Comparative Study on Maximal and Habitual Clenching through T-Scan System

Young-Ku Kim, D.D.S., M.S.D., Ph.D.

Dept. of Oral Diagnosis, College of Dentistry, Seoul National University

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Ⅰ. INTRODUCTION

The significance of occlusion and muscle activity in stomatognathic system have been studied in many ways.[1-3] Normal occlusion implies bilateral-simultaneous tooth contacts.

Tooth contacts have been used to evaluate for correct diagnosis and treatment of diseases developed in stomatognathic system.[4]

An understanding of the forces and timming of tooth contacts is essential in diagnosing and treating the disease of the stomatognathic system.[5]

The methods used to identify tooth contacts can be divided into two types : qualitative and quantitative methods.

Qualitative methods involve the use of marking papers, shim stocks, occlusal waxes, silicone impressions, or combination of these materials to identify the presence of tooth contacts, and the results are recorded by counting the number of contacts and describing the tooth locations.

Quatitative methods involve the use of photo occlusion which describes contact intensities, and the T-Scan system(Tekscan Inc., Boston, U.S.A.) which describes the timming and force characteristic of tooth contacts.

Several investigators have studied the distribution of tooth contacts during maximal clenching and have reported contact locations with respect to the tooth position.[6-11]

Even though maximal clenching as a standard have been used widely, they have elicited much problems.

The masticatory muscle in craniomandibular system is extremely sensitive, great care must be taken in order to study on occlusal contacts as a standards.[6]

There were few studies on the tooth contacts during maximal and habitual clenching by using T-Scan system(computerized occlusal analysis system).[12,13]

The purpose of present study was to measure the number and total duration of closure of tooth contacts by using T-Scan during maximal and habitual clenching, and to ascertain whether or not present method using habitual clenching can be used a standard modality for study on tooth contacts.

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Ⅱ. MATERIALS AND METHOD

1. Subject

Fifteen individuals of age ranged from 19 to 26 years were examined. They were selected according to the following criteria[4,13] : (1) normal tooth alignment with angle Class I molar and canine relation and no prior to orthodontic treatment, (2) complete dentition except for some occasionally missing third molars, (3) no pathologic periodontal condition or symptoms of craniomandibular disorder, and (4) no prosthesis. The subjects were primarily dental students and graduate students of Seoul National University.

2. Method

Subjects were asked to sit various position (upright, semisupine, supine) in dental chair, and the sensor of T-Scan was placed in the subject's mouth so that the pointer on sensor

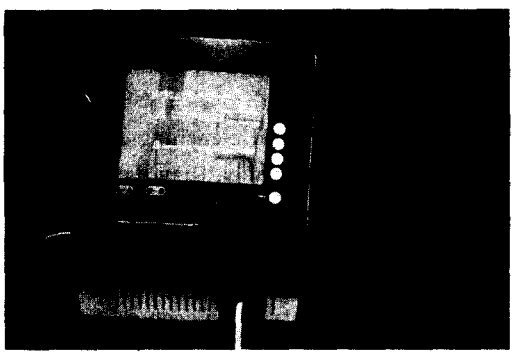

Fig.1. T-Scan system

Fig.2. A view of recording procedure by using T-Scan and EM2.

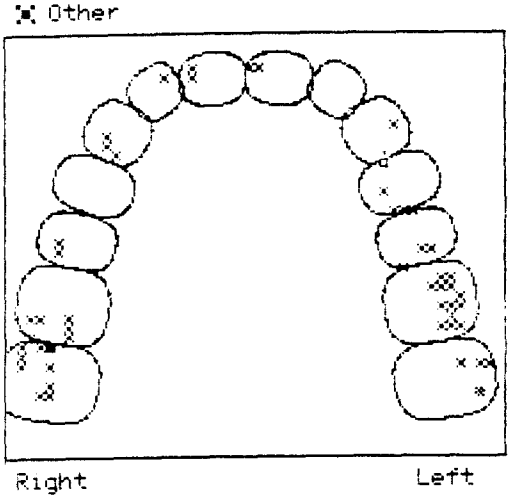

Fig.3 Typical time sequence display recorded by T-Scan during maximal clenching.

