Journal of Oral Hygiene and Health

Kawagishi S et al., J Oral Hyg Health 2016, 4:5
DOI: 10.4172/2332-0702.1000210

Short Communication OMICS International

Detection of Decrease in Stereognostic Ability of the Tongue in the Middle-Agers

Kawagishi S[1*], Masuda W[2] and Yoshino K[3]

[1]*Department of Health Improvement, Kyushu Dental University, Kitakyushu, Japan*

[2]*Department of Nutrition, Kyushu Women's University, Kitakyushu, Japan*

[3]*School of Oral Health Sciences, Kyushu Dental University, Kitakyushu, Japan*

[*]**Corresponding author:** Shigenori Kawagishi, Department of Health Improvement, Kyushu Dental University, 2-6-1 Manazuru, Kokurakita-ku, Kitakyushu 803-8580, Japan, Tel: +81-93-921-4302; Fax: +81-93-921-4302; E-mail: s-kawagishi@jcom.home.ne.jp

Received date: October 13, 2016; **Accepted date:** November 16, 2016; **Published date:** November 23, 2016

Abstract

We previously reported that senior aged people display reduced stereognostic efficiency of the tongue compared to the young adults, and suggested the feasibility of getting over this situation applying the training protocol mentioned by us. The same important issue to the development of therapy for decreased function is study on prevention of aging-dependent functional decline. Early prevention of the oral stereognostic ability decrement might be the better option while investigation of the issues should be considered during the early onset of the conditions in aged patients.

This study was conducted to understand the efficiency of tongue's stereognostic characteristics for middle-aged people with a comparative understanding with young adults. This analysis related to tongue was conducted in 78 young adults (mean age: 24.5 years) and 33 middle-agers (mean age: 50.5 years). The method applied in this study contained 20 varied shaped test pieces in the oral cavity of the subjects. The observations revealed that most of the young adults were able to identify different shaped test pieces compare to the older participants (mean correct number of responses: 16.8 and 15.2, respectively; $p<0.001$). Depending on the shapes the test pieces were divided into six groups. It was found that misidentification of a piece by the young participants lead to selection of similar piece belonging to the same group. Selection of pieces from other group was almost nil. On the other hand, the older participants (middle-agers) also identified test pieces less often from separate groups. Differences in degree of decrease in the stereognostic ability between middle-agers and seniors whose ability was reported previously were also discussed.

Keywords: Stereognostic; Aging-dependent; Middle-agers; Swallowing; Cerebrovascular disorders

Introduction

Community having more aged population, the diagnosis and treatment for impaired eating and swallowing functions, which were led by the growing number of the seniors along with the constant increase in the patients of cerebrovascular disorders, gain prominent attention [1-5]. In order to deal with this issue, the roles of oral somatic and taste perceptions for food consumption and gulping process have been highly studied [6-8]. As one of these sensory functions, we have focused on oral stereognostic efficiency because the dimension of an intraoral food material renders different vital oral sensory information owing to the requirement in different phases of food consumption and gulping. This includes masticatory, oral, and pharyngeal phases [9]. The proposed experiment has been assessed by a implementing a technique which aided in identifying the shape of test pieces in the oral cavity [10,11]. In our earlier contribution we have provided information on the result of the test piece identification which were found worth investigating considering the effective outcome on oral stereognostic ability [12]. This study demonstrated that the tongue was responsible for the oral stereognostic ability and it' ability was quite high. It was also shown that the stereognostic ability of seniors decreased to about 60% of the results observed in adults. Moreover, we have provided primary information on oral stereognostic ability with relation to poststroke patients those who were having dysphagia. Interestingly, in that report we represented noteworthy positive correlation with a videofluoroscopic dysphagia scale specifically in oral phase [13].

It is very important to develop the treatment method for seniors with eating and swallowing dysfunctions. We advocated the immense prospect of improving the tongue's stereognostic ability in the patients through this method [12].

One important issue in addition to the treatment is the prevention of aging-dependent decrease of the ability. For prevention study, first we need to know when the stereognostic ability begins to decrease. Although there is a wealth of research on oral stereognostic ability [14-20], the study on age as beginning of decrease in oral stereognosis was little reported. To obtain much information and gather evidence through this study, we inspected the tongue's stereognostic ability for the senior participant (middle-agers) and proved that their efficiency reduces in comparison to the young participants. The outcome also hinted that the degree of reduction in the middle-agers was quite smaller than in the senior which was reported previously.

