THERAPY

The role of anatomic measurements of velopharynx in the indication of velopharyngeal insufficiency surgical repair

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Abstract

The article is focused on an evaluation of some anatomic features of velopharynx (e.g. pharyngeal depth, velar length) that are evaluated together with dynamic clinical examinations before surgery to predict the best indication for pharyngoplasty. *(Tab. 3, Fig. 2, Chart 2, Ref. 10.)*
Key words: velopharyngeal insufficiency, pharyngoplasty, pharyngeal depth, velar length.

In 2000, D'Antonio et al reported a study which documented the relationship between the preoperative and postoperative anatomic measures of velopharynx and velopharyngeal function in patients who underwent Furlow Z-plasty for symptoms of velopharyngeal insufficiency. Till now, for the speech quality and articulation improvement we have indicated in our center the superiorly based pharyngeal flap using the Hönig technique (Hönig 1968). In our view the optimal timing for the pharyngeal flap is the pre-school age, in which the functional result of the operation can help in the process of children's adaptation to the group. Previous reported studies led us to evaluate the role of the anatomic measurements of velopharynx (pharyngeal depth, velar length) in the indication of pharyngeal flap in our patients.

Material and methods

Subjects

Subjects for the study were drawn from the patients who underwent surgery with regard to the symptoms of velopharyngeal insufficiency. In all patients the Wardill–Kilner technique was performed for the primary palatal closure. Seventeen candidates for Hönig pharyngoplasty based on endoscopic, perceptual and radiological findings, were selected for retrospective cephalometric assessments of velar length and pharyngeal depth. Subjects' characteristics are described in Table 1.

Cephalometric radiographs and measurements

Preoperative lateral cephalograms were performed at rest and during phonation of the syllable "pee" using a cephalostat head-holding device. The points and measurements at rest and during phonation are illustrated in Figs 1 and 2. The pharyngeal depth/velar length ratio and other measurements were calculated by two persons for more reliability. Age-matching group norms were compared with the report of Subtelny results (Subtelny 1957).

Tab. 1. Subjects' characteristics.

No	Gender	Diagnosis	Age at surgery
1	M	CLP left	8
2	F	CLP left	8
3	M	CP	12
4	F	CP	7
5	M	CP	11
6	M	CLP right	18
7	F	CP	8
8	F	CP	12
9	M	CLP left	9
10	F	CLP right	18
11	M	CP submucous	7
12	M	CLP right	15
13	M	CLP left	7
14	M	CLP left	14
15	F	CP submucous	7
16	M	CLP right	10
17	M	CLP right	16

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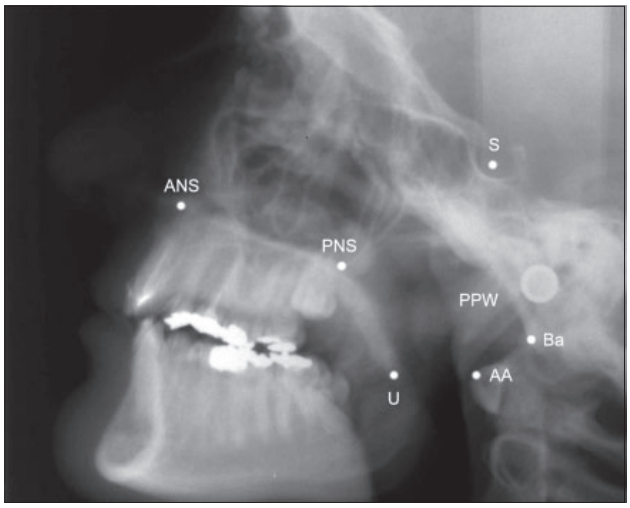

