Preventive effect of shimstock self-checking on loss of occlusal contact during stabilization appliance therapy

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Preventive effect of shimstock self-checking on loss of occlusal contact during stabilization appliance therapy

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This certifies that the doctoral dissertation

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감사의 글

본 논문이 마무리되기까지 많은 도움을 주셨던 분들께 감사의 인사를 드립니다. 박사과정을 무사히 마치고 논문의 시작부터 마무리에 이르기까지 세심한 지도와 아는 격려로 이끌어주신 김성택 지도교수님께 먼저 깊은 감사를 드립니다. 그리고 소중한 조언과 관심으로 지속적으로 저를 사랑으로 이끌어 주신 권정승 교수님께도 존경과 감사를 바칩니다. 또한 저의 논문 심사를 깊은 관심으로 맡아주시고, 연구에 대한 자세와 방향을 일깨워 주셨던 김성오 교수님과 김지환 교수님, 줄곧 관심과 애정을 가지고 많은 시간을 할애하여 심사에 참여해주신 한상훈 원장님께 깊은 감사의 인사를 드립니다.

연구 결과를 정리하여 논문으로 만드는데 많은 도움을 준 후배 김복음, 이정은 선생과 여러 가지로 바쁜 수련의 생활 중에도 싫은 내색 없이 실무적으로 많은 도움을 준 김희연 비서분과 다른 의국원 여러분 들에게도 감사드립니다.

생각만으로도 언제나 따뜻한 위안이 되어주는 사랑하는 아들 민하와 남편 마지막으로 성근, 무한한 사랑과 신뢰로 저를 보살펴 주시고 언제나 제 편이 되어 힘을 주시는 아버지와 어머니께 진심으로 감사와 사랑을 전합니다.

2020 년 6 월

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Abstract

Preventive effect of shimstock self-checking on loss of occlusal contact during stabilization appliance therapy

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Aims: The aim of this study was to assess the preventive effect of shimstock self-checking on loss of occlusal contact (LOC) complication during stabilization appliance (SA) therapy and to analyze the relationship between the time of recognition of occlusal change and irreversible LOC.

Methods: This study assessed 443 temporomandibular disorder (TMD) patients who have used SA. Among them, 235 patients visited the clinic regularly to have a TMD specialist check occlusal contacts in maximum intercuspation with shimstock. The other 208 patients not only visited for regular check-up but also performed shimstock self-checking daily by Occlusal Self Checker®. We investigated the incidence of LOC, one of the

serious side effects during SA therapy, in both groups.

Results: In the self checking (SC) group, the incidence of LOC was significantly lower than in the non-SC group (p=0.010); moreover, the irreversible LOC patients were significantly lower statistically (p=0.002). Self-checkers usually recognized LOC a month after SA delivery, whereas non-SC recognition came later.

Conclusions: This study suggests that shimstock self-checking may help to prevent LOC complications during stabilization appliance therapy.

Keywords: stabilization appliance, splint, dental occlusion, loss of occlusal contact, shimstock

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I. INTRODUCTION

Temporomandibular disorder (TMD) is a group of clinical problems affecting the temporomandibular joint (TMJ), masticatory muscles and other related structures (Chen YW et al., 2015). The management of TMD-related pain includes self-care, pharmacological pain control, physical therapy, and splint therapy (Fricton J et al., 2010; Ahrari F et al., 2014; Pramod GV et al., 2011; Tuncer AB et al., 2013; Al-Moraissi EA, 2015). However, the initial management of TMD-related pain has not been standardized. A stabilization appliance (SA) is commonly used when other noninvasive therapies have failed.

In practice, the SA is a removable splint, usually fabricated of resin and most often designed to cover all of the occlusal surfaces of the teeth in the upper or lower jaw. Several dental side effects during SA therapy have been reported, including excess salivation, xerostomia, temporomandibular joint pain, dental discomfort, discomfort, and occlusal change. Among the side effects, irreversible LOC is the most serious. To prevent it, regular supervision is necessary. In particular, the patient's occlusal contacts in maximum intercuspation should be monitored by a dentist at regular check-ups.

