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Research Article

Development of a Portable Non-Invasive Oral Motor Assessment Device and its Reliability

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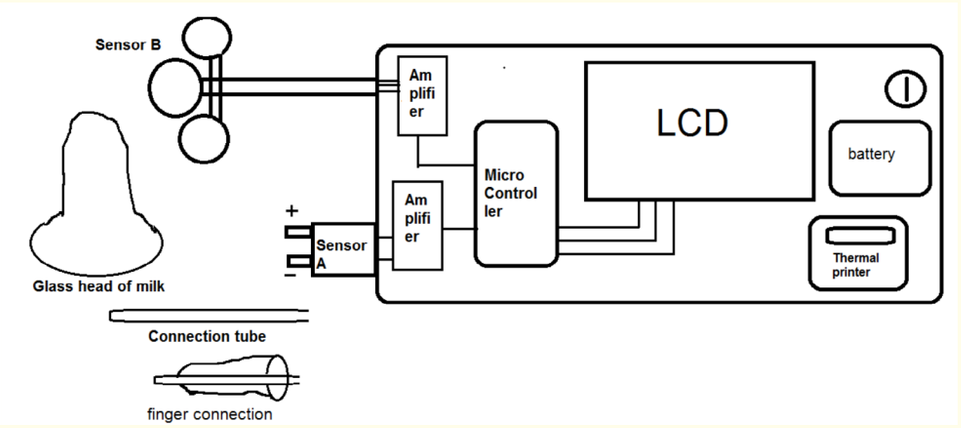
Graphical Abstract



Abstract

Purpose: Development of a portable non-invasive oral motor assessment device.

Method: New device is designed and twenty people (11 male and 9 female) in deferent range of age with no history of swallowing, orofacial, gastrointestinal, respiratory or neurologic problem were selected. sample was evaluated twice in 15 minutes intervals with device for assessment of reliability.

Result: There are correlation between the two measurements in test-retest and its significance and the degree of reliability of each measurement.

Conclusion: It can be concluded that these tools have an acceptable reliability and reliability index and it can be used as a reliable instrument in the evaluation of some oral motor skills.

Keywords: Oral Motor; Infant Feeding; Sucking Assessment

Introduction

The craniofacial and masticatory musculature is deployed for a variety of behaviors, including speech, communicative and non-communicative facial gestures, biting, chewing, swallowing, licking and ventilation. These diverse behaviors use many of the same muscles but with differing patterns of activation [1]. Oral-motor skills refer to movement of the muscles of face (e.g. mouth, jaw, tongue and lips). This includes muscle tone, muscle strength, range of motion, speed, oordination and dissociation (the ability to move oral structures, such as the tongue and lip, independently of each other) [2,3]. Clinical experience suggests that the acquisition and maturation of oral-motor movements underlies sound production and feeding skills (e.g. sucking, biting and chewing) [4]. Children with developmental disabilities may demonstrate oral-motor patterns that are not observed in typical development, atypical oral-motor patterns include jaw thrusting, tongue thrust, tonic bite reflex, lip retraction, tongue retraction and nasal regurgitation [5].

A child oral-motor skills may be assessed speech language pathologist.

Given the large number of clients in speech therapy consist of patients with impaired oral motor skills (adults and children), there are several device [6-12], assessment tests designed to assess the motor skills for children's [13-15] and adults [8]. But according to the researchers' knowledge of this study, there is no new device for assessing the oral motor skills. In this research we are developed the new portable device that can assessment the some of oral motor skills (such as blowing, nutritive sucking, non-nutritive sucking, finger feeding sucking, nipple feeding sucking, tongue palate pressure, up down of larynx in swallowing and lip power) and We examined its reliability in this study. The device registered with No.101149 in the Iranian Patent Organization.

Materials and Methods

Subjects

The following formula was used to calculate the sample size of the research:

$$n = \frac{Z^2_{1-\frac{\alpha}{2}}\delta^2}{d^2}$$

According to the variance of the variables of this study ($S^2 = 38$) and the volume of the effect (d = 2.7) at a significance level of 95%, the sample size of 20 people was obtained.

