Disclusion Time Uninfluenced by Overbite in a Pilot Study Using a T-Scan III System

เวลาการสบแยกไม่ได้รับอิทธิพลจากการสบเหลื่อมแนวดิ่ง ในการศึกษานำร่องซึ่งใช้ระบบที-สแกน 3

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ABSTRACT

The purpose of this study was to evaluate the influence of overbite to disclusion time (DT). Fifty subjects were divided into two groups, according to their overbite values (0- to 4-mm overbite, Group I and over 4-mm overbite, Group II). A T-Scan III system was used to evaluate the DT in left lateral excursion, right lateral excursion, and protrusion. An independent sample t-test was used for comparing inter-group mean DT. The results showed no inter-group significant difference in the mean DT. It was illustrated that the subjects' DT were not affected by their overbite. However, some further investigations should consider the relationships between DT and overjet, apart from overbite, and conduct in a larger sample.

บทคัดย่อ

วัตถุประสงค์ของการศึกษานี้ คือ เพื่อประเมินอิทธิพลของการสบเหลื่อมแนวดิ่งกับเวลาการสบแยก (ดีที) ผู้รับการทดลองจำนวน 50 ราย ถูกจำแนกเป็น 2 กลุ่มตามค่าการสบเหลื่อมแนวดิ่ง (การสบเหลื่อมแนวดิ่ง=0-4 มม., กลุ่มที่ 1 และมากกว่า 4 มม., กลุ่มที่ 2) ใช้ระบบที-สแกน 3 เพื่อประเมินดีที ในการเคลื่อนขากรรไกรไปด้านซ้าย ด้านขวา และในการยื่น เปรียบเทียบค่าเฉลี่ยเวลาการสบแยกระหว่างกลุ่มโดยใช้การทดสอบความแตกต่างระหว่างค่าเฉลี่ยสองค่าที่ได้จากกลุ่มตัวอย่างที่เป็นอิสระจากกัน ผลการศึกษาไม่พบความแตกต่างอย่างมีนัยสำคัญทางสถิติของค่าเฉลี่ยเวลาการสบแยกระหว่างกลุ่ม ซึ่งแสดงว่า ดีทีของผู้รับการทดลองไม่ได้รับผลกระทบจากการสบเหลื่อมแนวดิ่ง อย่างไรก็ตาม การศึกษาในอนาคตนั้น นอกจากการสบเหลื่อมแนวดิ่งแล้ว ควรพิจารณาความสัมพันธ์ระหว่างดีทีกับการสบเหลื่อมแนวนอนและดำเนินการในกลุ่มตัวอย่างที่ใหญ่ขึ้นด้วย

Keywords: Overbite, Disclusion time, T-Scan III system

คำสำคัญ: การสบเหลื่อมแนวดิ่ง เวลาการสบแยก ระบบที-สแกน 3

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Introduction

Occlusal component is one contributing factor influencing the development of temporomandibular disorder (TMD). Overbite, overjet, and disclusion time (DT), the parameters used in assessing static and dynamic occlusions, are clinically important indicators and related to TMD.

A research has shown an association between an overbite greater than 4 mm and TMD signs (Tinastepe and Oral, 2015), while some have revealed no association between such component and TMD signs or symptoms (Pullinger et al., 1988; John et al., 2002; Hirsch et al., 2005). Although a relationship between overbite and TMD has not been clarified by the available evidence-based researches, the routine occlusal analyses are clinically important examinations, particularly in TMD patients.

DT measurable by a T-Scan III system (Maness et al., 1987; Trpevska et al., 2017), the system's newest version, is defined as the duration of time starting after a patient moves the mandible from maximum intercuspation to an excursive movement (lateral or protrusion), until all posterior teeth are discluded and anterior teeth are in contact (Kerstein and Wright, 1991). It has been reported that a prolonged DT (over 0.5 sec) causes the contraction levels of temporalis and masseter muscles to be elevated (Kerstein and Wright, 1991; Kerstein et al., 2006). Although electromyography has shown some hyperactivities of masticatory muscles in patients with prolonged DT (Selaimen et al., 2007; Kerstein and Radke, 2012; Thumati et al., 2014), there is no report whether overbite affects the DT, by using the T-Scan III system.

Objective of the study

The aim of this study was to investigate an association between the subjects' overbite and their DT.

Methodology

This study was approved by Naresuan University Ethical Committee, Phitsanulok (IRB Number 2979/2018).

Subjects

Fifty subjects included in this study were those with at least 28 permanent teeth and undergoing no orthodontic treatment or TMD management. According to their overbite's distances, the subjects were divided into two groups (n=25 for each group), that is, Group I (0- to 4-mm overbite) and Group II (over 4-mm overbite).