However, some patients are unable to show up for their regular check-up for personal reasons. In this case, if patients can check their occlusion contact by themselves, they will not have to worry about LOC tendency. Whenever patients detect symptoms of LOC during personal monitoring, they can take action. For the convenience, a disposable shimstock is highly recommended to check their occlusal contact. The aim of this study was to assess the preventive effect of shimstock self-checking on LOC complication during SA therapy and to analyze the relationship between the time of recognition of occlusal change and irreversible LOC.

II. Materials and Methods

This retrospective study was conducted including TMD patients who had received SA therapy at the Orofacial Pain Clinic at Yonsei University College of Dentistry from February 2018 to February 2020. Investigation procedures were approved by the authors' university, Yonsei University Dental Hospital Institutional Review Board (Approval number 2-2019-0017).

This retrospective study includes 443 TMD patients who have used SA and been treated with TMD diagnosis, based on Diagnostic Criteria for Temporomandibular Disorder (DC/TMD) by a TMD specialist. All SAs of participants were removable, usually fabricated of resin and designed to cover all occlusal and incisal surfaces of the teeth in the upper or lower jaw. The patients were asked to wear it only at bed time. Patients were excluded from this study if their disposable shimstock compliance was less than 70%, they had arbitrarily stopped the SA or did not show up for their regular check-ups.

Upon starting SA therapy, patients were shown how to use the self-checker. If patients had declined it, they were included in the non-SC group. To determine the relationship between regular usage of disposable shimstock and the LOC incidence rate, we divided participants into two groups: those with Self Checker (SC) and those without (non-SC). 235 non-SC patients visited the clinic regularly for a TMD specialist to apply the shimstock. The other 208 patients not only visited for regular SA check-up but also performed shimstock occlusal self-checking daily using the Occlusal Self Checker®

themselves. For LOC evaluation, regular check-up at the clinic was performed by shimstock (GHM Hanel-Medizinal, Nurtingen, Germany). The thickness of the shimstock was 8 ㎛, which is below the range of reported thresholds for dental proprioception. This method may allow identification of occlusal contact and provide the dentist with reliable data. The Occlusal Self Checker® (Dental OK, Seoul, Korea) is designed to check the occlusal contact by patients themselves which consists of a shimstock and plastic handle. Patients in the SC group were asked to check their bite by using Occlusal Self Checker® daily (Figure 1). They usually look at canines or first premolars on both sides while biting the self-checker. If their centric occlusion did not include the canine and/or first premolar, they were instructed to check the second premolar. If any change in occlusal contact was detected in the SC group, they were asked not to wear occlusal splints on that day. If the symptoms had resolved the next day, those patients in the SC group were asked to resume occlusal splint treatment. If they still had occlusal change the following day, they were told not to wear the SA and to call the clinic for an appointment.

At regular check-up, centric occlusion was checked with shimstock by dentists. Any loss of occlusal contact that was previously present in canine, first premolar or second premolar was interpreted as occlusal change.

The data obtained was subjected to statistical analysis using Statistical Package for Social Science (SPSS), version 21.0 and p-value <0.05 was considered statistically significant at 95% confidence level. Chi-square test was applied to compare the incidence of LOC in SC and non-SC groups.

Figure 1. Occlusal Self Checker ® (Dental OK, Seoul, Korea) and the usage of self-checker which usually check occlusal contacts of bilateral first premolar at centric occlusion

III. RESULTS

A total of 443 patients were included in this study. The numeric variables are summarized as number and percentage of each group, SC and non-SC (Figure 2). 357 were female and 86 were male. Their average age was 34.4 years. 208 patients were the SC group who performed shimstock self-checking daily during SA therapy. The other 235 wore SA without self-checking. The demographic data of the participants are summarized in Table 1.

Occlusal change is defined as one or more changes of occlusal contact in centric occlusion as indicated by shimstock. There was a significant difference between the SC and non-SC group, the SC group having significantly lower incidence of LOC from wearing SA than the non-SC group (Table 2).