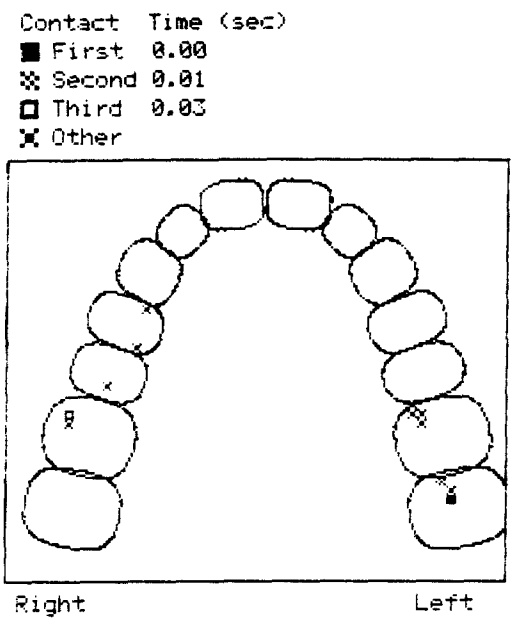

Fig.4 Typical time sequence display recorded by T-Scan during habitual clenching.

support was aligned with the midline of the subject's upper incisors[14]. The T-Scan system, is shown fig.1, digitizes the location and timing of tooth contact and presents a rapid, quantitative method of describing tooth contact data. Then subjects were asked to close on the occlusal sensor of T-Scan during maximal and habitual clenching(Fig.2)

Several practice closures were made until a repeatable pattern of contact was seen on the video monitor, and at that time four closures were recorded in time mode.

Muscle activity of anterior temporal muscle was measured by using EM2(Myotronic Research Inc., Seattle, Washington, U.S.A.).

Figure3, 4 show a typical time sequence display showing the tooth contact position and relative timing during maximal and habitual clenching.

The data were recorded by counting the number of tooth contacts according to tooth location and by getting total duration of closure from printing paper of the time sequence display. After approximately two months, ten out of fifteen individuals were re-examined in a same manner to that described above.

3. Statistical analysis

Data of each variable were inputed into an IBM personal computer and mean values and standard deviations of variables were attained using SPSS PC+(Microsoft Corp.). Differences in mean values of variables were submitted to paired t-test as all the observations had approximately normal distributions. Differences between distributions of variables were tested with Friedman Two-way ANOVA(Table. Ⅰ, Ⅲ) and Wilcoxon Matched-pair Signed-ranks Test(Table. Ⅳ).

Ⅲ. RESULTS

The mean values for the muscle activity of anterior temporal muscle during habitual clenching in upright, semisupine and supine chair position were 64.6%, 61.9% and 73.3% of maximum muscle activity of anterior temporal muscle(Table. Ⅰ)

The mean values for the number and the total duration of closure of tooth contacts during maximal clenching were 16.83 and 0.429sec. The mean values for the number and total duration of closure of tooth contacts during habitual clenching were 11.65 and 0.177sec (Table. Ⅱ).

No significant differences could be detected among various chair positions(upright, semi-

Table. Ⅰ Mean Values and standard deviations of the muscle activity of anterior temporal muscle recorded by EM2 during maximal and habitual clenching in various chair position.

