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FACE AND FOOT ASYMMETRY IN ADOLESCENTS

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ABSTRACT
Extensive studies have been conducted throughout the last century regarding laterality in Human beings and the mystery of one sided dominance in the animal kingdom. This study was conducted in Belgaum city during 2000.The objective of present study was to find the frequencies and prevalence of asymmetry in the use of face musculature and its correlation with foot preference in young subjects. 200 suitable subjects who were between 13 to 15 years of age were selected from local schools. Personal data was collected from the subjects, by providing them a questionnaire, in which they answered various questions. Various tests were conducted to determine the asymmetry in the face, foot preference and foot overlapping. Chi square test was used with paired T test for correlation between Face asymmetry and sex of the subjects. There was a significant correlation in both males and females for the tests in the upper part of the face, that is ($P<0.05$) for vertical wrinkling of the forehead, and ($P<0.01$) for winking respectively. Fisher's exact test was used to test significance of correlation between facial muscular dominance and foot preference of the subjects. Foot preference and vertical wrinkling of the forehead were highly significant ($P<0.0001$), winking exercise was highly significant ($P<0.001$). Correlation of foot preference with the facial musculature on the lower part of the face was just significant ($P<0.01$) for the lateral movement of angle of the mouth and ($P<0.05$) for the raising and everting of the upper lip with dilatation of nostrils respectively. The contraction of platysma didn't show any correlation with foot preference ($P>0.05$).

KEYWORDS: Facial dominance, Foot preference, Laterality etc.

INTRODUCTION

Motor laterality of one side of the body has been an established factor, but the concrete reason for this behavior in the whole animal kingdom lacks explanation, although many theories have been put forth. Prenatal testosterone has been implicated as an important factor in the development of extra genital sexual dimorphism including the differentiation of the nervous system [1]. It has been hypothesized that testosterone may slow growth within some areas in the left hemisphere and promote growth of certain areas in the right hemisphere. Testosterone has been implicated in the etiology of autism, dyslexia, migraine, stammering, autoimmune disease, sexual preferences and spatial, language, music, and mathematical abilities [2]. Studies indicated that there is lateralization of squamous cell carcinomas in the head-neck region, showing right sided lateralization in right handed patients and vice versa in left handed ones and a higher rate of left handedness in patients with squamous cell carcinoma [3]. Women have more symmetric size-standardized foot prints than do men. Mean size-independent shapes of male and female left and right foot prints were also calculated and together with analysis of individual asymmetry, they could be used for the quantitative diagnosis of borderline patients [4]. Vertical facial dimension is linked to abnormal foot motion. Imbalances in the pelvis and face (vertical facial dimension) can result from abnormal asymmetrical pronation patterns in the feet. A positive correlation was found linking the relatively more anteriorly rotated innominate and to the shorter vertical facial dimension [5].

MATERIALS AND METHODS

The total number of subjects included in the study was 200. Healthy and co-operative subjects who were mentally and physically fit were selected. Those with any deformity of the upper and lower limbs and those with the history of injury to facial nerve (7^{th} cranial nerve), were excluded from the study. Finally, 112 male subjects and 88 female subjects between the ages of 13 to 15 years were selected. The subjects were asked to answer a questionnaire in writing. They answered simple questions like their name, age, sex etc. They were also requested to mention, whether any member in the family is left-handed, and their relation to the subject. The hand used by each student to pick up and answer the questionnaire was noted without the knowledge of the subject. Each subject was interviewed and during the conversation, the dominant side of the spontaneous smile was noted. Various tests were conducted to see the functional asymmetry of the face, foot preference and foot overlapping. Observations were recorded.

A. Tests for function of facial musculature

The following tests were conducted to determine the facial muscular dominance.

1- Vertical wrinkling of the forehead

The subject was requested to vertically wrinkle the forehead and maintain the wrinkled forehead in position. The number of folds and degree of inward pull of the brows were observed and noted. The number of folds on either side of the forehead were counted and recorded. A score of 5 (five) was assigned to side with more degree of inward pull of the brow and score less than 5 (five) to the one with less degree of inward pull of the brow. The side with a higher score was determined as the dominant side of the forehead. In the next series of exercises in relation

to facial function, the subject was first demonstrated what he/she has to do. Later he/she was requested to mimic the exercise 10(ten) times. The subject was asked to do the exercise first on one side continuously for 10(ten) times, and then repeat on the other side, for 10(ten) times. The subject was observed and the side of the face with which he begins to do the exercise was noted. He/she was given rest between exercises for 1 (one) minute, after which the subject was asked to repeat the exercise.

