Morphometric Evaluation of Soft Palate in Oral Submucous Fibrosis-A Digital Cephalometric Analysis

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ABSTRACT

Aims: The present clinico-radiological study was done to evaluate the morphological variants of soft palate in oral submucous fibrosis (OSMF) patients using digital lateral cephalometry. Different variations in the morphology of soft palate were compared with stages of OSMF. Further, soft palate morphology in OSMF patients was compared radiographically with that of normal population. **Materials and Methods:** A total number of 100 patients who were a part of this study were divided in two equal Groups. Group 1 comprised of 50 patients clinically diagnosed with OSMF and Group 2 included 50 routine patients. **Results:** Six different morphological variants of soft palate were found. Among the study Groups, type 1soft palate was most commonly seen (56%) whereas type 5 was the least common variant. Majority of patients belonged to stage II OSMF and type 1soft palate was commonly seen in this stage of disease whereas butt shaped soft palate (type 3) was more common in stage III OSMF. **Conclusion:** In OSMF, type 1 and 2 are commonly seen but as the diseases advances, these are replaced by type 3 and 6 variants. In OSMF patients, there in reduction in the anterio-posterior dimension of soft palate.

Key words: Cephalogram; oral submucous fibrosis; soft palate

Introduction

Although the involvement of soft palate in OSMF patients was reported many decades earlier but still the medical literature reveals scarcity regarding its morphological variants.[1,2] Earlier studies have almost ignored the diversity in the shape of soft palate and documented it to be of only one kind. This study is an effort to shun this prevailing myth and describe various types of soft palate seen in different stages of OSMF. In patients suffering from OSMF there is gradual decrease in the anterio-posterior dimensions of soft palate which can be visualized on lateral cephalograms. Thus, we hypothesize that digital lateral cephalography, apart from being readily available, relatively inexpensive and non-invasive, may be an accurate diagnostic tool to assess the prognosis of OSMF. A comparison between soft palate morphology in OSMF patients and healthy population has also been done. Presence of hooked shaped soft palate is one of the precipitating factors for obstructive sleep apnea syndrome.

Materials and Methods

A total number of 100 patients who attended the outpatient department were a part of this study. This study was conducted at the Kothiwal Dental College and Research Center, Moradabad, India. Study Group or Group 1 comprised of 50 patients who were diagnosed with OSMF on the basis of clinical criteria given by Moore *et al.*, in 2011 which is as follows.[3]

Clinical

Stage I (S1):   Stomatitis and or blanching of oral mucosa
Stage II (S2):   Presence of palpable fibrous bands in buccal mucosa and/or oropharynx with or without stomatitis
Stage III (S3):   Presence of palpable fibrous bands in buccal mucosa and/or oropharynx, and in any other part of oral cavity with or without stomatitis.

Stage IV (S4):
a.   Any one of the above stage with premalignant lesions like leukoplakia, oral erythroplakia etc
b.   Any of the above stages with oral carcinoma.

Functional
M1: Interincisal mouth opening is upto or more than 35 mm
M2: Interincisal mouth opening is between 25-35 mm
M3: Interincisal mouth opening is between 15-25 mm
M4: Interincisal mouth opening is less than 15 mm.

After obtaining a written informed consent, they were subjected to digital lateral cephalometric radiography.

Group 2 or the control group included 50 healthy patients who visited the outpatient department. The patients with cleft palate or with history of surgery of cleft palate and those with fracture in head and neck region were excluded. After obtaining written informed consent, digital lateral cephalogram were taken. The exposure parameters for both the group were optimized as per the body type to obtain optimal images. Tracing [Figure 1] was done for all the digital cephalometric films and the shape of soft palate was compared with the standard pictures from the study done by You *et al.,* in 2008.[4]

Ethical approval was obtained from the Institutional Ethical Committee.

Results

Both the groups contained equal number of patients. Age of the patients ranged from 21-55 years of age. In Group I, the mean age of patients was 36.08 ± 8.6, the youngest patient was 21 years old and oldest was 55 years of age. Majority of the patients were aged between 31 to 40 years (36%). In Group II, age of patients ranged from 22-51 years with majority of the patients aged between 31 to 40 years (48%). The mean age of the patients was 34.98 ± 7.56 years. [$t = 0.680$, $P = 0.283$NS.]

In both the groups, majority of patients were males. In

Group I, there were 7 (14%) females as compared to 11 (22%) in Group II [$t = 0.751$, $P = 0.265$ NS].

Therefore, both the groups were comparable with respect to age and sex ratio.

In Group 1, majority of the patients were in OSMF Stage II ($n = 34$; 68%) followed by those in Stage III ($n = 11$; 22%) and Stage IV ($n = 4$; 8%). There were only 3 (6%) patients with OSMF Stage I.

