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ORIGINAL ARTICLE

DOUBLE BLIND COMPARATIVE STUDY OF SOMMERLAD'S LEVATOR MYOPLASTY AND FURLOW'S DOUBLE OPPOSING Z PLASTY

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ABSTRACT: AIMS AND OBJECTIVES: Aim of this study is to make out efficiency of these surgical techniques in correction of Velopharyngeal incompetence (V.P.I). **MATERIALS AND METHODS:** 20 cases of Velopharyngeal incompetence initially screened by speech therapist followed by accessing velopharyngeal gap and documenting in patients between 5to 15 years age group of both the sexes. They were randomly allotted for Furlow's double opposing Z plasty and Sommerlads's levator myoplasty. All these procedures were done by the same surgeon to avoid surgeon bias. Two to three years after surgery all these patients were subjected for Videofluroscopy. Velopharyngeal gaps were recorded and documented. Preoperative and post-operative Velopharyngeal gaps were recorded and analysed. **RESULTS AND CONCLUSION:** Both these techniques were equally efficacious in correction of Velopharyngeal incompetence if Velopharyngeal gap is less than 5mm. However both these techniques were failed to close if Velopharyngeal gap is more than 5mm.In such cases posterior wall augmentation was needed to obtain Velopharyngeal closure.

KEYWORDS: Velopharyngeal incompetence, palatal lengthening procedures, posterior pharyngeal wall augmentation, microscopic levator myoplasty, Furlow's double opposing Z plasty.

INTRODUCTION: The primary goal of cleft palate repair with or without cleft lip is to attain good speech function. Surgery of cleft palate came a long way from mere anatomical closure of cleft to a more functional closure of velopharynx with a stress on muscle repair and reorientation of muscle fibers, all aimed at obtaining normal or near normal speech. Current concepts of cleft palate repair states that a child with cleft palate should ideally be operated around the age of 9 months to 1 year, based on the age at which the normal speech purportedly develops.

Even in the best hands, 5-38% of the patients develop velopharyngeal incompetence following primary palatal surgery, resulting in abnormal speech.

Normal speech is characterized by intra oral build up and release of oral air stream for the production of various phonemes. This is mainly achieved by a valve like functioning of velum and pharynx; velum moves posteriorly and superiorly and pharynx moves medially and superiorly to close velopharyngeal gap, thus changing air flow. During normal conversational speech velopharynx moves rapidly, opening for velopharyngeal sounds and closing it for adjacent oral sounds. The ability to open and close the velopharynx rapidly so that speech has normal nasal and oral features constitutes normal velopharyngeal competence.

Velopharyngeal incompetence is inability to close the velopharyngeal sphincter completely; it can occur due to any structural defect of the velum or pharyngeal wall at the level of nasopahrynx or mechanical interference for closure. A complete understanding of the velopharyngeal closure is essential for the assessment and selection of adequate and optimal methods of treating the patients with velopharygeal incompetence.

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The abnormal speech caused by velopharyngeal incompetence is assessed subjectively or semi-objectively by speech therapist (Pathologists); the objective measurements include direct and indirect diagnostic methods which have been helpful in formulating the surgical procedure of choice.

Presently the gold standard for assessment of velopharyngeal incompetence is "direct visualization" procedures like multi-view video fluoroscopy and nasopahryngoscopy. Ideally VPI should be assessed initially by nasopharyngoscopy followed by multi-view fluoroscopy.

Nasopharyngoscopy equipment is not available with us and we do not have trained personnel for conventional multi-view video fluoroscopy; hence we have adopted Digital subtraction angiography equipment for documentation of the velopharyngeal movements without simultaneous audio recording and used the findings for clinical correlation.

We have under taken this study to document velopharyngeal gap objectively prior to operation and subjecting those patients with gaps up to 10 mm for Sommerlad's levator myoplasty or Furlow's double opposing Z plasty on a random basis. One year following surgery, these patients were re-evaluated and V. P gaps were determined again and the results were compared.

REVIEW OF LITERATURE: The earliest report of direct visualization of velopharyngeal closure is probably that of Hilton (1836)[1] who observed the movements of velum and lateral pharyngeal wall through a facial defect left by the spontaneous extrusion of a facial tumor in an adult.

The first radiographic observations of the velopharyngeal structures were reported as early as 1909 (Schier);[2] the use of motion pictures to study the movements of the velopharyngeal valve were first reported in 1930, initially as method of studying swallowing by Barclay.[3] The procedure was next applied to speech during the next decade by Harrington,[4] 1944. These studies were limited to the lateral view and the lateral view became the standard procedure for the study of velopharyngeal closure, using both still cephalograms (Subtelny)[5] and cinevideofluoroscopy (Moll).[6] in non-DSA mode.