Material and Methods

Subjects

Subjects were 78 young adults (students of Kyushu Dental University; 47 males, 31 females; mean age: 24.5 years; age range: 23 to 32 years) and 33 middle-agers (staffs of Kyushu Dental University; 22 males, 11 females; mean age: 50.5 years; age range: 45 to 55 years) and none of whom showed eating and swallowing dysfunction.

The ethical committee of Kyushu Dental University formally provided approval for the present study protocol. Consent is a written form was acquired from the study participants after proper explanation of the objective of the study.

Assessment of stereognostic ability of the tongue

Assessment of stereognostic ability of the tongue was conducted as described previously [12]. In this method applied shape of the intraoral polyethylene test pieces (13 mm length, 2 mm thickness) was evaluated. Representation of the test pieces are provided in Figure 1. Following the standard instruction provided by the American National Institute of Health, test pieces were developed and used [10]. To overcome the probable issue of chocking, a fine thread (diameter: 0.2 mm) was attached to each test piece. Six groups were formed for the 20 test pieces which are as follows: a polygonal-shaped group (Nos. 1 to 4), triangular-shaped group (No. 5 to 7), star-shaped group (Nos. 8 to 10), circular-shaped group (Nos. 11, 12), convex-shaped group devoid of corners along with ends swelling convexly (Nos. 13 to 16), and concave-shaped group except corners along with concave middle (Nos. 17 to 20) was considered.

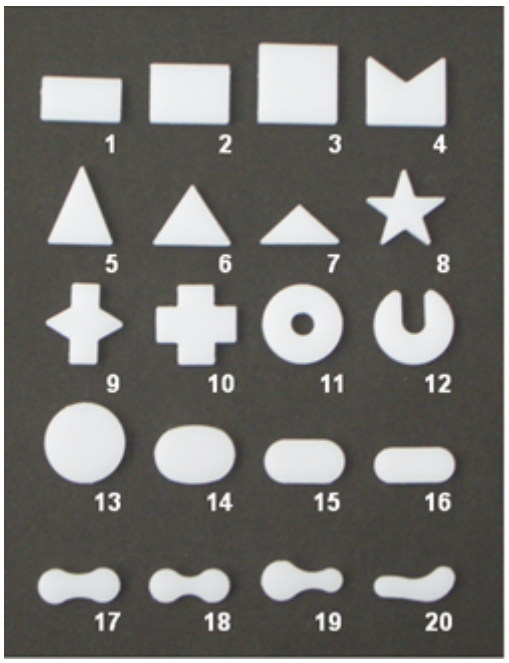


Figure 1: The polyethylene test pieces along with their physical forms (shapes) and difference.

The adopted test protocol followed is provided in the following section. All the subjects were invited into a quiet room between 2:00-5:00 p.m. and were requested to have their seat in an upright position. Further, they were requested to close their eyes and protrude their tongue where out of the 20 test pieces one for each participant was placed randomly. Next, the participants were instructed to test the piece to find out the shape. Additional condition was mentioned for the participants that they were not allowed to touch the piece with their teeth or gum during the determination of the shape of the respective pieces. Later on, they were asked to identify from the pictures having 20 different shapes as used in the study. There was a possibility for the participants to identify multiple times a single test piece while recording their respective responses. According to the study rule none of the participants were informed about their prediction result. Every participant was requested to repeat the test for four times. Data analysis was performed pertaining to determination of the stereognostic ability of the tongue. Previous studies established the fact that oral stereognostic capacity of a person is never affected by covering the palate [12].

Statistical analysis

We used unpaired and paired Student's t-test to determine significant differences. A p-value less than 0.05 were considered as significant.

Results

Number of correct responses in assessment of stereognostic ability of the tongue

The obtained results regarding the authentic responses from the young participants and middle-agers were found to be 16.8 ± 1.8 (mean ± SD) and 15.2 ± 2.4 in numbers, respectively. The number of correct responses was having minor difference which was found to be significant for the young adults than in the middle-agers ($p<0.001$, unpaired t-test).