This time, he/she was asked to begin on the side of the face, on which he/she last completed the exercise. At the end of each exercise, the subject was asked as to which side he/she felt comfortable in performing the exercise. The reply was noted. The subject was requested to repeat the exercise after 5(five) minutes of rest. In most of the subjects the first and second results, were same. The subjects with difference in first and second results were asked to repeat the exercises after 30 minutes of rest. After observing them again, an ultimate decision was made. Those, in whom perfect distinction was not seen, were classified as "Ambilateral". The various other exercises were:

2- Winking,
3- Lateral movement of angle of mouth,
4- Raising and everting the upper lip with dilatation of nostrils and
5- Contraction of platysma

All the exercises were tested alternately on both sides. Care was taken to see that the movements were fine and regular during rapid performance. Squeezing, twisting and extortions were avoided. The judgement of dominant side of the face was based on the performance with convenience and uniform rapidity of movements. Equal performances on both sides of face, after repeated testing, were recorded as "Ambilateral". Inability of the subjects to perform certain exercises was considered as a failure.

Tests for foot preference

The subjects were asked to kick a football towards a goal, from a distance of 10 meters in an attempt to make a score. The assessment was made on how accurately each subject aimed at the goal and how hard he/she kicked the ball. The subject was observed carefully as to which leg was first preferred to kick the ball. After each subject used both the legs, proper distinction was made between the dominant and non-dominant foot, by observing the comfort, accuracy and hardness with which the ball was kicked by each leg.

Test for foot overlapping

The volunteers were demonstrated about the exercises i.e. foot overlapping and they were asked to mimic the exercise. The foot which was on top and with which the subject was comfortable, was considered as a dominant one.

Ethics

The study was conducted on teenage student volunteers in a local school. Permission to conduct the study was granted by the Head of the institution. Willingness of each student and their parents was taken before conducting the study.

RESULTS

TABLE 1. Distribution of frequencies of Male Subjects with lateral dominance between each of the parameters studied

Sl.No	Function	No.Tested	No.R.D.	%R.D.	No.L.D.	%L.D.	No.A.L.	%A.L.
1.	Vertical wrinkling of the forehead	112	52	46.42	1	0.9	59	52.68
2.	Winking	112	79	70.54	7	6.25	26	23.21
3.	Lateral movement of angle of mouth	112	86	76.78	1	0.9	18	16.1
4.	Raising and everting the upper lip with dilatation of nostrils	112	30	26.27	-	-	56	50
5.	Platysma contraction	112	8	7.14	-	-	79	70.5
6.	Foot preference	112	110	98.20	2	1.80	-	-
7.	Foot overlapping	112	85	75.90	27	24.10	-	-

Abbreviations used: RD-right dominance, LD-left dominance, AL-ambilateral

TABLE 2. Distribution of frequencies of Female subjects with lateral dominance between each of the parameters studied

Sl. No.	Function	No.Tested	No.R.D.	%R.D.	No.L.D	%L.D	No.A.L	%A.L
1.	Vertical wrinkling of forehead	88	27	30.68	3	3.40	56	62.5
2.	Winking	88	62	70.45	13	14.77	9	11.36
3.	Lateral movement of the angle of the mouth	88	72	81.81	3	3.40	8	10.22
4.	Raising and everting the upper lip with dilatation of nostrils	88	13	14.77	1	1.13	42	48.86
5.	Platysma contraction	88	6	6.81	1	1.13	51	57.95
6.	Foot preference	88	84	95.50	4	4.50	-	-
7.	Foot overlapping	88	57	64.77	31	35.23	-	-

Abbreviations: RD:Right dominance, LD:Left dominance, AL: Ambilateral

TABLE 3. Results of individual facial exercises in Male and Female subjects

				Dominant side of the face					
				Right		Left		Ambilateral	
Sl.No.	Exercise	Sex	No.Tested	No	%	No	%	No	%
1.	Vertical wrinkling of the forehead	Male	112	52	46.42	1	0.8	59	52.67
		Female	88	27	30.68	3	3.40	57	64.77
2.	Winking	Male	112	79	70.53	7	6.25	26	23.21
		Female	88	62	70.45	13	14.77	9	10.22
3.	Lateral movement of angle of mouth	Male	112	84	75	1	0.8	18	16.07
		Female	88	72	81.8	3	3.40	8	9.09
4.	Raising and everting of the upper lip with dilatation of nostrils	Male	112	30	26.78	0	0	56	50
		Female	88	13	14.77	1	1.13	42	47.72
5.	Platysma contraction	Male	112	8	7.14	0	0	79	70.53
		Female	88	6	6.81	1	1.13	52	59.09

Abbreviations: RD:Right dominance, LD:Left dominance, AL: Ambilateral

TABLE 4. Results of individual facial exercises in right and left footed subjects

