ORIGINAL ARTICLE

Comparative Evaluation of Some Modern Approaches to Determining Chewing Effectiveness, Taking Into Account the temperament of patients

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ABSTRACT

Of the many functions that determine the essence of the dentofacial system, one can distinguish such a complex biomechanical reflex process as chewing. The variability of this function, noticeable during grinding, wetting food with saliva, the formation of a food lump and its transformation into a chyme, indicates clear boundaries between different chewing patterns. These variations are not only the difference in the activity of the dentofacial system during a pathological or normal physiological state, they also depend on the individual characteristics of the body. Even such factors as hunger, physical fatigue, and personal qualities of a person can affect the effectiveness of chewing food. There is a certain regularity in the functioning of the dentofacial system, depending on the temperament of the person, which can be traced in this work. Diagnostic methods for determining the effectiveness of chewing are diverse, have their own classifications and descriptions, but there is no clear indication of the scheme for their application in practice, since their results differ in comparison, and there is no way to choose the most suitable technique. The use of data on individual chewing effectiveness during restoration procedures in dentistry will help to give more accurate results, improve existing methods of registering chewing function and apply them to a dental appointment. Ease of use and maximum accuracy of the universal aggregated method will be interesting and accessible to a wide range of medical practitioners.
Key words: chewing effectiveness, chewing, temperament, sanguine, choleric, melancholic, phlegmatic, occlusion, dentition, swallowing reflex, orthognathic bite, registration of chewing function.

INTRODUCTION

Chewing is one of the main functions of the dentition, which determines its condition. Despite the variety of methods for assessing chewing effectiveness, an prosthodontist chooses the least time-consuming, most accurate and affordable method during his work. Based on this, the study of modern methods for determining the chewing effectiveness of each individual, as well as in comparison with each other, occupies a special place. An equally important aspect is the personality characteristics of the patient, including temperament, which must be taken into account when performing manipulations in the oral cavity, in particular when determining the effectiveness of chewing, as one of the possible stages of orthopedic treatment.

Comparison of the accuracy of methods for determining the masticatory effectiveness of the dentition: a computerized analysis of occlusion to assess masticatory effectiveness, taking into account the individual characteristics of the occlusal relationships and the method for determining the effectiveness of chewing according by V.N. Trezubov, taking into account the temperament of the person.

Objectives

1. To determine the effectiveness of chewing in a group of students in two ways: by computerized analysis of occlusiograms and a functional express test for determining chewing effectiveness according by Trezubov;
2. To reveal the temperament of those examined by the Eysenck test;
3. Compare the results of the samples, taking into account the temperament of the studied;
4. To evaluate the results of the selected methods for determining the effectiveness of chewing, draw conclusions;

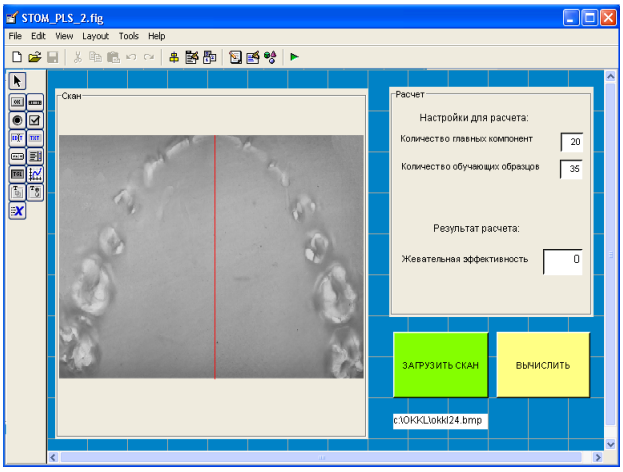
MATERIALS AND METHODS

In the course of work, a group of students consisting of 57 people determined the effectiveness of chewing in two ways: by computerized analysis of occlusiograms[1] and functional express test according to Trezubov[2].. The temperament of the subjects was identified by the Eysenck test[3]. We compared the results of the samples taking into account the temperament of the subjects and evaluated the results of the selected methods for determining the effectiveness of chewing.

To determine the masticatory effectiveness, we chose a computer system for scanning occlusiograms, as this is an affordable and modern method. The second diagnostic method was the express test of Professor V.N. Trezubova, because it is easy to use compared to other dynamic methods.

To use the program in the "MatLab" system (a program developed at the Department of Prosthetic Dentistry and Orthodontics with a course of propaedeutics of dental diseases at Ryazan State Medical University), it is necessary to register the bite of the subjects by removing the occlusiograms, and then get scans from existing wax bite patterns. Occlusiograms are removed using the technique of V.P. Potapov, which includes the following steps: selection of the wax plate, softening and placing it between the teeth of the upper and lower jaws, closing the dentition in the position of central occlusion[4].