T-Scan III system

For each participant, two visits (one week apart) of the data collections were set. Firstly, upper and lower diagnostic models were constructed after impression taking. All teeth were measured in mesio-distal width by using a digital vernier caliper (Mitutoyo, Kanagawa, Japan) for creation of individual dental arch's dimensions. Secondly, each of them was seated upright on a dental chair, with the Frankfort horizontal plane parallel to the floor. Before DT (sec) were recorded by using a T-Scan III system, Version 9.1.9 (Tekscan, MA, USA), a clinician instructed the participant to practice moving the jaw to lateral sides and protruding the jaw. The DT in all excursions were shown between points C and D in a timing table (Figure 1).

Statistical analyses of the data

The obtained data were analyzed with a statistical package program SPSS for Windows, Version 17.0 (SPSS, IL, USA). Standard descriptive statistics were used for calculating mean and standard deviation (SD) of each excursion's DT. An independent sample t-test was used for comparisons of the DT's mean values between Groups I and II. The level of significance was set at $P<0.05$.

Results

A total of 50 participants were consisted of 24 males and 26 females. The age ranges (years old) in Groups I and II were 18-26 (mean±SD=22.0±0.55) and 18-27 (mean±SD=22.5±0.44), respectively. Incisor and molar classifications of each group were shown in Table 1. There was no statistically significant difference in the mean age (P=0.682) or in the mean overjet (P=0.643) between Groups I and II. However, there was a statistically significant difference in the mean overbite (P=0.000).

Table 1 Number of the subjects' incisor and molar classifications in each group

	Incisor classifications (n)				Molar classifications (n)			
Group	I	II div.1	II div.2	III	I	II div.1	II div.2	III
I	10	5	1	9	12	5	1	7
II	2	9	14	None	2	9	14	None
Total	12	14	15	9	14	14	15	7

The DT of each excursion in both groups were shown in Table 2 and Figure 2. In all excursions (except protrusion), Group II possessed larger DT's mean values than Group I. With respect to each excursion, there was no statistically significant difference in the mean DT between Groups I and II (P>0.05).

Table 2 Range, mean, and standard deviation (SD) of the subjects' overbite and overjet in each group, together with their disclusion time in each excursion.

					Disclusion time (sec)					
	Overbite (mm)		Overjet (mm)		Left excursion		Right excursion		Protrusion	
Group	Range	Mean±SD	Range	Mean±SD	Range	Mean±SD	Range	Mean±SD	Range	Mean±SD
I	0.5-3.5	2.28±0.82[a]	0.5-4	2.52±0.92	0.89-2.82	1.89±0.53	0.35-3.68	2.23±0.94	0.35-4.04	1.97±0.96
II	4.0-8.0	5.16±1.02[b]	0.5-5.0	2.82±1.24	1.03-3.26	2.11±0.60	0.56-4.17	2.31±1.07	0.75-3.48	1.97±0.79
P-value		0.000		0.643		0.171		0.791		0.991

Different superscripted letters indicate intra-column statistically significant difference (P<0.05).

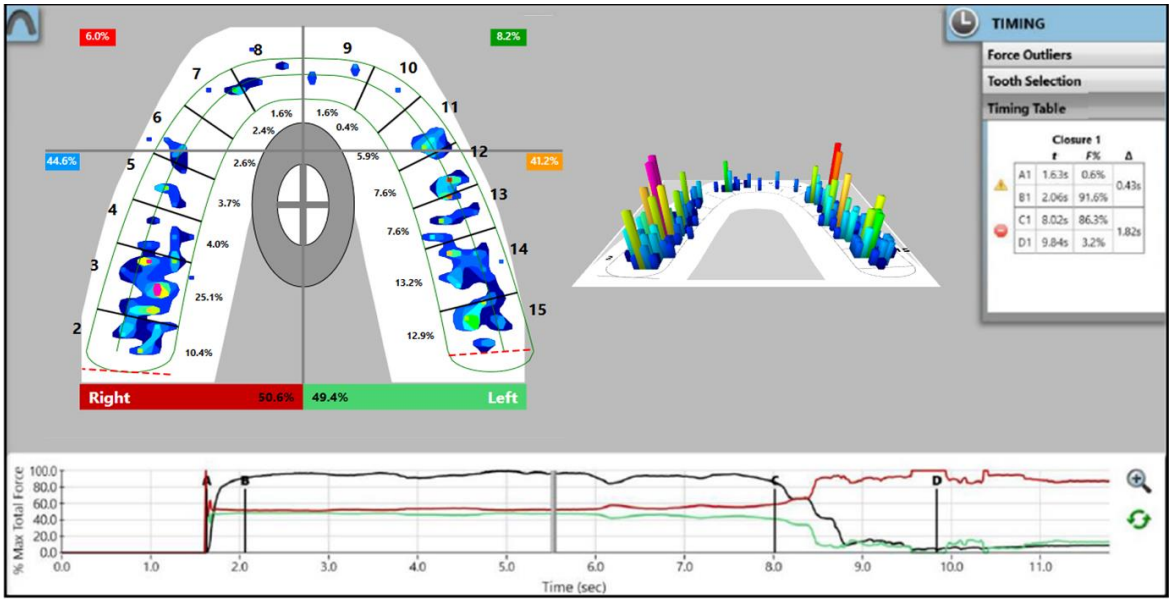

Figure 1 A timing table (upper right) and disclusion time, the time difference between points C and D, in a graph of force versus time (bottom).