After tracing and comparing the soft palate morphology with the standard pictures provided by You *et al.,*[3] following results were derived.

Type 1soft palate was the most common variant, found in 28 patients (56%) in Group 1 and in 32 patients (64%) in Group 2. The second most commonly occurring variant was rat tail shaped/type 2, present in 20% and26% cases in Groups 1 and 2, respectively. Type 3 was noticed in 7 patients (14%) in Group 1 and majority of these belonged to stage III OSMF. Whereas in Group 2, only 2 cases (4%) demonstrated type 3 soft palate, 4 cases (8%) in Group 1 demonstrated crook shaped type 6 soft palate whereas no cases were seen in Group 2. Only 1 case (2%) from each group showed type 4 soft palate. One case (2%) from Group 1 revealed type 5 soft palate but no case was reported with type 5 in Group 2 [Figure 2].

In OSMF patients, type 1 was seen in majority of cases whereas stage III cases revealed type 3 soft palate [Figure 3].

Although, majority of cases from both the groups demonstrated type 1 or type 2 soft palate, the length of soft palate (i.e. anterio-posterior dimension) was comparatively less in OSMF patients. Mean length of type 1soft palate was 29.62 mm and 35.86 mm in Groups 1 and 2, respectively. Similarly, type 2 soft palate measured 29.31mm and 35.24 mm (mean values), respectively in Group 1 and 2 [Figure 4]. On comparing the data, it was found to be statistically significant for type 1 ($P = 0.017$), type 2 (0.049) and not significant for type 3 ($P = 0.390$).

Discussion

The soft palate or velum is the posterior fibromuscular part of the palate that is attached to the posterior edge of hard palate. It participates in most oral functions, notably in velopharyngeal closure, which is related to normal function of sucking, swallowing and pronunciation.[4,5] Velopharyngeal closure refers to normal apposition of soft palate with the posterior and lateral pharyngeal walls.

You *et al.,* in 2008[4] conducted an *in vivo* study, titled, "Morphological variety of the soft palate in normal individuals: A digital cephalometric study" on 200 normal subjects where lateral cephalometric analysis on the morphology of the soft palate was done which revealed the variable radiographic
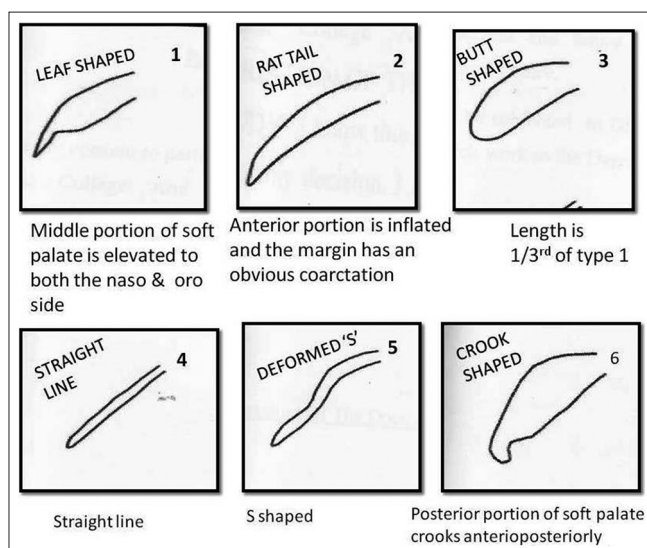

LEAF SHAPED 1	RAT TAIL SHAPED 2	BUTT SHAPED 3
Middle portion of soft palate is elevated to both the naso & oro side	Anterior portion is inflated and the margin has an obvious coarctation	Length is 1/3rd of type 1
STRAIGHT LINE 4	DEFORMED 'S' 5	CROOK SHAPED 6
Straight line	S shaped	Posterior portion of soft palate crooks anterioposteriorly

Figure 1: Diagrammatic representation of various shapes of soft palate

SN	Type of soft palate	Group I		Group II	
		No.	%	No.	%
1.	1	28	56	32	64
2.	2	10	20	13	26
3.	3	07	14	02	4
4.	4	01	2	01	2
5.	5	01	2	00	0
6.	6	04	8	00	0
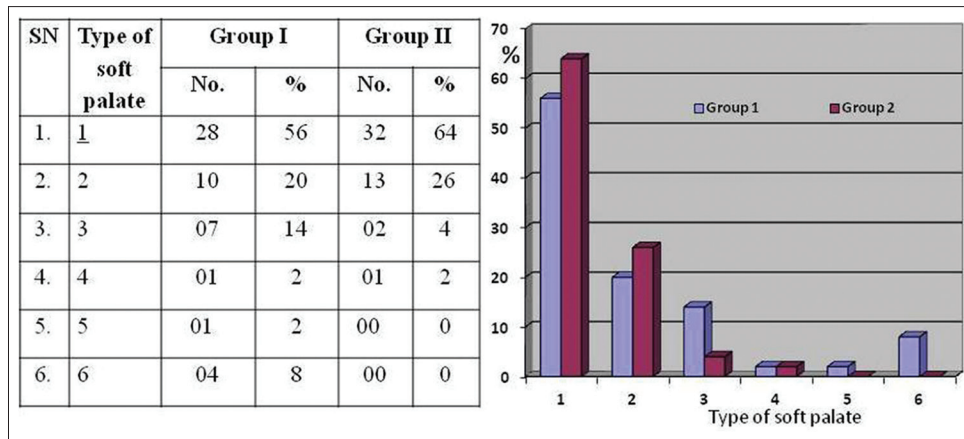
Figure 2: Table and graph showing comparison of types of soft palate in Groups 1 and 2