In addition, the time of recognition of LOC was different between the two groups. The non-SC group usually showed LOC from 2 weeks to 2 months after starting SA therapy because of their regular check-up period. On the other hand, the SC group recognized their LOC change from 1 day to 1 month after starting SA therapy as they checked their bite daily (Figure 3). In other words, daily checking lets the patients notice their LOC change early, leading them to stop wearing SA as soon as possible.

At next regular check-ups, bite recovery was checked in patients who had occlusal change. Some patients recover their bite after stopping SA or adjusting the appliance usage. At last check-up, some patients' bite still had not recovered, and later they were diagnosed as irreversible LOC. The SC group showed statistically significant low

incidence of irreversible LOC compared with the non-SC group. Irreversible LOC occurred in only 6.25% of the SC group. In contrast, it occurred in 17.02% of the non-SC group (Figure 4).

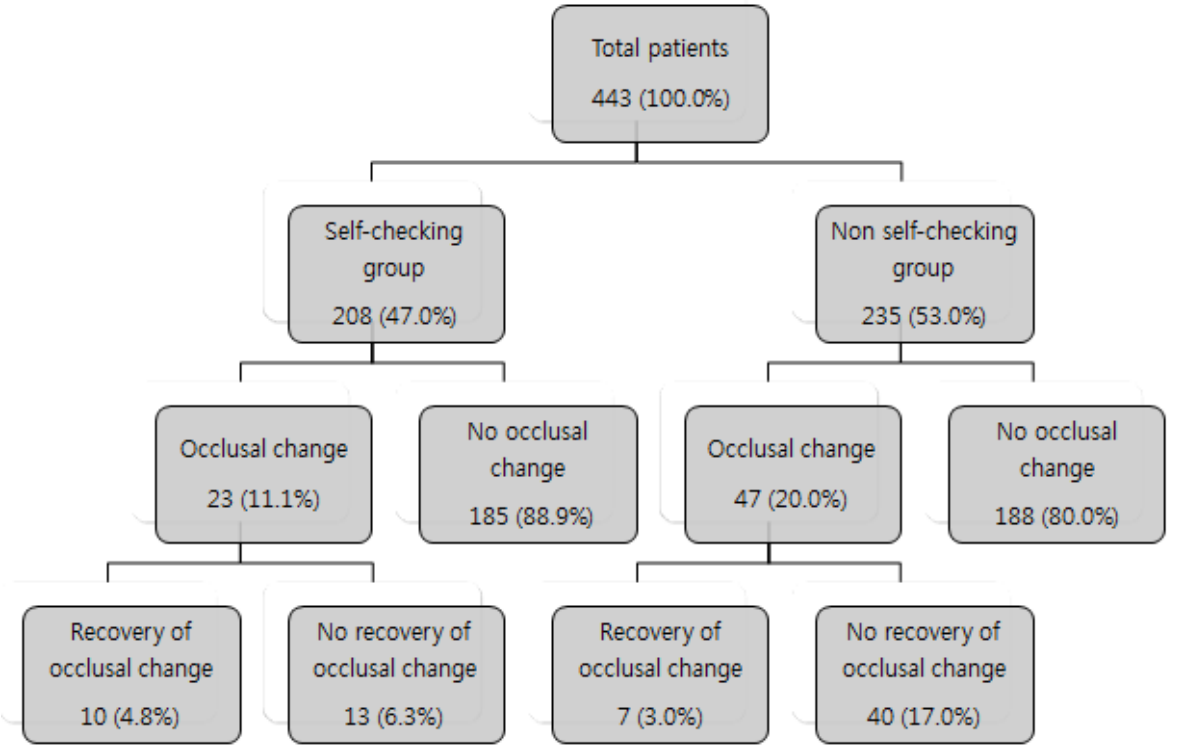

Figure 2. Flowchart of the study participants

Table 1. Clinical characteristics of the study subjects at baselines

Variable	Self-checking group	Non self-checking group	Total
Number of patients, *N* (%)	208 (47%)	235 (53%)	443 (100%)
Age (years)	34.5 ± 12.5	34.3 ± 13.5	34.4 ± 13.0
Male/female, *N*	43/165	43/192	86/357

Table 2. Incidence of loss of occlusal contact in SC and non-SC groups

Variable	Self-checking group	Non self-checking group	p-value
No occlusal change	185 (88.9%)	188 (80.0%)	0.010
loss of occlusal contact	23 (11.1%)	47 (20.0%)	

Values are presented as *N* (%).