In 1969 two new procedures for direct visualization of the velopharyngeal valve were introduced; the multi-view video fluoroscopy (Skolnick)[7,8,9] and nasopharyngoscopy by (Pigott).[10,11] this revised the scientific community's concept of velopharyngeal closure.

Many discussions were appeared in the literature later regarding assessment of VPI but there is no uniform agreement on how nasopharyngoscopy and videofluroscopy studies should be reviewed and reported.

An international working group meeting at New York in 1989 recommended the use of at least two views for complete evaluation; frontal and lateral. An enface view (basal, Townes) view may be added, along with oblique projections in case of asymmetry.

The main objective of primary of palatal repair is adequate function of velopharynx and normal oro-nasal resonance. The three aims of cleft palate surgery are to make the patient speak well, eat well and look well in that order of importance. The success of palate repair depends upon providing intact palatal surface and restoration of adequate muscle function to achieve velopharyngeal competence.

AIMS AND OBJECTIVES: To document pre-operative and post-operative velopharyngeal gaps To find out which method is superior in surgical correction of VPI.

To find out the post-operative gain in the length of soft palate in Furlow's double opposing Z plasty and Sommerlad's levator myoplasty.

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DIGITAL IMAGING: The radiological images considered in conventional fluoroscopic techniques were analog images. The video signal from the TV camera tube is an analog signal, a voltage which varies smoothly as the image brightness is scanned in the raster of horizontal lines. If it is converted to digital form the image can be enhanced in various ways and stored in a computer.

The video signal from the TV camera is applied to an analog digital converter or digitalizer. This samples the signals at equally spaced intervals. The image brightness is divided into a matrix of pixels and stored in frames of memory locations in the core memory of commuter. The image is displayed by reading out the brightness values of pixels in sequence, from the computer memory in synchronism with the electron pencil scanning in the monitor. This digitalized imaging provides plenty of opportunities in recording and analyzing the study using different soft wares to retrieve various data from the same study with greatest additional advantage of image processing to obtain the best imaging quality possible.

Advantages: The voltage of the X rays is auto adjusted in accordance with the depth of penetration required, by a sensor which receives signals returned from the body surface of the patient so that optimum quality image can be obtained with exact required radiation exposure. At the same time, the time required and risk of additional exposure involved in adjusting the X ray voltage to obtain optimal contrast of the image can be avoided in contrast to conventional equipment; in addition to the copper filters used in reducing the absorption of unnecessary radiation, primary and secondary collimation is possible in digital devices. The primary collimation focuses the radiation to the desired field, avoids exposure to the rest of the body and secondary collimation further reduces the additional radiation in the field by selecting only X rays with highly qualified voltage to be focused onto the concerned organ. Thus overall radiation exposure is low compared to the conventional fluoroscopy.

Person performing the procedure need not stay in the procedure room, thus exposure to radiation can be avoided. Magnification of the image, edge enhancement, the brightness, contrast can be adjusted to obtain the best quality images using pixel transfers for image processing, whereas in conventional video fluoroscopy, image processing cannot be done once the image is recorded. Patient data, procedure, all the details of the radiation exposures can be recorded and archived. Whole examination can be reviewed by the surgeon at a remote place also if image transferring facility is available through a network.

PATIENTS AND METHODS: This is a prospective study done during the period August 2005 to December 2007.Patients presenting with impaired speech following cleft palate repair were initially screened by a speech therapist (Pathologist). Patients with VPI are then evaluated for objective documentation by using multiview digital fluoroscopy.

Velopharyngeal closure gaps (On phonation) less than 10 mm were selected for study, and these patients were subjected to Sommerlad's levator myoplasty or Furlow's double opposing Z plasty on a random basis. Results were documented.

Since standard video recording equipment was not available in fluoroscopy unit of radiology department, Digital subtraction angiography suite was adopted to take motion picture of velum of soft palate and posterior pharyngeal wall. Non DSA mode of suite was used to record the velopharyngeal function. The equipment used in this study was AXIOM ARTIS FA, Siemens digital subtraction angiography suite manufactured by Siemens medical services.