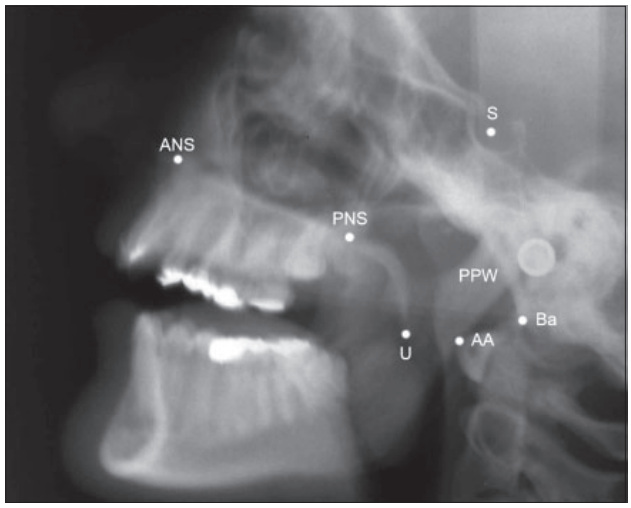

Fig. 1, 2. Craniometric endpoints and velopharyngeal measures at rest (1) and during phonation (2). ANS — anterior nasal spine, PNS — posterior nasal spine, U — tip of the uvula, S — midpoint of the sella turcica, Ba — basion, AA — atlas, PPW — posterior pharyngeal wall, a junction of the palatal plane, PNS — PPW pharyngeal depth, PNS — U velar length. (2) V — endpoint of the velum at the junction of the palatal plane, V — PPW pharyngeal depth, V — U velar length.

Results

Table 2 and Chart 1 show the measures of velar length and pharyngeal depth and the calculation of pharyngeal depth/velar length ratio for individual subjects on preoperative cefalograms at rest. Each measure is accompanied by the normative value for age-matched subjects evaluated by Subtelny. Measures on preoperative cefalograms at rest and during phonation are shown in Table 3 and Chart 2. In our clinical material the mean pharyngeal depth/velar length ratio was about 0.70 % at rest and about 0.69 % during phonation. The mean difference between the patients with VPI and age-matched norms in pharyngeal depth was 5.6 mm and in velar length 7.1 mm. The mean pharyngeal depth/velar length ratio difference at rest between the subjects before pharyngeal flap and age-matched norms was 0.019 % (Tab. 2). The difference between pharyngeal depth/velar length ratio at rest and phonation was about 0.092 % (Tab. 3).

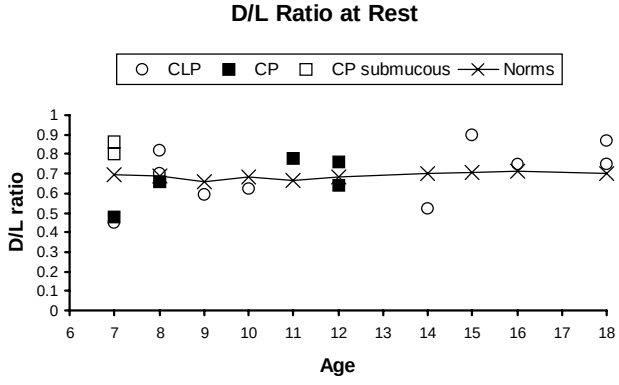

Chart 1. Preoperative measures of depth/length ratio at rest for subjects due to the cleft type compared with age-matched norms.

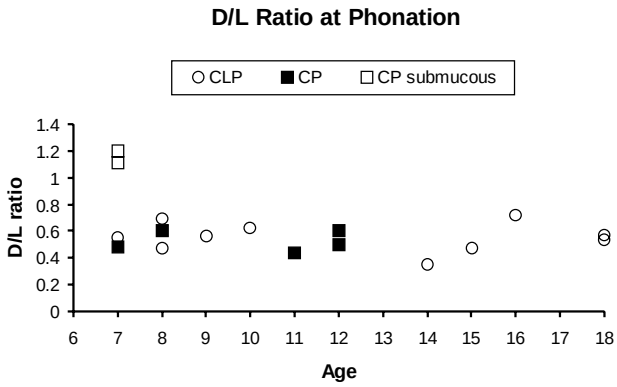

Chart 2. Preoperative measures of depth/length ratio during phonation for subjects due to the cleft type compared with age-matched norms.

Discussion

There are scientific discussions aimed at finding out the most effective primary and secondary operation techniques for velopharyngeal insufficiency prevention or improvement. In primary palate repair, the principles of push-back or double-opposing Z-plasty are already entrenched. Double opposing Z-plasty (Furlow, 1986) has some advantages including repositioning the levator muscle in the anatomic position, lengthening of the soft palate, and avoidance of the midline scar, which reduces the potential for velar shortening. Previous studies have documented that in the cases of velopharyngeal insufficiency the double opposing Z-plasty resulted in the positive speech outcome. Wide pharyngeal flap pedicle can result in snoring, limited nasal breathing or in the accumulation of mucus at the nasal side of the pedicle

Tab. 2. Measures of velopharyngeal anatomy and depth/length ratio at rest for subjects before pharyngeal flap compared with age-matched