P-values by chi-square test ($p<0.05$)

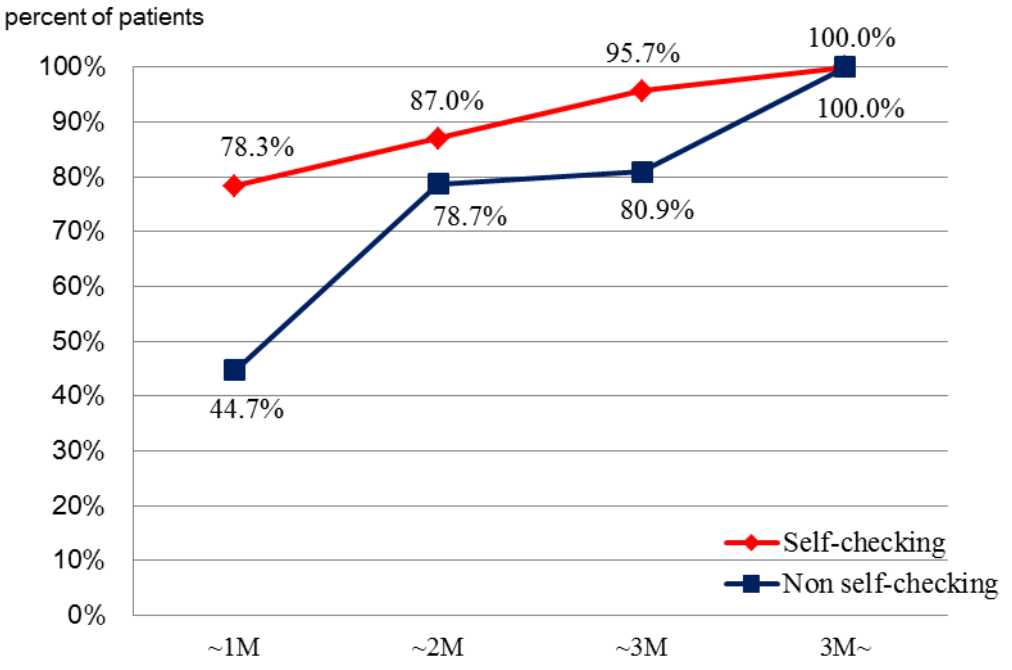

Figure 3. The time of recognition of LOC in SC and non-SC groups (total=70)

(M: month)