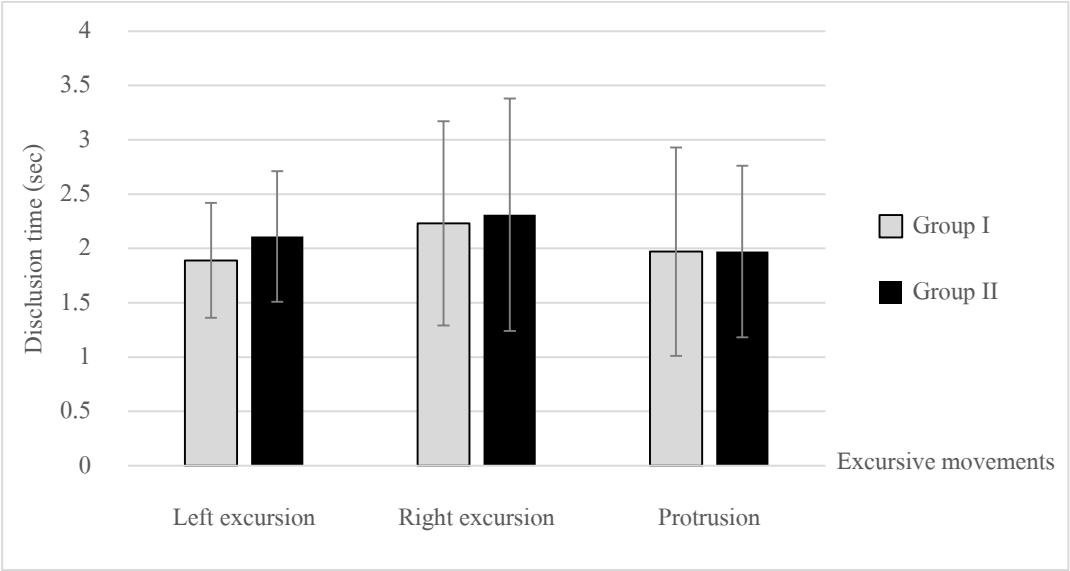

Figure 2 Inter-group comparisons of the disclusion time (sec) in each excursion, the results of which showed no inter-group statistically significant difference.

Discussion

This study showed that the DT of all excursions (except protrusion) in Group II were longer than those in Group I, despite no inter-group statistically significant difference. The results implied no association between overbite and DT.

It is documented that during excursions the incisors should contact to allowing the posterior teeth's immediate disclusion (Al-Hiyasat et al., 2004; Oltramari et al., 2007). The processes are determined by overjet and overbite, both of which play a role in the anterior guidance's achievement (Oltramari et al., 2007; Trpevska et al., 2014). Despite the lack of an association between overbite and DT in this study, a clinician should be aware that an incisor relationship might contribute to TMD. Consequently, any treatment relating to oral re-establishment must be carefully performed, when malposition and relationships of incisors exist.

Owing to some detectable association between the overbite and DT with the usage of a 4-mm overbite cut-point (Tinastepe and Oral, 2015), a cut point of overbite at 4-mm was then used in the present study. On the contrary, some studies reveal that neither overjet nor overbite is related to the risk of TMD, with their selection criterion of a 3-mm overbite (John et al., 2002; Hirsch et al., 2005). In addition, some subjects with an overbite greater than 4 mm are reported to remain in the masticatory system's adaptive capacity (Lowe, 1980; Anders et al., 2000). Such observations cause their conclusion of a non-association between overbite and TMD.

It is reported that subjects with an overjet larger than 3 mm possess the posterior teeth's prolonged DT (Oltramari et al., 2007). Because of a small sample size in this study, an inter-group non-significant difference in their mean overjet was detected. Consequently, the influence of overbite on DT was only focused. DT seen in the study were rather varied, probably because of the dependence of DT on mandibular movement's velocity, the rate of which is difficult to control. Not only should the sample size be larger, but also should the evaluations whether both overjet and overbite are associated with DT be performed in some further researches.

Conclusion

Despite no observable association between DT and overbite, a patient's improper overbite should not be overlooked. With an inappropriate incisal relationship, their malocclusion should be corrected to a proper occlusion.

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