Twenty people (11 male and 9 female) in deferent range of age with no history of swallowing, orofacial, gastrointestinal, respiratory or neurologic problem were selected.

Device

The schematic of the device is shown in figure 1. As shown, it is a portable device that has two sensors, an internal computer, an internal processor, printers, and special probes for evaluation.

The sensor 1 is *MPXV7007* series piezoresistive transducers are state-of-the-art monolithic silicon pressure sensors. The sensor 2 is piezoelectric sensor (Shown in figure 1) is the kind of pressure sensors used [16]. It is made by solid materials, which can accumulate electric charges in response to applied mechanical stress.

Reliability is the degree of uniformity of results over a given time and under the same conditions and with the same working method as is characterized by the reliability and repeatability of the measured results [17]. In this method first explained the process of working to people. Then, each sample was evaluated twice in 15 minutes intervals. The problem of determining the appropriate time interval for test run and the test takers' reluctance to run second run has been discussed by many scholars. According to the researchers, three types of effects, including fatigue effect, memory effect, Genuine Change Effect, will be effective in maintaining test retention value [17]. This test may only produce the effects of partial fatigue from the production of speech tests, which is a 15-minute gap between the test and the retest and second tests.

Test-retest of sensor 1 (Suction section)

As seen in figure 2, the suction tube connects to the device from one side to the mouth tube at the other. The tester then inserts the tube into the case's mouth and after ensuring that the case is positioned correctly, he wants to suck (at least 3 seconds).

As the case starts sucking, the tester puts the device in recording mode and, after sucking the case, automatically saves the numbers in the internal memory and also transfers them to the flash. After 15 minutes and sufficient rest, the above process is repeated again for retest.

Test-retest of sensor 1 (blowing section)

As seen in figure 3, the blowing tube connect to the device from one end to the mouth tube at the other site. The tester then inserts the tube into the test case's mouth and after ensuring that the case is positioned correctly. The viewer wants to blow (at least 3 seconds). As the sucker begins to suck, the tester puts the device in recording mode and when the case is finished, the device automatically stores the numbers in the internal memory and also transfers them to the flash. After 15 minutes and sufficient rest, the above process is repeated again for retest.