The base wax plate extracted from the oral cavity carries information about the occlusal contacts of the teeth in the form of a fingerprint and represents a transfer from which data will be read from the «MatLab» program. This program is a database system aggregated with mathematical analysis.



The system's database contains a training set of initial data - scans, each of which is associated with the number of masticatory effectiveness previously measured by the method of chewing samples taken from a particular patient. After mathematical processing of data from one scan, the program can accept the new supplied information and calculate the masticatory effectiveness of the patient who owns the next scan. The accuracy of the results of determining the effectiveness of chewing by a scan unknown to the program, that is, not included in the initial set of scans, depends on such factors as the representativeness of the training set and the number of basic components of mathematical analysis, which are distributed in the calculation method of projection onto latent structures. To date, the program uses scans of 1470x925 pixels in size, taken in a mode with 256 shades of gray. In order to create a set of initial data for the program, 140 students aged 18 to 23 years were examined, who first received occlusiograms by registering occlusal contacts of the dentition in the central occlusion position on the base wax plates, and then diagnostic tests were performed to determine chewing effectiveness.

After a computerized analysis of the scans of the occlusiograms in the MatLab program, the results of chewing efficiency were obtained according to the test of V. N. Trezubov. This method is quite easy to implement, since in the process it is not necessary to sift the chewed material through a sieve, as is required in many such dynamic samples. The food irritant in this technique is the almond kernel or a cube of carrots weighing 0.5-1 grams. The examinee is invited to chew the test material until the swallowing reflex, that is, to the insurmountable desire to swallow a formed food lump. According to the authors of the test, normally this desire arises 16 seconds after the start of the chewing act in individuals with an orthognathic bite and intact dentition. After that, registering and analyzing the time spent chewing on the stimulus, the value of the preliminary chewing efficiency (E1) for a given person is selected, summarized by the developers in a table. When chewing test material in 16 seconds or less, preliminary chewing efficiency is 100%, in 17 seconds - 94.1%, in 18 seconds - 88.9%, in 19 seconds - 84.2%, in 20 seconds - 80% and etc. The adjusted or final chewing effectiveness (E2) is calculated taking into account the correction factors for age (K1) and the condition of the dentition (K2) according to the formula.

Based on the condition of the dentition and age, studies have been completed.

We found out that they are different. This may be due to defects and deformations of the maxillofacial area of available etiology. To learn the personal characteristics of students participating in the experiment. After it became clear that there is a definite connection between speed and personality type.

The temperament of each of the examined students was determined by the Eysenck test. The test consists of 57 psychological questions, after the answers to which, the testee is assigned one of the four standard types of temperament: choleric, melancholic, sanguine, and phlegmatic. The average test time was 10 minutes. This method makes it possible to judge the type of personality in the framework of temperament.

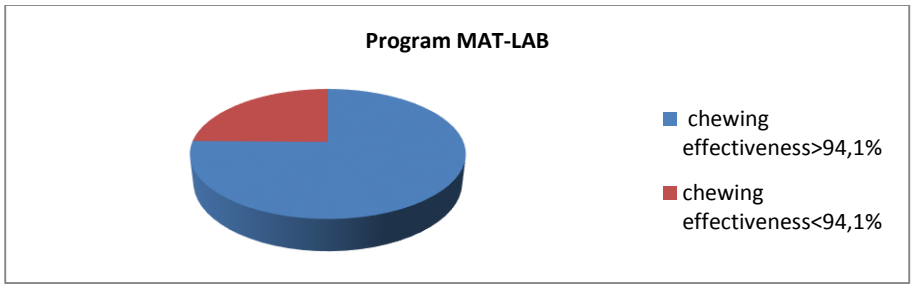
Among the studied students, all 4 temperaments were identified: choleric, easily excitable, unbalanced, melancholic - prone to sadness and gloomy thoughts, sanguine - lively, active, easily experiencing setbacks and phlegmatic - inert, balanced. The most emotionally unstable types of temperament: melancholic and choleric. Phlegmatic and sanguine are most emotionally stable[5].

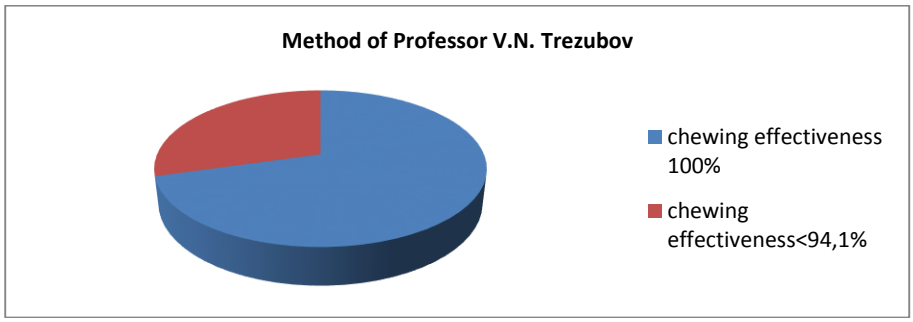
RESULTS

The value of chewing effectiveness, measured using the developed computer program, was 95–100% in 80% of the subjects, 86–94% in 20%. Upon receipt of the chewing efficacy values by express method of functional test according to V.N. To Trezubov, 74% of the subjects chewed the test material for 16 seconds or less, 26% for 17 or more, which corresponds to the values of preliminary chewing efficiency of 100%, 94.1% or less. Obviously, the results of the two methods for diagnosing chewing effectiveness are not identical. Temperament can affect the time of chewing food, that is, indirectly affect the accuracy of a functional express test according to Trezubov.