		Range	Mean	S. D.	Probability
Maximum	Upright	107-255	189.8	43.3	P=0.4419 *
	Semisupine	122-255	186.5	42.4	
	Supine	136-255	191.1	41.3	
Habitual	Upright	75-213	123.2	39.2	P=0.3274 *
	Semisupine	26-202	118.5	47.7	
	Supine	75-226	140.5	43.4	
%	Upright	47.4-84.4	64.6	11.6	P=0.1546 *
	Semisupine	21.5-92.2	61.9	17.5	
	Supine	51.9-92.4	73.3	14.4	

* P>0.05 : not-significant

Table. Ⅱ Mean Values of the number and the total duration of closure of tooth contacts recorded by T-Scan during maximal and habitual clenching.

	Number of Tooth Contact		Duration of Closure	
	Habitual	Maximum	Habitual	Maximum
Range	5.8-15.6	9-23.5	0.09-0.40	0.24-0.65
Mean	11.65	16.82	0.177	0.429

Table. Ⅲ Mean Values and standard deviations of the number and the total duration of closure of tooth concats recorded by T-Scan during maximal and habitual clenching in various chair position.

			Range	Mean	S. D.	Probability
Number of Tooth Contact	Maximum	Upright	9-24	16.82	4.33	P=0.3442 ✳
		Semisupine	9-25.5	15.14	5.00	
		Supine	9-26	15.17	5.11	
	Habitual	Upright	5.8-17	11.65	3.24	P=0.2865 ✳
		Semisupine	1-16.6	9.77	4.03	
		Supine	4.8-15.5	10.27	3.03	
Duration of Closure	Maximum	Upright	0.24-0.65	0.429	0.149	P=0.6271 ✳
		Semisupine	0.03-0.83	0.392	0.233	
		Supine	0.18-0.78	0.452	0.194	
	Havitual	Upright	0.09-0.40	0.177	0.077	P=0.2962 ✳
		Semisupine	0.00-0.48	0.196	0.136	
		Supine	0.07-0.64	0.227	0.181	

✳ P>0.05 : not-signficant

Table. Ⅳ Mean Values of number and the total duration of closure of tooth contacts recorded by T-Scan during maximal and habitual clenching in first experiment and second experiment.

				Range	Mean	Probability
T-Scan	Habitual	No. of Tooth Contact	T1	5.8-17	11.11	P=0.8127 ✳
			T2	7.0-17.5	11.22	
		Duration of Closure	T1	0.09-0.40	0.18	P=0.9549 ✳
			T2	0.05-0.33	0.18	
	Maximum	No. of Tooth Contact	T1	9-24	16.5	P=0.2604 ✳
			T2	9-23	15.7	
		Duration of Closure	T1	0.26-0.65	0.43	P=0.0125 ✳
			T2	0.54-0.89	0.67	

T1 : First experiment
T2 : Second experiment

✳ P>0.05 : not-significant
✳✳ P<0.05 : almost-significant

supine, supine) (Table. Ⅲ).

After approximately two months, ten out of fifteen individuals were re-examined in a same manner to that described above. No significant differences were found between first experiment and second experiment except the total duration of closure during maximal clenching(Table. Ⅳ).

Ⅳ. DISCUSSION

The individual occlusion should be characterized by its influence on the function of the stomatognathic system and not by the way teeth intercuspate and establish specific morphological relations.[15]

A closer analysis of the natural occlusion as to the number and distribution of occlusal contacts should make it possible to describe numerically the effects of e.g. occlusal adjustment. This seems important as the input from periodontal receptors around antagonizing teeth, in close association with joint and muscle receptors, influence the jaw muscle motor behaviour.[16]

In previous studies on the number of contacts in intercuspal position different methods have been used which explains the varying results.[17,18]

An understanding of the timming and force of occlusal tooth contacts during habitual clenching is essential in diagnosing and treating the disease of the stomatognathic system.[13,14]

Normal occlusion implies bilateral simultaneous tooth contacts.[19] Quantitative occlusal analysis system (T-Scan system) which describes the timming and force characteristic of tooth contacts is essential in studing on occlusal contacts.

