Oral Diadochokinetic Rate in Adults†

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Abstract

Diadochokinetic rate has traditionally been used for assessment, diagnosis and therapy in patients who suffered from oral cancer resection, glossectomy, oral myofunctional disease, dysphagia, dysarthria, functional articulation disorders or apraxia of speech. This is because diadochokinetic rate shows the documented structural and physiological changes in the central nervous system and the peripheral components of oral and speech production mechanism.

Diadochokinetic rates were obtained from seventy-six normal subjects by counting the repetition of oral function (/a:-u:/; /u:-i:/; and /i:-a:/), tongue function (tongue movement from side to side of lip corner and lan lan lan lan la), and lip-tongue function (/p-t-k/ and /p^h-t^h-k^h/) in 15 seconds. The Count-by-Time test was used for data collection.

The finding showed average diadochokinetic rates (syllables or times per 15 seconds) were 33.6, 33.16, 30.58; 24.21, 15.10, 26.50 and 26.30 for /a:-u:/, /u:-i:/, /i:-a:/, tongue movement from side to side of lip corner, lan lan lan lan la, /p-t-k/, and /p^h-t^h-k^h/. Most of the correlation analysis showed a high positive relationship.

The results of this study are guidelines of normal diadochokinetic rates. In addition, they can indicate the severity of diseases and evaluation of treatment.

Speech is a highly integrated physiological act characterized by a series of complex motions executed in a kinetic chain. Motor speech is the muscle motility that governs the rate with which any set of utterances can be accomplished. The articulators for speech consist of weights (mass of the body organs), levers (mandible and hyoid bone), and devices for producing force (muscles and nerves). They may be presumed to follow the laws of mechanics(1).

Diadochokinetic syllable production and oral function would appear to be well worth additional attention as a means of scrutinizing certain physiological functions in speech. So the oral

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diadochokinetic rate has always been used for measurement of the neurophysiological intactness of the motor speech system: structural and physiological changes in the central nervous system and the peripheral components of the speech production mechanism(2). Most speech language pathologists popularly use diadochokinetic tasks and oral function as a routine clinical measurement, diagnosis and follow-up of speech disorders.

Diadochokinesis is defined as the performance of rapid repetition of single syllables and trisyllabic compilations(3) or diadochokinesis is the ability to excute rapid repetitive movement of articulators(4). It has a high correlation between tongue mobility, articulation and intelligibity(5). Abnormality of diadochokietic rates indicates the oral motor deficits and speech disorders such as oral cancer resection, deficits of tongue (tongue tied, glossectomy, microglossia macroglossia), oral myofunction diseases, dysphagia, functional and organic articulation defects (dysarthria, apraxia of speech, hearing loss) etc.(1, 5-8).

Increase of the diadochokinetic rate indicates an improvement of the function and health of speech mechanism. The oral diadochokinetic rate is a simple and useful method for clinical assessement diagnosis and follow-up in oral motor system and speech disorders.

The typical approach to measurement of diadochokinetic syllable rate has been to count the number of syllables spoken in a given period of time. Two methods produced equivalent data and are popular in data collection and analysis : one to establish the limits of the time period and the other to establish the number of syllables within the time limit(1). An examiner would be required to pay attention between watching the stop watch and counting the syllables being spoken in both methods. The former has received more research attention, because it is believed that paying attention in watching the stop watch is less than in the latter.

The goal of this study was to find the average diadochokinetic rates of lip function, tongue function and lip-tongue function following these : /a:-u:/; /u:-i:/; /i:-a/; mobility of tongue (move tongue from right side to left side of lip corner, lan lan lan lan la production); /p -t -k/ and /p^h-t^h-k^h/ within the time limit (15 seconds). Are there also significant differences among diadochokinetic rates ?

Subjects

Seventy six fourth-year physical therapy students were subjects. These subjects were judged by the experimenter to have age appropriate articulation, normal structure and function of oral peripheral mechanism, normal body size, fluent speech and there was no history of neurological disease.

METHOD

Diadochokinetic rates were obtained for each subject on repetition of the following sounds : /a:-u:/; /u:-i:/; /i:-a/; move tongue from right side to left side of lip corner; lan lan lan lan la; /p -t -k :/ and /p^h-t^h-k^h/. Each subject was asked to correctly repeat these targets following the experimenter. Then the subject tried it by himself as fast as he could within 15 seconds or until the experimenter told him to stop. This was done with 30-60 second intervals between each target. The research assistant counted the number of syllables and mobility of tongue during 15 seconds under the experimenter's supervision. Criterior of counting, each sound of /a:-u:/; /u:-i:/; /i:-a/; lan lan lan lan la; /p-t-k/; /p^h-t^h-k^h/ and each time the tongue moved from right side to left side of lip corner obtained one point.