Table 1: The data are summarized

B	Time (sec)	Temperament	Method of Professor V.N. Trezubov (%)	Program MatLab	Difference(%)
1	24	melancholic	66,7	98,8	-32,4
2	11	sanguine	100	98,5	+1,5
3	12	sanguine	100	87,1	+12,9
4	13	choleric	100	98,6	+1,4
5	9	sanguine	100	99,5	+0,5
6	17	melancholic	94,1	99,4	-5,6
7	8	sanguine	100	99,4	+0,6
8	9	choleric	100	99,3	+0,7
9	16	sanguine	100	99,5	+0,5
10	10	choleric	100	97,2	+2.8
11	20	phlegmatic	80	84,7	-5.9
12	6	choleric	100	99,7	+0.3
13	7	phlegmatic	100	99,8	+0.2
14	6	phlegmatic	100	94,4	+5.6
15	17	melancholic	94,1	98,7	-4.9
16	11	sanguine	100	87,7	+12.3
17	6	sanguine	100	99,8	=0.2
18	20	phlegmatic	80	93,0	-16.25
19	7	phlegmatic	100	98,9	+1.1
20	7	phlegmatic	100	98,9	+12,2
21	15	melancholic	93,8	98,0	-4,2
22	19	phlegmatic	79	92,0	-13
23	13	choleric	100	98,6	+1,4
24	16	sanguine	100	99,5	+0,5
25	7	phlegmatic	100	98,8	+1,2
26	11	sanguine	100	87,8	+12,2
27	7	choleric	100	99,7	+0,3
28	16	melancholic	95,5	97	-1,5
29	9	choleric	98	96,4	+1,6
30	6	sanguine	100	99,8	+0,2
31	7	phlegmatic	100	98,9	+1,1
32	24	melancholic	66,7	98,8	-32,4
33	15	melancholic	93,8	98,0	-4,2
34	9	choleric	100	99,3	+0,7
35	11	sanguine	100	98,5	+1,5
36	11	sanguine	100	87,7	+12,3
37	16	melancholic	95,5	97	-1,5
38	7	phlegmatic	100	98,9	+1,1
39	7	phlegmatic	100	98,8	+1,2
40	15	melancholic	93,8	98,0	-4,2
41	9	choleric	100	99,3	+0,7
42	17	melancholic	94,1	99,4	-5,6
43	8	sanguine	100	99,4	+0,6
44	9	choleric	100	99,3	+0,7
45	6	choleric	100	99,7	+0,3
46	20	phlegmatic	80	84,7	-5,9
47	19	phlegmatic	79	92,0	-13
48	13	choleric	100	98,6	+1,4
49	16	sanguine	100	99,5	+0,5
50	7	phlegmatic	100	98,8	+1,2
51	11	sanguine	100	87,8	+12,2
52	7	choleric	100	99,7	+0,3
53	16	melancholic	95,5	97	-1,5
54	9	choleric	98	96,4	+1,6
55	19	phlegmatic	79	92,0	-13
56	20	phlegmatic	80	84,7	-5,9
57	6	choleric	100	99,7	+0,3





DISCUSSION

When taking into account the types of temperament, we found that in melancholic and choleric patients, the results differ significantly from those obtained from scans. The time for which the food stimulus chews melancholic is above 16 seconds. In most cases, the subject chews slowly, which is typical for this type of temperament, respectively, chewing effectiveness is about 100%. Most choleric and sanguine people, on the contrary, have a short chewing time before activating the swallowing reflex, which also corresponds to this temperament. Phlegmatic people chew at a moderate speed, and the chewing time of the test material is close to 16 seconds. The existing difference in the values of chewing effectiveness can be eliminated by adjusting for the temperament of the subject.

CONCLUSIONS

Without a doubt, the computer program for determining the effectiveness of chewing is modern, affordable and its results are reliable, while the express test according to Trezubov is simple to use, but inferior in accuracy. Based on the data of the study, we can conclude that the determination of masticatory effectiveness by the method of Professor V.N. Trezubova, adjusted for personality temperament, gives the most accurate results, and can be used in dental practice at the stages of orthopedic treatment during rehabilitation procedures as an improved model of diagnostic methods.

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