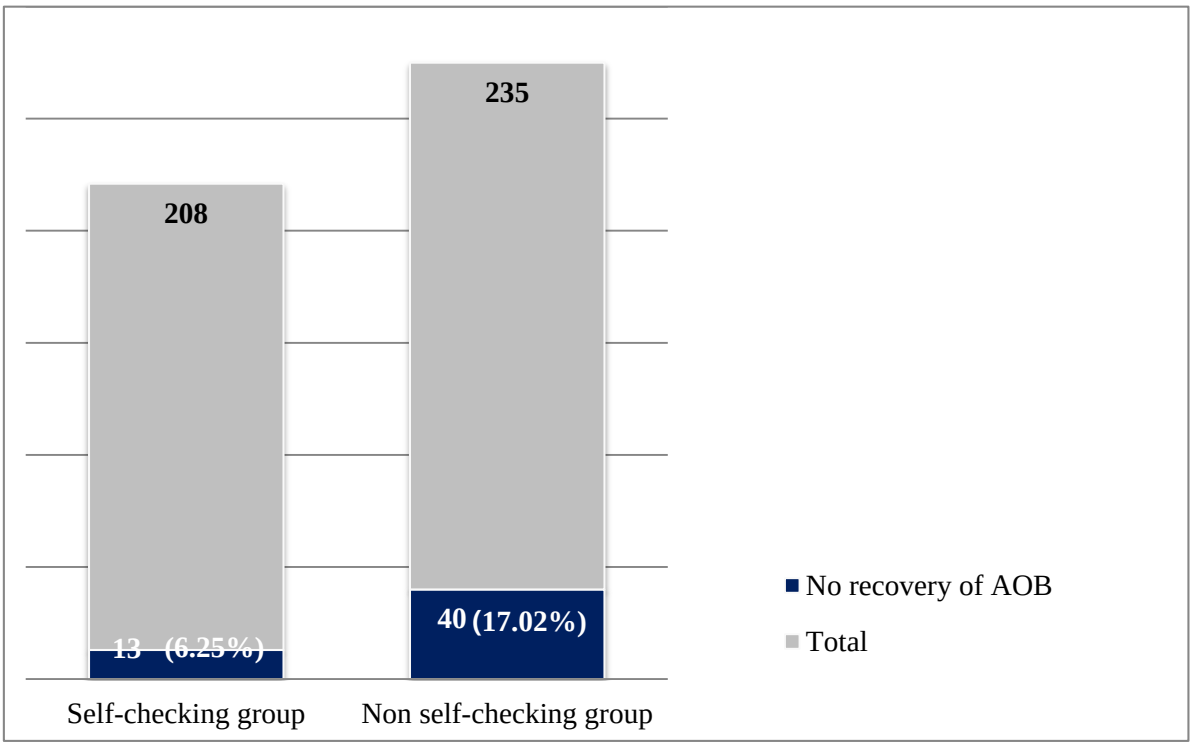

Figure 4. Incidence of irreversible loss of occlusal contact in SC and non-SC groups

IV. DISCUSSION

In this study, 443 TMD patients were included. Among 443 TMD patients, 357 were female and 86 were male. Several studies have reported TMD prevalence in female (Bueno CH et al., 2018). Their average age was 34.4 years. Most studies corroborate the age range of the present study (20–40 years) (Liu F et al., 2013; Progiante PS et al., 2015; Maixner W et al., 2011). The SA therapy is one of the most widely accepted methods of treatment for the signs and symptoms of TMD. Clinical reports suggest that the occlusal splints are useful for treatment of pain in TMJs and masticatory muscles or both (Wright EF et al., 2009; Türp JC1 et al., 2004).

Some side effects were reported during appliance therapy. Initial transient side effects might include excess salivation or mouth dryness, temporomandibular joint and dental discomfort and irritation of intra-oral tissues (Chan AS et al., 2009). Occlusal changes in response to the use of SA had already been reported (Widmalm SE, 1999; Brayer L et al., 1976). In addition, TMD treatment is conservative and reversible as long as patients avoid full-time wear that can lead to permanent occlusal changes (Klasser GD et al., 2009) and prior research has suggested that SAs should be used at night to meet the necessary daily usage time (Badel T et al., 2009; Conti PC et al, 2006; Lin SL et al., 2017; Proff P et al., 2007).

In order to avoid possible side effects of stabilization appliances, it is recommended that the splints cover the entire occlusal surface and not be used around the clock. In addition, a follow-up appointment with a dentist is required (Widmalm SE, 1999; Fricton J, 2006).

Nonetheless, LOC still occurred after SA treatment. In this retrospective study, SA therapy occasionally led to LOC, as reported in the literature (Todd MA et al., 1994; Nissani M, 2001).

Given the risk of possible irreversible LOC due to occlusion, patients should generally use SA with caution. Monitoring the progress of splint therapy is important, so it is essential to monitor occlusal contacts on the splint at each adjustment appointment.