RESULTS

The mean and standard deviation from the diadochokinetic rate in a 15 seconds observation were analyzed and are shown in Table 1.

The scores represent repetition of syllables and number of tongue movements by 76 adults. The finding showed the average diadochokinetic rate syllables or times per 15 seconds) were 33.6, 33.16, 30.58, 24.21, 15.10, 26.50 and 26.30 for /a:-u:/, /u:-i:,/ /i:-a:/, tongue movement from side to side of lip corner, lan lan lan lan la, /p-t-k/ and /p^h-t^h-k^h/.

Paired *t*-test analysis showed that most of the mean differences of each pair were significanlty different. The number of syllables per 15 seconds of /a:-u:/ was significantly more than that of lan lan lan lan la, /p-t-k/, and /p^h-t^h-k^h/ ($p < 0.05$). The number of syllables per 15 seconds of /u:-i/ was significantly more than that of /i:-a:/, lan lan lan lan la, /p-t-k/ and /p^h-t^h-k^h/ ($p<0.05$). The number of syllables per 15 seconds of /p-t-k/ was significantly more than that of lan lan lan lan la ($p<0.05$). The number of syllables per 15

Table 1. Mean and standard deviation of diadochokinesis (syllable production and tongue movement) in 15 seconds.

Mean, S.D.	Diadochokinetic rate						
	lip function			tongue function		lip-tongue function	
	/a:-u:/	/u:-i:/	/i:-a:/	tongue move side to side	lan lan lan lan la	p-t-k	p^h-t^h-k^h
Mean	33.6	33.16	30.58	24.21	15.10	26.50	26.30
S.D.	8.10	7.84	5.59	5.59	2.85	5.48	5.17

Table 2. Correlations and p-values of diadochokinesis.

Correlation and p-value	Diadochokinetic rates				
	lip function			tongue function	lip-tongue function
	/a:-u:/ and /u:-i:/	/u:-i:/ and /i:-a:/	/i:-a:/ and /a:-u:/	tongue move and lan lan lan lan la	/p-t-k/ and /p^h-t^h-k^h/
Correlation	0.825	0.962	0.874	0.006	0.828
p-value	0	0	0	0.960	0

seconds /p^h-t^h-k^h/ was significantly more than that of lan lan lan lan la ($p<0.05$) and the number of tongue movements in 15 seconds ($p<0.05$). The number of tongue movements in 15 seconds was significantly more than the number of syllables of lan lan lan lan la ($p<0.05$).

A Pearson product-moment correlation coefficient and 95 per cent confidence intervals were calculated for each pair of variables. The results showed most of the correlations were positive except for the correlations of tongue movement from side to side and the number of syllables of lan lan lan lan la (r: 0.006 p=0.960); that of /p-t-k/ (r=0.220 p=0.088) and that of /p^h-t^h-k^h/ (r=0.144, p=0.268). The number of syllables of /p^h-t^h-k^h/ and that of lan lan lan lan la (r=0.334, p=0.09) had no significant relationship. Some of diadochokinetic analysis is shown in Table 2.

Table 2 shows the diadochokinetic rates in lip function (/a:-u:/, /u:-i/, /i:-a:/) have a significant positive relationship. There is also a significant positive relationship of diadochokinetic rates in lip-tongue function but there is no relationship between diadochokinetic rates in tongue function.

DISCUSSION

A number of studies have shown diadochokinetic rates measurement to have significance in studies of speech pathology. Routine use of this technology has not been developed. The previous reports used both Time-by-Count and Count-by-Time techniques for the study of diadochokinetic rate. Time-by-Count technique is more populalar than Count-by-Time[1,5] This paper used the latter technique to collect data because of difference of number of syllables or functions to be studied. The same limited time (15 seconds) was also an easy technique to collect the data which the recent studies also used[3,4].

Means of diadochokinetic rates (Table 1) could be used to be guidelines of normality. They were applied as milestones for distinctness of abnormality, severity and evaluation of oral motor deficits and speech disorders. The high correlation among diadochokinetic rates (Table 2) implies that diadochokinetic rates indicate each other.

