kilner, Calnan beheaded a tradition in a learned and comprehensive treatise on "The Error of Gustav Passavant" [and his pad], which was presented at Coronado, California, in 1953 and awarded second prize by the Foundation of the American Society of Plastic and Reconstructive Surgeons. As one of his most effective thrusts against the importance of Passavant's pad, Calnan used the renowned Victor Veau, noting that in 1943, after study with radiographic methods, Veau had said:



James Calnan

Veau had a remarkable understanding of the situation

What does Passavant's ridge do, that mysterious formation which has already brought a century's immortality to a Frankfort surgeon? Naturally we have had some experience of it. We have operated on 1,747 cases of cleft palate. First of all, Passavant's fold exists hardly at all in one-fifth of the cases. It is used perhaps in deglutition. It has nothing to do with speech. A fold which projects for 1 cm. cannot in speech close an orifice 3 to 5 cm. in diameter. But the main question for us is to know if such a fold could be of useful help in assuring occlusion in those cases where we have reconstructed an insufficient palate. Behold that which experience has taught us: more often this fold is sited below the point where the velum seeks to meet the roof of the cavum—and that is understandable; the fold is formed by the functional hypertrophy of the upper fibres of the superior constrictor muscle of the pharynx, and as you have seen this constrictor stops at the level of the atlas.

He did allow that

There are some fortunate cases, which are rare, where the fold helps occlusion . . . but speech is not of good quality.

Browne's modification of the Passavant theory compared the velopharyngeal sphincter to the sphincter ani. Calnan again used Veau to counter this stand:

Veau goes further and suggests that if the speech mechanism is comparable to the sphincter ani then man would long ago have found some other way in which to express himself.

Then, too, Veau's speech analyst, Madame Borel-Maisonny, noted in 1950 that the posterior pharyngeal wall was always immobile in normal speech; movement, as indicated by a transverse fold, was taken as a sign of an incompetent nasopharyngeal sphincter.

Calnan confirmed Veau's opinion but from his observations reduced the dimensions of the velopharyngeal orifice to a width nearer 2.0 to 2.5 cm., and the anteroposterior diameter to 1.0 to 1.5 cm. His measurement of the projection of Passavant's ridge, moreover, was usually less than 1 cm. With lateral x-ray films of the palate and pharynx of various cases and key overlay sketches, he maintained his objections to Passavant's theory and presented his final argument in five parts.

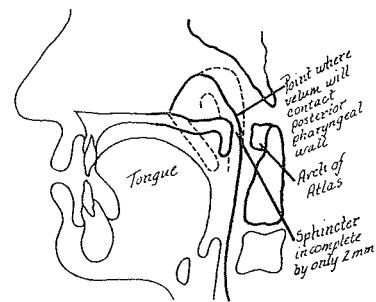
1. *Inconsistent.* Calnan noted that Passavant observed his ridge in only one of 50 normal subjects while using a postnasal mirror, and he hazarded the guess that Passavant was recording a gagging reflex rather than normal speech. Other inconsistencies presented pointed out the occurrence of Passavant's ridge in less than 25 percent of unoperated cleft palates, but in all those cases it would rise, evidently if being required for speech. It appeared in the 1-month-old infant and the adolescent but was more common in the adult, and even varied greatly in the same individual over a period of time. When viewed from above after removal of the maxilla for carcinoma in four patients, there was no evidence of forward motion of the posterior pharyngeal wall during speech, but a pronounced ridge was observed at low level on gagging and swallowing.

2. *Uneconomical.* It would be a waste of effort and energy to ruck the posterior pharyngeal wall forward if a normal velum can reach and occlude the nasopharyngeal isthmus. Lateral closure or narrowing of this isthmus by salpingopharyngeus and palatopharyngeus muscle contractions is more efficient since the elevated velum is unable to occlude the lateral pharyngeal recesses.

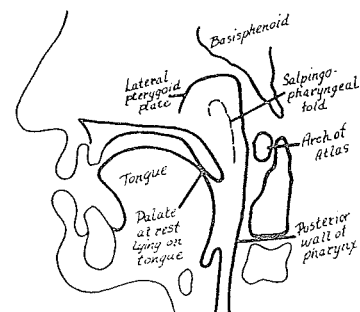
3. *Ridge too low.* Passavant's muscle bulge occurs on the posterior pharyngeal wall at the level of the arch of the atlas, but the height to which the normal soft palate lifts back during speech is about 1 to 2 cm. above the level of the atlas. As there are no superior constrictor muscle fibers above the arch of the atlas, the ridge rises at too low a level to play an active part in speech. Calnan condemned several surgical procedures with:

This is further confirmed by the consistent failure to obtain normal speech of all forms of pharyngoplasty which try to imitate Passavant's ridge.

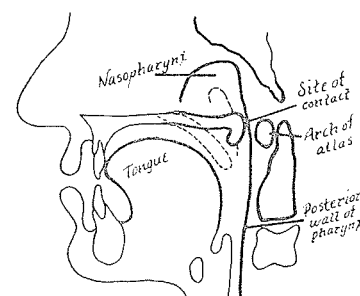
4. *Contraction too slow.* The relatively slow contraction and relaxation of the ridge, the stage of contraction lasting invariably for more than 1 to 2 seconds, contrasts sharply with the rapid movements of the velum, which are in the order of 0.1 to 0.01 second. In 1936 Wardill declared that the ridge remained erect throughout speech and did not relax until the velum returned to its position of rest. Calnan did not agree and noted no radiographic evidence of this assertion.