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SPEECH SAMPLE: In evaluating velopharyngeal incompetence the velopharynx is visualized by using words that does not contain nasal words. Only non-nasal words are used because production of these words would maintain the elevation of the velum and help to determine whether the velum can remain elevated throughout a non-nasal word. These words below do not contain nasal sounds as m, n. They also avoid l and r sound which are difficult for children to pronounce under normal circumstances.

Therefore these words are useful in evaluating the ability to close the velopharyngeal port:

Boat cupcake pipe tooth.
Batch dishes safety top.
Bandages face sea food type.
Cab foot sheep.
Cage jeeps sheet.
Cat juice sixty six.
Catch jokes shoes.
Cheap just socks.
Chicks' keeps stop.
Chips kitty suit.
Choose packages Susie.
City past tack.
Coat pat teeth.
Cookie path tick tack.

PROCEDURE OF RECORDING: All these patients were explained about the procedure to be performed. The Confidence of these children needs to be gained before starting the actual procedure to avoid wasted exposures while trying to record. The patient is made to lie down on the DSA suite between the X-ray tube and the image intensifier with the head straight and patient looking at the ceiling. Diluted barium sulphate contrast is instilled in to the nostrils with a 5ml syringe of about 1to 2 ml and 2 to 3 ml of diluted barium sulphate is also given through the mouth for better delineation of tongue and oral surface of the palate and pharyngeal walls.

First, the lateral view is obtained so as to get better idea about the velar elevation prior to the other views. For lateral view recordings, the head is positioned as for the true lateral position of the skull x ray, with both orbits lying in the same plane. The patient is asked to repeat the speech sample while the investigator pronounces the words as described earlier. Recording of procedure is taken for 20 seconds.

X-ray tube is rotated 90 degrees without any need for the patient to change the position. Again position is adjusted for the Townes view by making fine adjustments in the cranial angulations by observing the values on the monitor and the view of velopharyngeal port. Recording is taken while repeating the same speech sample for another 20 seconds. After the recording is over measurements were taken using the inbuilt measuring tools within the system (Developed by PC LITE software). The recorded motion picture is studied frame by frame; measurements were taken using standard landmarks for the analysis of velopharyngeal incompetence. The standard error for taking measurements in mm/pixel is adjusted to 0.1 to 0.2 ratio. Based on the findings obtained, appropriate treatment is advised according to the study protocol.

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ANALYSIS: Unlike the still pictures, motion pictures do not give the absolute measurement of velopharyngeal gap. We recorded the speech sample for 20 seconds each (Lateral and Townes view); an average of the standard maximum measurements were obtained and velopharyngeal function is reported. Standard measurements like length of soft palate in resting stage, thickness of the soft palate at resting state and on maximum elevation of soft palate. Depth of pharynx in the plane of the palate, velopharyngeal gap in anteroposterior plane and posterior wall mobility are obtained in standard lateral view. Lateral pharyngeal wall movements are observed in Townes view.

Length of Soft Palate: The distance between posterior nasal spine and uvula is measured in the resting state of the palate.

Thickness of Soft Palate: The distance between nasal surface and oral surface of the palate during resting state and maximum elevation of soft palate in palatal plane is compared This gives idea about muscle functioning of the palate especially the function of musculusuvulae. The tension caused by the contraction of levator muscle produces a Genu at maximum elevation.

Depth of Pharynx: The distance between the PNS and posterior pharyngeal wall in the palatal plane measures the depth of the pharynx. Presence of the Adenoids is not taken in into consideration in reporting the measurements. If length to depth ratio is more than 60% then the outcome of palate repair is good.

Gap on Phonation in AP Plane: The Distance from the nasal surface of the velum and posterior pharyngeal wall in the palatal plane when palate is elevated to its maximum.

Posterior Wall Mobility: Movement of posterior wall is noted in lateral view.

Lateral Wall Mobility: Lateral pharyngeal wall mobility in vertical plane is assed in Townes view
The data analysis was done with SPSS Version 13 for statistical significance.

RESULTS:

1. This is the preliminary report of prospective study done during the period August 2005-December2007.
2. It was a random double blind study patients were allotted to Furlows and Sommerlads repair on random basis.
3. Total 40 patients.
4. 20 patients for each group taken up for study.
5. Patients of either sex between the ages 5-20 yrs of who had been operated for cleft palate (Post op Group III II, unilateral, bilateral clefts-Nagpur classification) were taken up for surgery.
6. After surgery only 15 patients turned for follow-up in each group.