Shape recognition

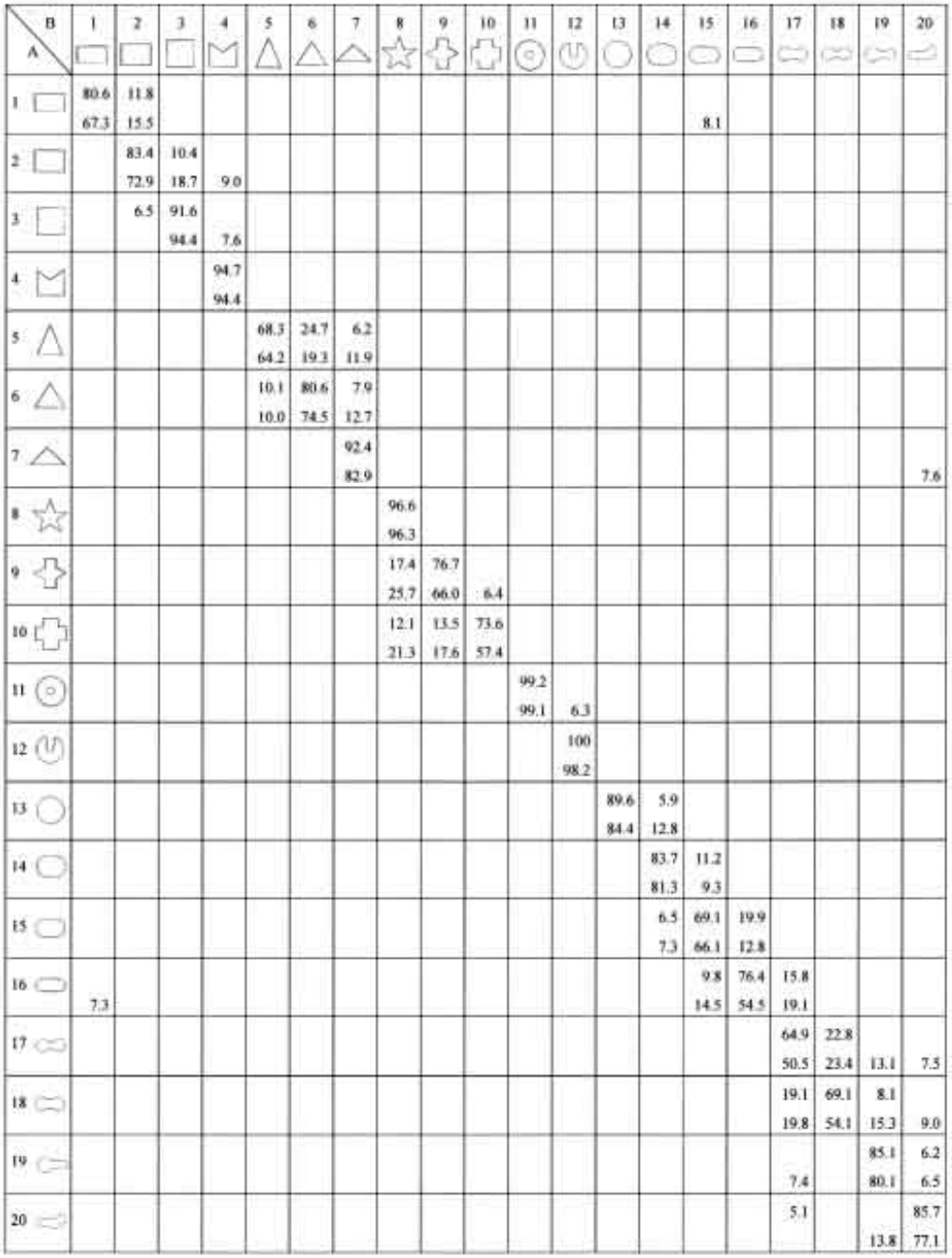
The resultant percentage for the authentic responses (correct response rate) with relation to each of the 20 test pieces is provided in Figure 2. For the young adults, the lowest correct response rate was seen for test piece No. 17, at 64.9%, and the highest rate was seen for test piece No. 12, at 100%. The lowest rate for the middle-agers was with piece No. 17, at 50.5%. The highest rate was 99.1% with test piece No. 11. There was little difference in correct response rates for test piece Nos. 3, 4, 8, 11 and 12 between the young adults and middle-agers. The correct response rates for other test pieces were clearly lower in the middle-agers than in the young adults.