X Rays at rest

	Depth mm		Length mm		Depth/Length ratio %		Difference %
No	VPI	normal	VPI	normal	VPI	normal	
1	19.3	19.9	27.1	28.8	0.712	0.687	0.025
2	19.2	19.9	23.0	28.3	0.834	0.687	0.147
3	22.0	21.0	34.2	31.4	0.643	0.683	-0.020
4	10.4	19.0	21.0	28.0	0.495	0.696	-0.201
5	18.1	20.4	23.3	30.9	0.776	0.663	0.113
6	18.0	24.2	24.0	33.6	0.750	0.702	0.048
7	23.3	19.9	35.0	28.3	0.665	0.687	-0.022
8	13.3	21.0	17.3	31.3	0.768	0.683	0.085
9	13.0	19.7	22.2	29.0	0.585	0.660	-0.075
10	21.1	24.2	24.0	35.2	0.879	0.702	0.177
11	16.2	19.0	20.0	28.0	0.810	0.696	0.114
12	20.2	22.0	22.0	32.8	0.918	0.705	0.213
13	10.3	19.0	22.1	28.0	0.466	0.696	-0.230
14	13.4	22.0	25.4	31.8	0.527	0.700	-0.173
15	12.0	19.0	14.0	28.0	0.857	0.696	0.161
16	16.0	20.6	26.1	30.0	0.613	0.683	-0.070
17	12.1	23.5	16.1	32.9	0.751	0.714	0.037
delta	15.3	20.9	23.3	30.4	0.709	0.691	0.019

Tab. 3. Measures of velopharyngeal anatomy and depth/length ratio at rest and phonation for subjects before pharyngeal flap.

VPI X Rays at rest and phonation

	Depth mm		Length mm		Depth/Length ratio %		Difference %
No	rest	phonation	rest	phoantion	rest	phonation	
1	19.3	9.2	27.1	13.3	0.712	0.691	0.021
2	19.2	7.3	23.0	15.0	0.834	0.486	0.348
3	22.0	10.1	34.2	20.1	0.643	0.502	0.141
4	10.4	10.0	21.0	21.1	0.495	0.473	0.022
5	18.1	8.0	23.3	18.2	0.776	0.439	0.337
6	18.0	8.1	24.0	14.0	0.750	0.578	0.172
7	23.3	12.2	35.0	20.0	0.665	0.610	0.055
8	13.3	9.0	17.3	15.2	0.768	0.592	0.176
9	13.0	9.0	22.2	16.1	0.585	0.559	0.026
10	21.1	8.1	24.0	15.0	0.879	0.540	0.339
11	16.2	20.0	20.0	18.4	0.810	1.086	-0.276
12	20.2	7.4	22.0	15.0	0.918	0.493	0.425
13	10.3	11.4	22.1	20.0	0.466	0.570	-0.104
14	13.4	7.4	25.4	20.0	0.527	0.370	0.157
15	12.0	12.0	14.0	10.4	0.857	1.153	-0.296
16	16.0	16.1	26.1	26.1	0.613	0.616	-0.003
17	12.1	10.3	16.1	14.1	0.751	0.730	0.021
delta	15.3	10.3	23.3	17.2	0.709	0.617	0.092

that can be a source of infections of a nasopharynx and the middle ear. In extreme cases the nocturnal respiratory apnoe were also reported. As the matter of these facts, since 2002 Furlow Z-plasty has become a standard technique in our surgical protocol.

Influenced by reports of D'Antonio (2000), the purpose of this study was also to describe the radiographic dimensions of velopharynx and the measures of velopharyngeal function in a group of our VPI patients before Hönig pharyngoplasty. Even the cephalometric measures of pharyngeal depth and velar length have confirmed the velopharyngeal dimensions, the depth/length ratio have not showed any significant correlation with preoperative clinical findings. Also the final mean difference of the depth/ /length ratio at rest compared with age-matched norms was not significant. The difference between the depth/length ratio at rest and during phonation was minimal, too.

Unfortunately, our cefalometric study was limited, because in patients with pharyngeal flaps (as opposed to patients after Furlow Z-plasty) the postoperative measures and so their pre/ /postoperative comparisons are not easily available and exact.

In addition, in our experience the results of dynamic clinical examinations before surgery predict the best indication for pharyngoplasty. Static anatomic features like pharyngeal depth and velar length could be helpful but not determinative.

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