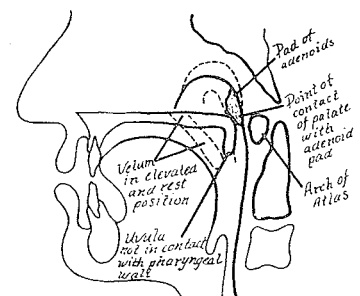
Example: Girl, 12 years old, who had palate closed at 3 months and has incompetent sphincter but no Passavant's ridge



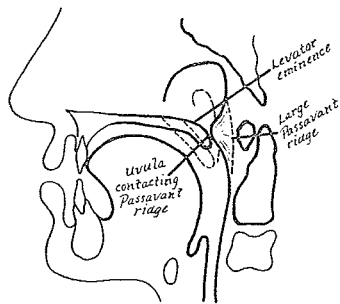
Example: Normal palate and speech in 50-year-old female with no Passavant's ridge



Example: Normal palate and speech in 6-year-old girl with no Passavant's ridge



Example: Normal speech in 10-year-old boy after cleft palate closure in infancy; velum meeting adenoid pad and too high for Passavant's ridge



Example: 20-year-old female with no nasal escape until speech speeds up, when nasal escape becomes increasingly obvious; Passavant's pad *too slow*

5. *Its fatigability.* Passavant's pad becomes fatigued. In some adult patients with cleft palate, a well-marked ridge may be seen on the posterior pharyngeal wall on phonation of "ah." If this sound is repeated at one-second intervals, the ridge becomes less marked and eventually unrecognizable after a few minutes. In sharp contrast is the effortless normal rapid speech, which can be uttered at a rate of more than 60 words per minute for several hours.

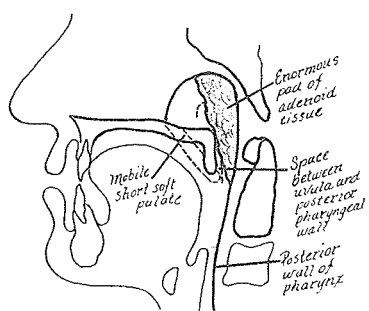
Calnan's concluding statement in 1954 was:

That Passavant's ridge can and does occur in association with cleft palate is recognised: that it is a factor in normal speech is denied.

In 1957 Calnan's continued interest in the truth about Passavant's ridge stimulated him to collect further information. In 1956 Ardran and Kemp had studied a series of bulbar poliomyelitis patients using cineradiography. In one case, when the constrictor muscles of the pharynx were paralyzed, a Passavant's ridge appeared on swallowing. In no case was a Passavant's ridge seen when the posterior pillars of the fauces were paralyzed. The implication was that the palatopharyngeus muscle, not the superior constrictor, produces the ridge.

These findings, along with other data, caused Calnan to admit:

The ridge has been found to be of muscular origin but the muscle responsible for it has not yet been settled.



Example: Normal speech in 30-year-old male after closure of cleft palate in infancy; short velum contacting adenoid pad with *no evidence* of a Passavant's ridge

Calnan's final conclusions in 1957 were consistent with his previous stand, but his emphasis had shifted:

In only four cases (of 158 cleft palate patients) did Passavant's ridge make contact with the levator eminence of the elevated soft palate, and so play a part in . . . speech. In every patient the quality of rapid conversational speech was spoiled by obvious nasal escape. The adenoid pad is more important than Passavant's ridge, for it is usually sited well above the latter. Adenoidectomy may cause nasal escape in speech irrespective of any damage done to the posterior pharyngeal wall.

He continued:

"Passavant's ridge" should be mentioned only in small print as a footnote, in works dealing with speech, for its interest as the basis of another medical myth.

In 1968 Carpenter and Morris offered additional evidence that in some individuals the pad's activity appeared to be compensatory in nature, in terms of the reduction of the velopharyngeal opening and in terms of the appropriate and consistent manner in which this reduction takes place.

In 1969 Raymond Massengill, Thomas Walker and Kenneth Pickrell of Duke University reported that out of cinefluorographic films of 190 postoperative cleft palates, 18 demonstrated a Passavant's pad. Although the presence of the pad did aid in velopharyngeal closure, there appeared to be no relationship between the presence of the ridge and the size of the velopharyngeal gap.

It is probably true that in the normal speech mechanism Passavant's ridge is too low, too slow, inconsistent, inefficient and unnecessary, but in cleft palates, where the velopharyngeal sphincter needs all the aid it can muster, the heroic compensatory action of the superior constrictor muscle and/or palatopharyngeus muscle rucking a ridge may offer some help to a few, and any help is appreciated.



Ridge vainly rising toward incompetent velum

THE OMNISCIENT PASSAVANT

Passavant is best known for his pad, but his contributions outreach this ridge. In his critical evaluation of the results of the von Langenbeck operation, Passavant observed nasal intonation in speech following successful closure of the cleft palate. He ascribed this deficiency to the inability of the velum to reach the pharyngeal wall and, as early as 1862, began to develop procedures to facilitate closure of the velopharyngeal opening. During his surgical career his ingenuity led him to attempt almost every principle used today to reduce the velopharyngeal aperture. He achieved posterior extension of the palate by suturing the posterior pillars of the fauces together. He created a velopharyngeal synechia. He pushed the palate back. He brought the pharynx forward by folding a pharyngeal flap on itself. He fitted a collar-button obturator into a transverse velar incision to increase posterior projection of the velum. He did indeed spur the evolution of cleft palate surgery with the goal of not merely closing the cleft hole but correcting velopharyngeal incompetence.

*He was
no
● - filler!*