				Facial dominance					
Sl.No	Exercise	Foot preference		Right		Left		Ambilateral	
		RD/LD	No.Tested	No	%	No	%	No	%
1.	Vertical wrinkling of forehead	RD	194	78	40.20	1	0.51	111	57.21
		LD	6	-	-	5	83.33	1	16.67
2.	Winking	RD	194	139	71.64	14	7.21	33	17.01
		LD	6	1	16.66	4	66.68	1	16.66
3.	Lateral movement of angle of mouth	RD	194	155	79.89	2	1.03	14	7.21
		LD	6	1	16.66	2	33.34	3	50
4.	Raising and everting the upper lip with dilatation of nostrils	RD	194	43	22.16	0	0	91	46.90
		LD	6	0	0	1	16.67	5	83.33
5.	Platysma contraction	RD	194	14	7.21	0	0	123	63.40
		LD	6	0	0	1	16.67	5	83.33

Abbreviations: RD:Right dominance, LD:Left dominance, AL: Ambilateral

TABLE 5. Numeric distribution of various facial exercises compared with Footedness and Sex

					Sexes	
			Foot		Male	Female
Sl.No	Exercise	Lateral dominance	RD	LD		
1.	Vertical wrinkling of forehead	RD	79	4	27	52
		LD	3	4	3	1
2.	Winking	RD	141	20	62	79
		LD	3	5	13	7
3.	Lateral movement of angle of mouth	RD	155	2	72	84
		LD	2	2	3	1
4.	Raising and everting the upper lip with dilatation of nostrils	RD	43	0	13	30
		LD	0	1	11	0
5.	Platysma contraction	RD	14	0	6	8
		LD	0	1	1	0

Abbreviations: RD:Right dominance, LD:Left dominance

DISCUSSION

Table 1 depicts the frequencies in male subjects with lateral dominance of each parameters studied. Table 2 depicts the same frequencies in females with lateral dominance of each parameters studied. Most of the subjects exhibit right sided dominance for the upper part of the face and for foot preference and foot overlapping. However, there is ambilaterality in the lower part of the face, especially for the platysma contraction. There were some failures for this exercise as well. Foot preference has been given only superficial attention in studies of hemispheric lateralization, although it has potential utility for predicting hemispheric dominance. It has yet to be determined whether footedness and handedness has the stronger relationship to other aspects of cerebral lateralization and whether both measures together predict lateralization better than one of them alone [6]. Some of the workers suggest that foot laterality may emerge after

5th year of life in roughly 1/3rd to 1/4th of the population [7] Table 3 depicts the results of facial exercises in both males and females. It is evident that both males and females used one side of the face for most of the exercises. However, significant number of subjects exhibited ambilaterality for the lower part of the face. Males used right side of their face for most of the exercises, which ranged from 46.42% to 76.78%, they showed 50%to 70.5% of ambilaterality for lower part of the face. Females also tended to use the right side of their face for most of the exercises which ranged from 30.68% to 81.81%, The lower part of the face exhibited ambilaterality ranging from 48.86% to 57.95% for different exercises. Chi square test was used to analyze the results of significance between face and sex of the subject. There was a significant correlation between facial musculature and sex of the subjects. The vertical wrinkling of the forehead had a significance of $P<0.05$ in both males and females. The winking exercise showed a significance of $P<0.01$ in both sexes. There was no significant correlation between the lower part of the face and sex of the subject. Table 4 depicts the results of individual facial exercises in right and left footed subjects. Fisher's exact test was used to find the correlation between face and foot preference in all the subjects. A highly significant correlation was seen between Vertical wrinkling of the forehead and foot preference $P<0.0001$. Similarly a highly significant correlation existed between Winking and Foot preference $P<0.0006$. Test for Lateral movement of the angle of the mouth and foot preference had a significant correlation $P<0.01$. Exercises for raising and everting the upper lip with dilatation of nostrils and foot preference were correlated significantly $P<0.05$. The platysma contraction had no correlation with foot preference $P>0.05$. Foot preference has been a potential factor for the cause of corns and callus formation in lower extremities of physically active individuals which is highly significant ($P<0.005$), [8]. The World cup foot ball players are as right footed, as general population approximately upto79%. The remaining players are largely left footed as biased towards the use of their preferred foot as their right footed counter parts [9]. 70% of the subjects exhibited right sided dominance for foot overlapping, and 29.6% were left dominant for the same. This is nearly similar to the findings in earlier studies, where 62% were right and 26% were left dominant for the exercise [10]. Table 5 depicts the results of individual facial exercises compared with footedness and sex. Fisher's exact test was used and there was no correlation between footedness and sex of the subjects $P>0.05$. Literature search did not reveal many studies regarding correlation between face and foot asymmetry.

CONCLUSION

It is concluded that extensive studies are necessary on the correlation between face and footedness, to improve the performance of sportsmen, factory workers, skilled artists etc.

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