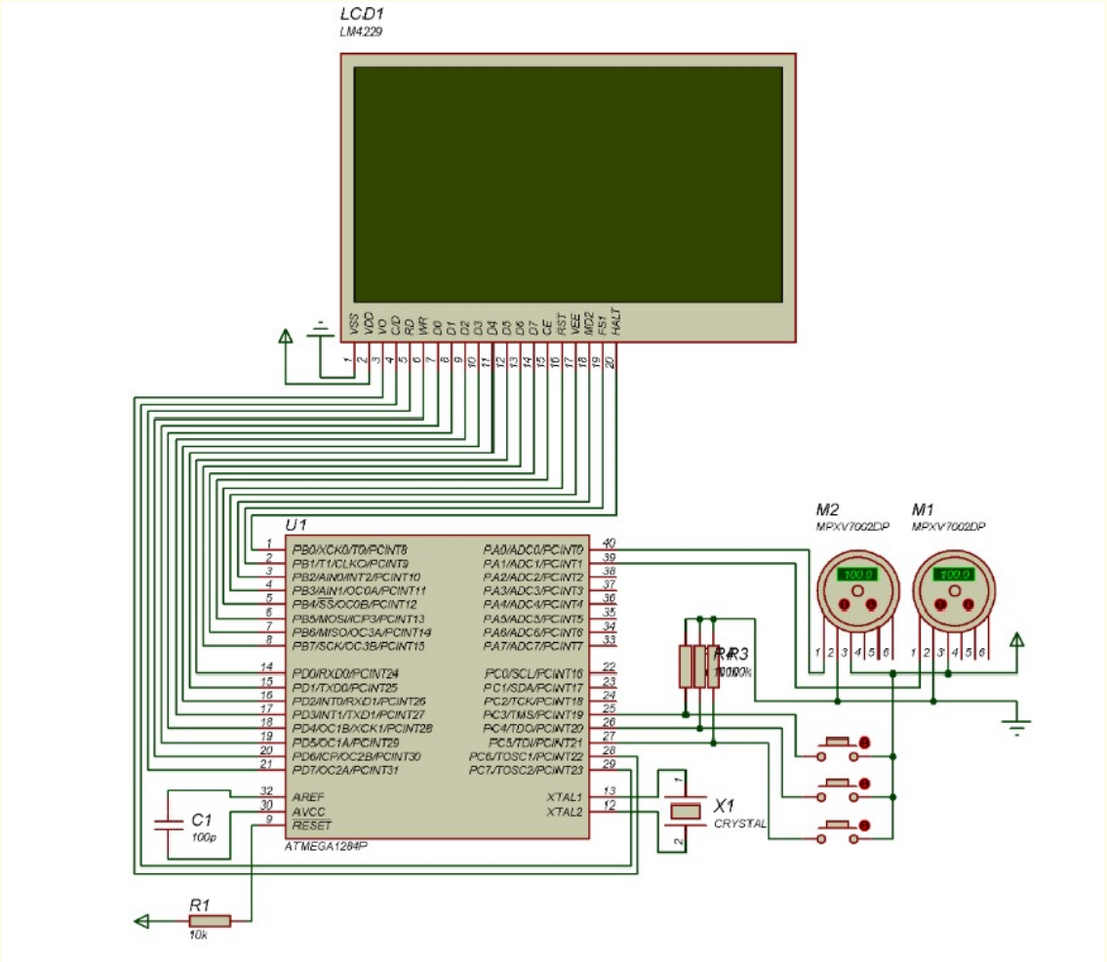


Figure 1

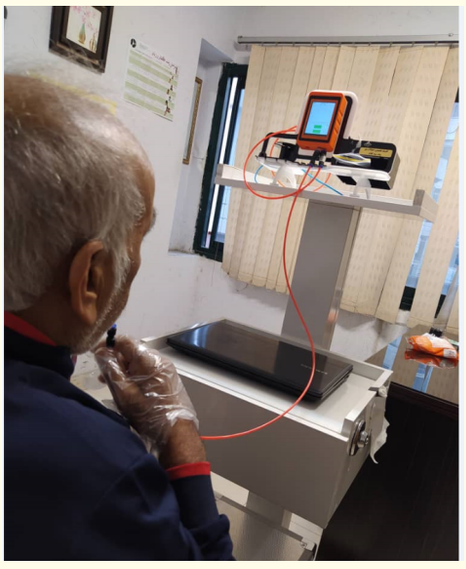


Figure 2

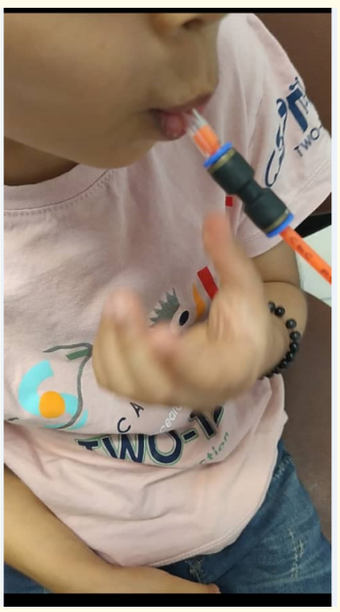


Figure 3

Test-retest of sensor 2 (Lips closure pressure)

As seen in figure 4, the tester insert the sensor between the lips and ensure that the sensor is positioned correctly. at the same time as the case's pressure, the tester puts the device in recording mode and upon completion of the case pressure, the device automatically stores the numbers in the internal memory and also transfers them to the flash. After 15 minutes and sufficient rest, the above process is repeated for again for retest.