DISCUSSION: The main objective of palatal surgery in cleft palate patient is to achieve adequate velopharyngeal function and normal oro nasal resonance. Primary palatal repair should be done before the child develops speech to avoid speech impairment due to wrong learning methods. Even in the best of hands 5-38% develops velopharyngeal incompetence following primary palatal repair. As

there are various surgical procedures for the management of post-surgical VPI, it becomes imperative to determine objectively the degree of VPI; nasopharyngoscopy and multi-view fluoroscopy have been used variously for this purpose; digital radiography equipment provides a lot of advantages over conventional, equipment.

None of our patients in this study received speech exercises to correct the articulation errors prior to the initial fluoroscopic assessment of this study. With Sommerlad's technique the average pre op VP gap of 4.66 mm came to 1.26 mm with an average gain of 3.40 mm in the soft palate length. The highest gain in the length noticed with Sommerlads repair was 5mm. 7out 12 cases were successfully closed in the study. With Furlow's double opposing Z plasty the average VP gap of 4.40 mm came to 0.6 mm with an average gain of 3.86 mm in soft palate length. The highest gain in the length noticed with Furlow's procedure was 7mm. 11 out of 13 cases were closed the VP gap successfully.

The average gain in the mobility of posterior pharyngeal wall after surgery was 1mm.The highest gain in the posterior wall mobility was 3mm. The amount of radiation exposure for lateral view at each time 180.4 microrads/square meter body surface area, and for Townes it was 290.6 microrads /square meter body surface area.

The correlation co efficient for Furlow's double opposing Z Plasty is 0.967 with the preoperative velopharyngeal gap to that of postoperative gain. The correlation co efficient for sommerlad's levator myoplasty is 0.569 with the preoperative velopharyngeal gap to that of postoperative gain.

CONCLUSION: In the present era of evidence based clinical practice, objective evaluation of VPI is essential in selecting the proper treatment plan. Adoption of digital video fluroscopy for VPI evaluation is definitely useful in the treatment planning, and helpful in the outcome.

In Velopharyngeal gaps less than 5mm there is no statistically significant difference in the efficacy between Sommerlads levator myoplasty and Furlow's double opposing Z plasty however in large velopharyngeal gaps more than 5 mm, both these techniques were failed to close the gap.

Furthermore the operating surgeon felt that doing Furlow's double opposing Z plasty is easier in secondary repairs. Contraction of one part of sphincter leads to synchronous recruitment of muscles of entire circumference of the velopharynx.

BIBILOGRPHY:

1. Hilton W. Case of a large bony tumour in the face completely removed by spontaneous separation. Observations upon some of the functions of the soft palate and pharynx. Guys Hosp Rep. 1836; 1: 493–506.
2. Scheier M. Die Bedeutung des Röntgenverfahrens fur die physiologie der sprache und der Stimme. Archiv Laryngol Rhinol. 1909; 22: 175–179.
3. Barclay, A.E., The normal mechanism of swallowing Brit.j.Radiol, 3, 534-53.
4. Harrington, A Study of the mechanism of velopharyngeal closure, J.S peech and hear disorder, 9, 325-345, 1944.
5. Subtelny JD. A cephalometric study of the soft palate. Plast. Reconstr. Surg. 1957; 19: 49. [PubMed].
6. Moll KL. Velopharyngeal closure on vowels. J Speech Hearing Res. 1962; 5: 30–37. [PubMed].
7. Skolnick ML. Video velopharyngography in patients with nasal speech, with emphasis on lateral pharyngeal motion in velopharyngeal closure. Radiology. 1969; 93: 747–755. [PubMed].

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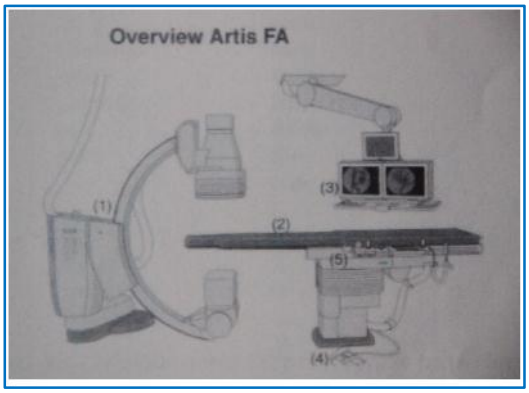
8. Skolnick ML. Videofluoroscopic examination of the velopharyngeal portal during phonation in lateral and base projections - a new technique for studying the mechanics. Cleft Palate J. 1970; 7: 803–816. [PubMed].
9. Skolnick ML, McCall GN, Barnes M. The sphincteric mechanism of velopharyngeal closure. Cleft Palate J. 1973; 10: 286–305. [PubMed].
10. Pigott RW. The nasendoscopic appearance of the normal palatopharyngeal valve. Plast Reconstr Surg.1969; 43: 19–24. [PubMed].
11. Pigott RW, Bensen JF, White FD. Nasendoscopy in the diagnosis of velopharyngeal incompetence. Plast Reconstr Surg. 1969; 43: 141–147. [PubMed].