However, some patients could not visit every appointment for personal reasons. In such cases, the risk of loss of occlusal contact is greater. Shimstock self-checking and simple usage instruction lets patients check their bite change objectively. In addition, early detection of loss of occlusal contact may prevent irreversible LOC. As a result, the incidence rate was reduced in the SC group because their symptoms of LOC were recognized within 1 day to 1 month in most patients. This means they could get help within 1 month. With proper self-checking, patients may recognize LOC change within 1 day. However, the instruction to check whole centric occlusion is hard for ordinary patients. In addition, some patients might use the self-checker incorrectly. Even considering these errors, early detection of loss of occlusal contact mostly happened in the SC group. This can help to reduce irreversible LOC by taking action that stop wearing SA as soon as possible. Even though several patients in the SC group also experienced LOC, their bites recovered significantly. The non-SC group could recognize their bite change at regular check-ups. On average, most patients noticed these change from 2 weeks to 2 months, which is within the usual check-up period.

There are some limitations of our study, similar to those of other studies in the literature.

First, this study was done retrospectively, analyzing patient' records and files. In addition, the number of patients who experienced loss of occlusal contact was insufficient in this study. Also, there were some biases in that osteoarthritis leads to LOC. In this chart review, there was insufficient information about diagnosis of osteoarthritis. As self-checker instructions were that they should check canines or first premolars (sometimes the second premolars) on both sides, some patients with LOC or progressive osteoarthritis were excluded in advance.

Other limitations include the short time and various treatment periods. Therefore, long-term and uniform evaluation is recommended. Although the bite changes occurred during the first months of splint use, long-term studies of patients who were treated with SA are needed (Zamburlini I et al., 1991). A larger sample size is also needed. Additional study is needed to identify whether early detection of the LOC is actually an important factor in preventing LOC or not.

V. CONCLUSION

TMD are a group of clinical problems affecting TMJ, myofascial muscles and other related structures. Splint therapy is the most common treatment of TMD. Although SA is the most useful option for treating TMD, its side effects include irreversible LOC which is one of the worst side effects may be happened. Occlusal Self Checker® allows patients to check the centric relation of occlusion daily, thereby allowing them to recognize their occlusal change early and thus prevent LOC. Therefore, using Occlusal Self Checker® by patient himself may contribute to preventing irreversible LOC.

Within the limitations of the study, it can be concluded that SA therapy with Occlusal Self Checker® might prevent incidence of LOC.

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ABSTRACT (in Korean)

교합안정장치치료 시
교합셀프체커의 교합접촉상실 예방효과

<지도 김 성 택 교수>

연세대학교 대학원 치의학과

김 서 린

측두하악관절질환의 치료법 중에 하나인 교합안정장치는 통상적인 치료법으로 알려져 있다. 하지만 장치치료 중에 교합변화의 합병증이 발생할 수 있어 주의를 요한다. 이 연구는 이러한 교합변화가 발생하는 것을 교합셀프체커로 예방할 수 있는지 평가하고 교합 변화를 인지하는 시점과 비가역적 교합변화의 관계를 분석하기 하는데 목적을 둔다. 교합안정장치 치료를 받고 있는 측두하악관절장애 환자 443 명의 차트를 후향적으로 검토했다. 그 중에서 235 명의 환자가 정기적으로 병원에 내원하여 심스탁을 이용하여 교합을 체크하였고, 나머지 208 명의 환자는 정기적으로 내원하여

교합검사를 시행하는 것 이외에도 교합셀프체커로 매일 스스로 교합을 체크했다. 두 그룹에서 교합안정장치 치료 중 발생하는 심각한 부작용의 하나인 교합변화의 발생률을 조사했다. 그 결과, 셀프체크그룹은 교합변화의 발생율이 교합셀프체커를 사용하지 않은 그룹보다 유의미하게 낮았다 ($p = 0.010$). 또한 비가역적 교합변화가 발생한 환자는 통계적으로 유의하게 낮았다 ($p = 0.002$). 또한, 교합셀프체커를 사용한 그룹은 일반적으로 교합안정장치치료 시작한지 1 개월 후에 교합변화를 인지했지만, 사용하지 않은 그룹은 셀프체커그룹에 비해 더 늦게 인지하는 것으로 확인된다. 따라서 이 연구를 통해 교합셀프체커의 사용이 교합안정장치 치료중인 환자의 교합변화 합병증을 예방할 수 있을 것으로 사료된다.

핵심되는 말: 교합안정장치, 구강장치, 교합, 교합변화, 심스탁