In context to the authentic response rate related to the 20 different test pieces, the mean value was significantly lower in the middle-agers (75.8%) than in the young participants (83.7%) ($p<0.001$, paired t-test). Figure 2 also shows the results regarding misidentified shapes. It was noticed that misidentification of the shape but the young participants lead to recognizing something similar. The middle-agers happen to identify pieces used for the test from various separate groups in rare case.

Discussion and Conclusion

In an earlier study using the same test piece shapes we employed herein, oral stereognostic ability was reported to begin to develop, in

general, at about 8 years of age, and to continue until its development is complete in the early teens [10,21]. This particular study and several other previous investigations represented that older participants are having comparatively less efficiency for stereognostic than the younger participants [8,11,12,22]. The present study investigates a comparative efficiency assessment between the middle aged and young participants. Interestingly, we obtained the similar value of authentic response as earlier in this study [12,23], thus, confirming the reliability and authenticity of the obtained values.



A \ B	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	80.6 67.3	11.8 15.5													8.1					
2		83.4 72.9	10.4 18.7	9.0																
3		6.5	91.6 94.4	7.6																
4				94.7 94.4																
5					68.3 64.2	24.7 19.3	6.2 11.9													
6					10.1 10.0	80.6 74.5	7.9 12.7													
7							92.4 82.9													7.6
8								96.6 96.3												
9								17.4 25.7	76.7 66.0	6.4										
10								12.1 21.3	13.5 17.6	73.6 57.4										
11											99.2 99.1	6.3								
12												100 98.2								
13													89.6 84.4	5.9 12.8						
14														83.7 81.3	11.2 9.3					
15														6.5 7.3	69.1 66.1	19.9 12.8				
16	7.3														9.8 14.5	76.4 54.5	15.8 19.1			
17																	64.9 50.5	22.8 23.4	13.1	7.5
18																	19.1 19.8	69.1 54.1	8.1 15.3	9.0
19																	7.4		85.1 80.1	6.2 6.5
20																	5.1		13.8	85.7 77.1

Figure 2: Recognition results. A (Vertical): Participant with inserted test piece in their mouth cavity; B (Horizontal): The test piece chosen by participants. Values shown in the figure are the ratios ofthe test piece selected by the subjects relative to the actual one kept into their mouth (upper,young adults; lower, middle-agers; values of less than 5% are omitted).

Even though there was a minute difference among the age groups considered but the statistical significance obtained through P-values established the existing variation between middle-aged and young age groups. The observed comparative results related to each piece made the stereognostic activity noticeable. The correct response rates of many different kinds of test pieces were clearly lower in the middle-agers than in the young adults. There were little differences in the some kinds of test piece with high correct response rate. Those test pieces could be easily recognized. The reason may be that they have large contact area with tongue, and simple or distinguishing shapes from other test pieces.

For responses where the test piece was misidentified, the middle-agers selected rarely pieces from other groups not from the same group. The outcome of this study strongly suggests that the middle-aged participants are already going through a reduced stereognostic capacity of their tongue, eventually ability of this group was found to be higher when compared the older participants. According to the earlier report [12], the diminution of the ability of seniors was evident (mean value of appropriate number of authentic responses: 10.1), and in misidentification the seniors selected pieces from other groups more than the middle-agers (4 test pieces from different groups in the middle-agers, 30 test pieces in the seniors). We already proposed in our earlier report regarding the feasibility of improving the present level of ability in older participants through the adopted training system. This possibility and the present finding suggest that the start of oral care containing training at the middle-agers may be helpful to prevention of decrease in the oral stereognostic ability with age.

Acknowledgement

The authors wish to thank John Wiley and Sons, Ltd. that requires no permission to reuse the material in our article “Decrease in stereognostic ability of the tongue with age”. This research was partially supported by a Grant-in-Aid for Scientific Research (No. 15K01404) from the Japan Society for the Promotion of Science.