A comparision of diadochokinetic rates of each function, indicated that the diadochokinesises were nearly the same rate for the same number of syllables : lip function (/a:-u:/ = 33.6, /u:-i:/ = 33.16, /i:-a:/ = 30.58) lip-tongue function (/p-t-k/=26.50, /p^h-t^h-k^h/= 26.30). It might also be said that the number of syllables affected diadochokinesis more than the manner of articulation (aspirated or unaspirated sounds).

In addition, the result of the diadochokinetic rate in 15 seconds of /p-t-k/ (26.50 syllables in 15 seconds) in this finding was almost equal to that of the oldest children which Fletcher studied[1] (10 syllables in 5.7 seconds or 26.31 syllables in 15 seconds) and it was in the vicinity of Robb, Hughes and Fress's study[5]. So this finding supports the results of previous studies although we used different techniques (Count by Time and Time by Count Test) to collect data.

SUMMARY

The results of this study are guidelines for normal diadochokinetic rates. We can use them to indicate the abnormality of oral motor deficits or speech disorders, including severity, and evaluation of treatment. The researchers have shown diadochokinetic rates measurement to have significance in the studies of oral motor and speech deficits; routine use of this technology has not developed. In our developing country with lack of professionals and instruments, it is still the best indicator for a clinician's routine work. Comparison of techniques and extending to include syllable repetition at a maximum rate of utterance should be studied in further research.

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อัตราการออกเสียงซ้ำ ๆ ในผู้ใหญ่†

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อัตราการออกเสียงซ้ำๆ นิยมใช้เป็นเกณฑ์ในการประเมิน, การวินิจฉัย และการรักษาผู้ป่วยที่มีปัญหาซึ่งจำเป็นจะต้องทำการผ่าตัดมะเร็งในปาก ผ่าตัดลิ้น, โรคของกล้ามเนื้อในปาก, การกลืนลำบาก การพูดไม่ชัดทั้งแบบไม่มีความบกพร่องและมีความบกพร่องของโครงสร้างและการทำงานของอวัยวะที่เกี่ยวข้องกับการพูดมาช้านาน เพราะว่าอัตราการออกเสียงซ้ำสามารถใช้เป็นข้อบ่งชี้ของความเปลี่ยนแปลงของโครงสร้างและการทำงานของระบบประสาทของอวัยวะในปากและอวัยวะที่เกี่ยวข้องกับการพูด

ผู้วิจัยได้ทำการศึกษาอัตราการออกเสียงซ้ำ ๆ ของผู้ใหญ่ปกติจำนวน 76 คน เพื่อหาเกณฑ์มาตรฐานในการออกเสียงซ้ำ ๆ ของปากและลิ้น 3 หน้าที่คือ การเคลื่อนไหวริมฝีปาก (อา–อู; อู–อี และ อี–อา) การเคลื่อนไหวลิ้น (การเคลื่อนไหวลิ้นแตะมุมปากทั้ง 2 ข้างและการออกเสียง ลันลันลันลันลา) และการเคลื่อนไหวริมฝีปากและลิ้น (เปอะ–เตอะ–เกอะ และ เพอะ เทอะ–เคอะ) ภายในเวลา 15 วินาที

อัตราการออกเสียงซ้ำๆเฉลี่ยมีดังนี้ อา–อู = 33.6; อู–อี = 33.16; อี–อา = 30.58; การเคลื่อนไหวลิ้นแตะมุมปาก = 24.21; ลันลันลันลันลา = 15.10; เปอะ–เตอะ–เกอะ = 26.50 และ เพอะ–เทอะ–เคอะ = 26.30 ครั้งใน 15 วินาที อัตราการออกเสียงซ้ำๆส่วนใหญ่มีความสัมพันธ์กันแบบเส้นตรง

ผลการศึกษาครั้งนี้สามารถใช้ค่าเฉลี่ยของอัตราการออกเสียงซ้ำๆของคนปกติเป็นเกณฑ์มาตรฐานในการเปรียบเทียบกับผู้ป่วยที่มีความบกพร่องของระบบประสาทและกล้ามเนื้อของอวัยวะในปากหรืออวัยวะที่เกี่ยวข้องกับการพูดเพื่อบ่งบอกถึงความรุนแรงของโรค ความก้าวหน้าของการรักษาได้ เป็นอย่างดี

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