DIGITAL IMAGING:



SOMMERLADS DATA:

AGE/SEX	DIAGNOSIS	PREOPGAP	POGAP	GAIN
15/F	PO BIL GRIII	5MM	NIL	5MM
5/F	PO RT GRIII	3MM	NIL	3MM
10/F	PO LTGRIII	4MM	NIL	4MM
13/F	POBILGRIII	5MM	NIL	5MM
12/F	PO RT GRIII	3MM	NIL	3MM
13/M	PO LT GRIII	3MM	NIL	3MM
15/F	PO LT GRIII	2MM	NIL	2MM
15/F	PO RT GRIII	4MM	2MM	2MM
8/F	POBILGRIII	5MM	2MM	3MM
4/M	PO BIL GRIII	5MM	2MM	3MM
16/M	PO RT GRIII	5MM	3MM	2MM
16/M	PO LT GRIII	5MM	2MM	3MM
5/M	PO RTGRIII	7MM	3MM	4MM
12/M	PO BIL GRIII	7MM	3MM	4MM
17/M	POLT GRIII	7MM	2MM	5MM
	AVERAGE	4.66MM	1.26MM	3.4MM

Table 1

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FURLOWS Z PLASTY- DATA:

Sl. NO.	AGE/SEX	DIAGNOSIS	PREOPGAP	POGAP	GAIN
1	14/M	PO BIL GRIII	4MM	2MM	3MM
2	13/F	PO RT GRIII	3MM	1MM	2MM
3	5/F	PO BIL GRIII	3MM	NIL	3MM
4	15/M	PO LT GRIII	9MM	3MM	6MM
5	20/M	PO RT GR III	5MM	NIL	5MM
6	7/M	PO GRIII	5MM	NIL	5MM
7	4/M	PO GRIII	3MM	NIL	3MM
8	11/F	PO LT GRIII	2MM	NIL	2MM
9	15/F	PO GRII	1MM	NIL	1MM
10	14/F	POGRIII	3MM	NIL	3MM
11	7/F	POGRIII	4MM	NIL	4MM
12	18/F	PO RT GRIII	10MM	3MM	7MM
13	14/F	PO GRII	6MM	NIL	6MM
14	13/F	PO GRIII	5MM	NIL	5MM
15	18/F	PO GRIII	3MM	NIL	3MM

Table 2

EXAMPLES:

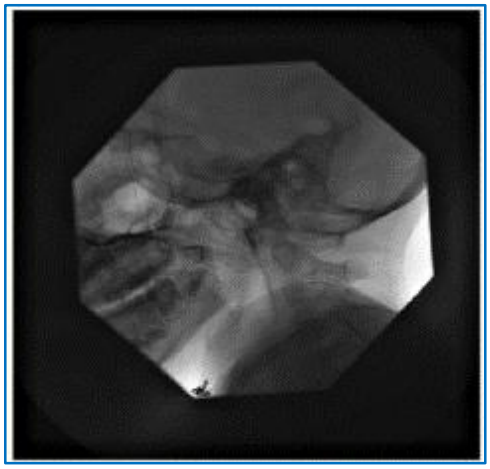

Fig. 1: PRE-OP

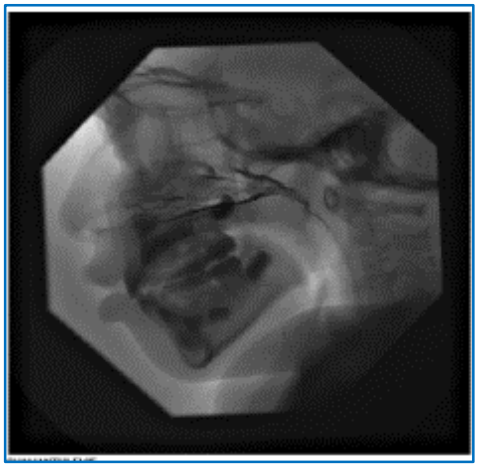

Fig. 1: POST-OP

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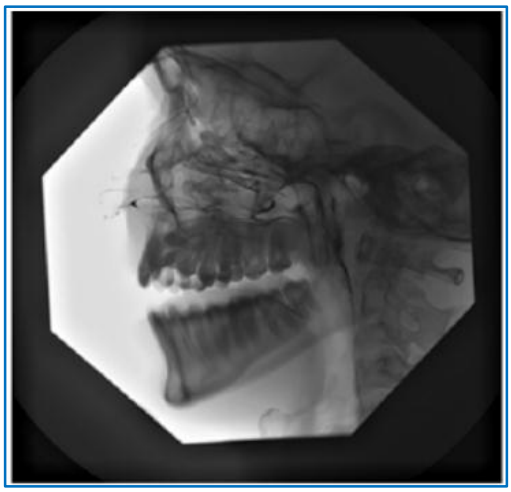

Fig. 2: PRE-OP

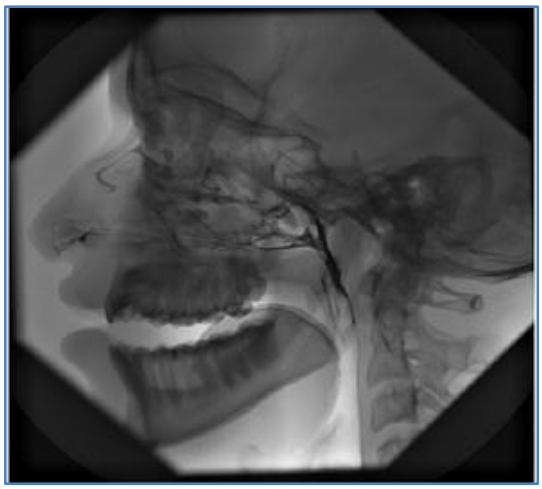

Fig. 2: POST-OP

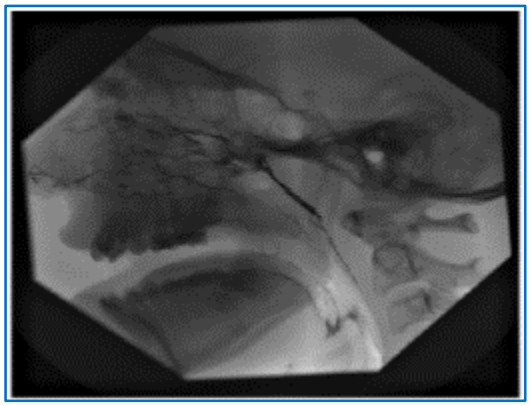

Fig. 3: PRE-OP

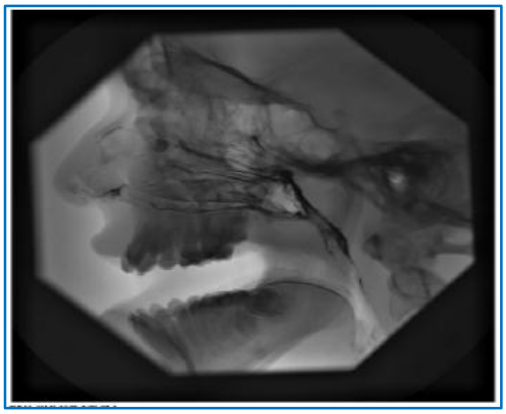

Fig. 3: POST-OP

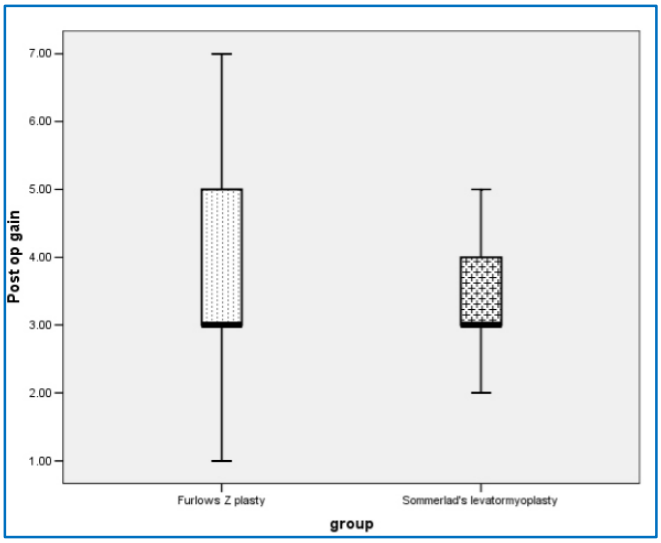

Fig. 4: POST-OP GAIN

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