References

1. Gordon C, Hewer RL, Wade DT (1987) Dysphagia in acute stroke. Br Med J (Clin Res Ed) 295: 411-414.
2. Foley NC, Martin RE, Salter KL, Teasell RW (2009) A review of the relationship between dysphagia and malnutrition following stroke. J Rehabil Med 41: 707-713.
3. Kim JS, Choi-Kwon S, Kwon SU, Lee HJ, Park KA, et al. (2005) Factors affecting the quality of life after ischemic stroke: young versus old patients. J Clin Neurol 1: 59-68.
4. Miura H, Yamasaki K, Morizaki N, Moriya S, Sumi Y (2010) Factors influencing oral health-related quality of life (OHRQoL) among the frail elderly residing in the community with their family. Arch Gerontol Geriatr 51: e62-65.
5. Campbell-Taylor I (2008) Oropharyngeal dysphagia in long-term care: misperceptions of treatment efficacy. J Am Med Dir Assoc 9: 523-531.
6. Boliek CA, Rieger JM, Li SYY, Mohamed Z, Kicckham J, et al. (2007) Establishing a reliable protocol to measure tongue sensation. J Oral Rehabil 34: 433-441.
7. Mason EJ (1967) Studies on oral perception in involving subjects with alternations in anatomy and physiology. In: Bosma JF (Ed.), Second symposium on oral sensation and perception. Charles C Thomas, Springfield, Illinois. pp: 295-301.
8. Calhoun KH, Gibson B, Hartly L, Minton J, Hokanson JA (1992) Age-related changes in oral sensation. Laryngoscope 102: 109-116.
9. Logemann JA (1998) Evaluation and treatment of swallowing disorders (2nd edn.). PRO-ED, Austin, TX.
10. Arndt WB, Gauer J, Shelton RL, Crary D, Chisum (1967) Refinement of a test of oral stereognosis. In: Bosma JF (Ed.), Second symposium on oral sensation and perception. Charles C Thomas, Springfield, Illinois. pp: 363-378.
11. Jacobs R, Serhal CB, van Steenberghe D (1998) Oral stereognosis : a review of the literature. Clin Oral Investig 2: 3-10.
12. Kawagishi S, Kou F, Yoshino K, Tanaka T, Masumi S (2009) Decrease in stereognostic ability of the tongue with age. J Oral Rehabil 36: 872-879.
13. Shimodozono M, Kawagishi, Yoshino K, Matsumoto S, Kawahira K (2009) Relationship between oral stereognostic ability and videofluoroscopic dysphagia in poststroke patients. The 5th World Congress of the International Society of Physical and Rehabilitation Medicine (ISPRM). Istanbul, Turkey.
14. Berry DC, Mahood M (1966) Oral stereognosis and oral ability in relation to prosthetic treatment. Br Dent J 120: 179-185.
15. Müller F, Link I, Fuhr K, Utz KH (1995) Studies on adaptation to complete dentures. Part II: Oral stereognosis and tactile sensibility. J Oral Rehabil 22: 759-767.
16. Jacobs R, Bou Serhal C, van Steenberghe D (1997) The stereognostic ability of natural dentitions versus implant-supported fixed prostheses or overdentures. Clin Oral Investig 1: 89-94.
17. Pow EH, Leung KC, McMillan AS, Wong MC, Li LS, et al. (2001) Oral stereognosis in stroke and Parkinson's disease: a comparison of partially dentate and edentulous individuals. Clin Oral Investig 5: 112-117.
18. Catalanotto FA, Moss JL (1973) Manual and oral stereognosisi in children with cleft palate, gonadal dysgenesis, pseudohypoparathyroidism, oral facial digital syndrome and Kallman's syndorome. Archs Oral Biol 18: 1227-1232.
19. Landt H, Ingervall B (1975) Oral ability to recognize forms and oral motor ability in 11-years -old-children. J Oral Rehabil 2: 63-73.
20. Eitner S, Wichmann M, Schlegel A, Holst S (2007) Clinical study on the correlation between psychogenic dental prosthesis incompatibility, oral stereognosis, and the psychologic diagnostic tools SCL-90-R and CES-D. Int J Prosthodont 20: 538-545.
21. Arndt WB, Elbert M, Shelton RL (1967) Standardization of a test of oral stereognosis. In: Bosma JF (Ed.), Second symposium on oral sensation and perception. Charles C Thomas, Springfield, Illinois. pp: 379-383.
22. Ikebe K, Amemiya M, Morii K, Matsuda K, Furuya-Yoshinaka M, et al. (2007) Comparison of oral stereognosis in relation to age and the use of complete dentures. J Oral Rehabil 34: 345-350.
23. Kawagishi S, Tanaka T, Shimodozono M, Yoshino K (2013) Simplifying the assessment of stereognostic ability of the tongue in elderly subjects using six selected test pieces. Aging Sci 1: 111.