The total duration of closure is a calculation of the total elapsed time from first contact to last contact and is always reported by the T-Scan system for any closure, but the total duration of closure statistic and its relationship to muscle incoordination has recently been described.[13] It is necessary to study patients exhibiting symptoms of muscle dysfunction in the future.

In the present study, the mean values of muscle activity of anterior temporal muscle by using EM2 during habitual clenching in upright, semisupine and supine chair position were 64.6%, 61.9% and 73.3% of maximum muscular activity of anterior temporal muscle.

Although maximum clenching have been used in many studies as a standard,they have much problems. These results show that habitual clenching by using T-Scan system seems to be a standard modality for occlusal study.

In the present study, the mean value for the number of tooth contacts and the total duration of closure during habitual clenching is smaller than the mean values during maximal clenching.

These results are in agreement with those of Riise and Ericsson, who analysed occlusal contacts in the intercuspal position at light and hard pressure in adults.[7,8]

They showed that smaller number of contacts were registered at light pressure than at hard pressure.

In the present study, no significant differences could be detected among various chair posions(upright, semisupine, supine).

These results were not in agreement with past investigators.[9]

It was suggested that more research should be conducted to improve the accuracy of relaxation technique and occlusal recording technique. After approximately two months, ten out of fifteen individuals were re-examined in a same manner to that described above. No significant difference could be found between two experiments except the total duration of closure during maximal clenching.

Therefore, present method using habitual clenching for occlusal study seems to have

reproducibility.[20-22]

V. CONCLUSION

The author analysed the number of tooth contacts and the total duration of closure of tooth contacts by using computerized occlusal analysis system during maximal and habitual clenching, in fifteen adults with complete dentition showing no sign of occlusal problems.

The obtained results were as follows :

1. The mean values for the muscle activity of anterior temporal muscle during habitual clenching in upright, semisupine and supine chair position were 64.9%, 61.9% and 73.3% of maximum muscular activity of anterior temporal muscle.
2. The mean values for the number and total duration of closure of tooth contacts during maximal clenching were 16.82 and 0.429sec. The mean values for the number and total duration of closure of tooth contacts during habitual clenching were 11.65 and 0.177sec.
3. There was not a significant difference among various chair position.
4. There was not a significant difference between first experiment and second experiment except the total duration of closure during maximal clenching.
5. The present method using habitual clenching can be used a standard modality for study on tooth contacts.

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T-Scan System을 이용한 Maximal Clenching과 Habitual Clenching의 비교연구

서울대학교 치과대학 구강진단학교실
김 영 구

악구강계의 질환을 진단하고 치료후의 예후를 판정하기 위하여 maximal clenching시에 측정된 tooth contacts의 수와 분포가 이용되어 왔다. 그러나 maximal clenching시 반복된 tooth contacts의 측정은 저작근 피로등 문제점을 가지고 있다.

본 연구는 건강한 성인 15명을 대상으로 maximal clenching 및 habitual clenching시 T-Scan System을 이용하여 치아접촉 수와 접촉시간을 측정, 비교, 검토하여 habitual clenching을 이용한 방법이 tooth contacts의 연구에 이용될 수 있는지를 확인 하는데 목적이 있으며,

연구결과는 다음과 같다.

1. Habitual clenching시 upright, semisupine 및 supine position에서의 전측두근의 근활성은 maximal clenching시의 64.6%, 61.9% 및 73.3%로 나타났다.
2. Maximal clenching시 치아접촉 수와 접촉시간은 16.82개 및 0.429초로 나타났으며 habitual clenching시에는 11.65개 및 0.177초로 나타났다.
3. 치아접촉수와 접촉시간은 체위에 따라 크게 변화되지 않았다.
4. 치아접촉 수와 접촉 시간의 측정시에는 habitual clenching을 이용하는 방법이 maximal clenching을 이용하는 방법보다 재현성이 더 높은 것으로 나타났다.
5. Tooth contacts의 연구시 habital clenching을 기준으로 사용할 수 있다.