Type of soft palate	Stage I	Stage II	Stage III	Stage IV
1	3	24	-	-
2	-	09	01	-
3	-	-	08	-
4	-	-	01	-
5	-	01	-	-
6	-	-	01	03
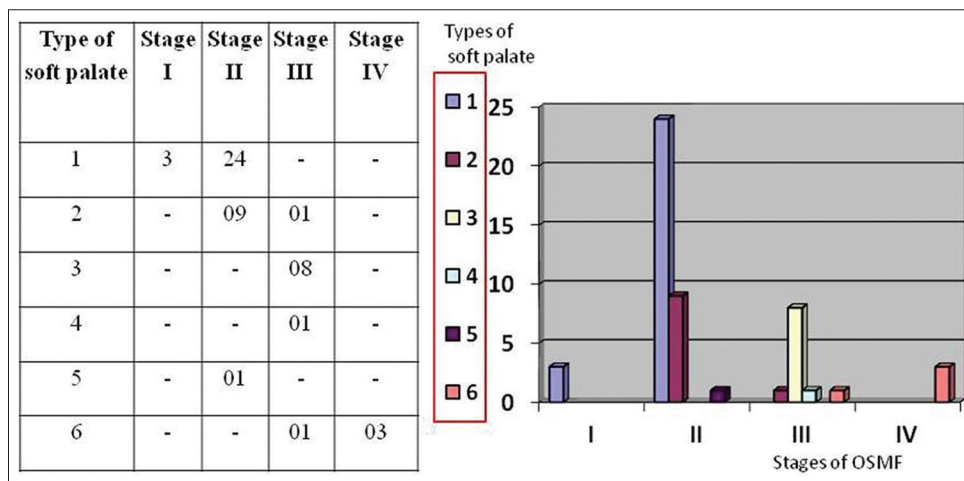
Figure 3: Table and graph showing different types of soft palate in various stages of OSMF

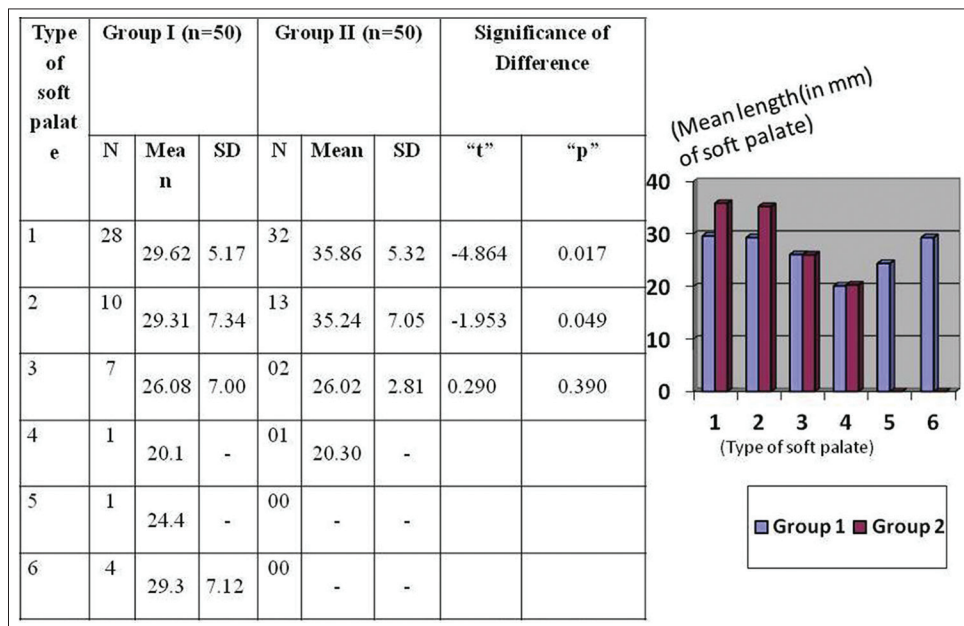| Type of soft palate	Group I (n=50)			Group II (n=50)			Significance of Difference	
	N	Mean	SD	N	Mean	SD	"t"	"p"
1	28	29.62	5.17	32	35.86	5.32	-4.864	0.017
2	10	29.31	7.34	13	35.24	7.05	-1.953	0.049
3	7	26.08	7.00	02	26.02	2.81	0.290	0.390
4	1	20.1	-	01	20.30	-		
5	1	24.4	-	00	-	-		
6	4	29.3	7.12	00	-	-		