Figure 4

Results

As seen in table 1, the mean negative pressures of suction in the test and retest are shown.

As seen in table 2, the mean blowing positive pressures in the test and retest are presented.

In table 3, the mean tongue and palate pressure are presented in the test and retest.

The reliability of the measuring instrument for information of sucking pressure, blowing pressure and lips closure pressure

Case	Test	Retest
1	-1.089	-0.910
2	-9.112	-10.211
3	-12.230	-12.759
4	-12.30	-13.89
5	-6.821	-7.019
6	-12.501	-11.630
7	-6.157	-5.807
8	-12.049	-14.924
9	-9.043	-10.914
10	-4.53106	-4.30381
11	-1.075	-1.126
12	-2.922	-3.091
13	-16.006	-17.725
14	-2/551	-2/578
15	-2/703	-2/995
16	-13/016	-13/117
17	-2/9234	-3/06194
18	-1/986	-1/795
19	-21/382	-22/060
20	-12/922	-13.283

Table 1: Mean of sucking pressure.

Numbers are based on kilopascals(Kpa)

Case	Test	Retest
1	1.884	1.156
2	2.824	2.254
3	7.647	7.914
4	10.076	10.398
5	2.562	2.443
6	3.95	3.090
7	5.916	5.457
8	1.998	2.058
9	7.597	6.650
10	7.921	7.739
11	2.376	1.902
12	3.676	3.755
13	6.248	5.434
14	6/622	6/512
15	3/067	3/309
16	8/151	8/697
17	3/437	3/549
18	3/550	3/437
19	3/262	3/544
20	3/783	4/159

Table 2: Mean of blowing pressure.

Numbers are based on kilopascals(Kpa)

Case	Test	Retest
1	8.823	7.684
2	9.111	10.214
3	9.45487	5.03695
4	48.742	47.817
5	5.560	7.420
6	3.068	3.713
7	34.389	32.981
8	4.605	2.358
9	35.539	28.394
10	33.39	36.69
11	4.246	3.410
12	9.449	7.949
13	34.604	32.567
14	3.217	4.514
15	4.124	5.327
16	26.410	28.234
17	5.792	4.536
18	9.142	11.612
19	5.126	6.324
20	7.580	9.362

Table 3: Mean of lips closure pressure.

Numbers are based on kilopascals(Kpa)

based on data obtained from 20 individuals according to table 4 is as follows.

Measures	Pearson Correlation	Sig. (2-tailed)	Reliability
Mean of sucking pressure	0.991	0.000	0.995
Mean of blowing pressure	0.984	0.000	0.991
Mean of lips closure pressure	0.985	0.000	0.992

Table 4

Numbers are based on kilopascals(Kpa)

Table shows the correlation between the two measurements in Test-Retest, and its significance, and the degree of reliability of each measurement. The Spearman-Brown formula was used to calculate the reliability.

According to the calculated reliability values, it can be concluded that these tools have an acceptable reliability and reliability index.

Discussion

Digital measurement of air pressure is a continuous chain. That is, due to the changeable nature of air pressure, pressure sensors are forced to record all changes in air pressure within a defined time frame (according to the loaded schedule) in this type of system. The tester should select and analyze the range that is the most significant change in pressure related to tasks.

According to the results obtained from sensor number one, it can be said that this sensor has good reliability and it can be used for studies such as infant nipple feeding assessment, infant finger feeding assessment, infant bottle feeding assessment, sucking assessment in adult and child's, blowing assessment in adult and child's.

Sensor number two show good reliability. But the placement of the sensor and the place of pressure on the sensor are important. It is practically impossible to repeat the same test conditions for this sensor when do retesting. also due to the lightness and shape of the sensor, we can use it to receive online feedback in treatment.

Conclusion

However, according to the obtained results, it can be suggested that if more comprehensive research is done using this device, it can be used as a reliable instrument in the evaluation of some oral motor skills.

Conflict of Interest

The authors report no declarations of interest.

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