Figure 4: Table and graph showing comparison of length of soft palate in Groups 1 and 2

appearance of the soft palate. By observing the soft palate they classified the radiographic appearances of the velum into six types. As it is well known that soft palate is a commonly involved site in OSMF, this study has been carried out to investigate different variants of soft palate in OSMF patients using digital lateral cephalogram. Cephalometry is a relatively inexpensive method and permits a good assessment of the soft tissue elements that define the soft palate and its surrounding structures.[5]

On the basis of the results, it can be concluded that there are six different morphological variants of soft palate [Figure 5]. Moreover, there is considerable decrease in length of soft palate in OSMF [Figure 4].

These findings coincided with the results of the study done by You *et al.*, in 2008. They also found type 1 and 2 to be most common. They reported the least common variant to be type 6
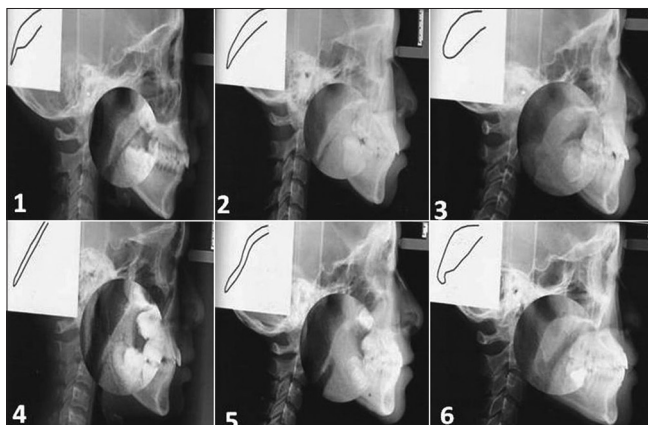
which was not so in our study (type 6 = 8%) According to our study, the least common variants were type 4 and 5.

Bacon *et al.*, in 1990[6] compared a Group of 43 adult males with sleep apnea syndrome with an homologous control Group by cephalometric evaluationwhere they observed that inobstructive sleep apnea patients the length of soft palate was increased and hypothesized it to be a key factor in obstructive sleep apnea. The mean length of soft palate was 45.6 mm with standard deviation of 4.1mm in obstructive sleep apnea whereas it was 38.7 with 3.2 in control group.

Elongation of soft palate in obstructive sleep apnea was also observed by studies carried out by Lyberg T, Krogstad D and Djupesland G in 1989[7] and by Pepin *et al.*, in 1992.[8]

Thus, while examining patients, elongation of soft palate along with hooked appearance should be noted as it may be a predisposing factor for obstructive sleep apnea.

Conclusion

Thus it can be concluded that there is gradual reduction in the length of soft palate in OSMF patients [Table 1]. Initial stages of OSMF present with either type 1 or type 2 soft palate, but as the disease progresses, an increased frequency of type 3 and 6 are noted. The results of this study establish morphometric changes of soft palate as a useful tool to assess the severity of OSMF. Larger number of clinical studies are necessary to support morphometric evaluation of soft palate as a basis for staging of OSMF. Moreover, elongation of soft palate along with hooked appearance may be a predisposing factor for obstructive sleep apnea.

Figure 5: Different morphological variants of soft palate as seen on digital lateral cephalogram

Table 1: Summary table showing comparison of demographic characteristics, soft palate morphology between cases and controls

Variable	Control (n=50)	Cases (n=50)	Significance of difference
Mean age±SD (Range) in years	34.98±7.57 (22-51)	36.08±8.61 (21-55)	t=0.579; P=0.499
Male gender	39 (78%)	43 (86%)	χ^2=1.084; P=0.298
OSMF Stage			
No OSMF	50 (100%)		χ^2=100; P<0.001
Stage I		3 (6%)	
Stage II		34 (68%)	
Stage III		10 (20%)	
Stage IV		3 (6%)	
Type of soft palate			
I	33 (66%)	27 (54%)	χ^2=9.044; P=0.107
II	14 (28%)	10 (20%)	
III	2 (4%)	7 (14%)	
IV	1 (2%)	1 (2%)	
V	0	1 (2%)	
VI	0	4(8%)	
Mean soft palate length±SD (range) in mm	34.32±6.20 (21.3-47. 2)	29.46±6.18 (17.6-42.1)	t=3.925; P<0.001

Comparison of Demographic Characteristics, Soft Palate Morphology between cases and controls

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