

# The Effectiveness of a Modified Type of the Mandibular Repositioning Device on the Elimination of Snoring

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## Abstract:

**Statement of Problem:** Snoring is the most common sleep disorder which in itself may only be viewed as an obnoxious disturbance in human society; however it must be considered a potential indicator of significant medical problems such as: hypertension, obstructive sleep apnea, cerebrovascular infarction and ischemic heart disease.

**Purpose:** The purpose of this study was to evaluate the effectiveness of a modified type of Mandibular Repositioning Device (MRD splint) on the treatment of snoring.

**Materials and Methods:** This before and after interventional study was carried out on 15 patients (4 females and 11 males) who suffered from snoring. All subjects had no upper airway obstruction. Maxillary and mandibular splints were made by clear heat-cured acrylic resin. A special screw connected to the anterior portion of the maxillary splint and an orthodontic wire No 1 positioned on the lower splint. The devices were tried in the mouth and relined with a softliner. This appliance was designed to protrude the mandible by use of a screw system. Snoring grades were determined before, and 3 weeks after treatment with the MRD. Data were analyzed by the Wilcoxon test.

**Results:** A significant difference was observed between the snoring severity, before and after using the splints ( $P = 0.001$ ).

**Conclusion:** The present study showed this modified type of splint can be effective in decreasing or eliminating snoring. The effectiveness of the splint in the treatment of snoring could be related to its role of widening the upper airway.

**Key Words:** Snoring; Mandibular repositioning device; Snoring severity; Splint

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## INTRODUCTION

Snoring is the most common sleep disorder which affects 25% to 45% of the adult population. It appears between the age of 30 to 40 years in 20% of men and 5% of women. Snoring is characterized by audible, high frequency oscillations of the soft palate, pharyngeal walls, epiglottis and tongue, occluding and opening a narrowed pharyngeal airway. It is produced in the collapsible part of the pharynx, the area between the epiglottis

and choanae. Increase in airflow velocity due to pharyngeal narrowing can cause vibration of the soft tissues (particularly the soft palate and tonsillar posterior pilli), which results in the sound of snoring [1].

When sleeping in a supine position, there is a progressive reduction in all muscle activity, which results in tongue relaxation. In this situation, the base of the tongue approaches the posterior wall of the pharynx, and narrowing of the airway occurs [2]. Because of

the reduction in pharyngeal dimensions, the speed of airflow increases in an attempt to maintain the required oxygen to the lungs, subsequently producing increased airways resistance. Increase in airflow velocity often causes vibration of the soft tissues [3,4]. The uvula is usually the source of vibration, but any tissue that can vibrate may cause snoring. Although the tongue is often a major cause of upper airway obstruction, conditions which impinge on the airway including obesity, edema, polyps, inflamed adenoids or tonsils, or tumors may cause this problem [2].

The intensity of snoring may be classified into 5 grades: I: No snoring, II: occasional mild snoring, III: constant mild snoring, IV: strong but tolerable snoring, V: strong and intolerable snoring [1]. Snoring in itself may only be viewed as an obnoxious disturbance in human society, however, it must be considered a potential of significant medical problems such as: hypertension, cerebrovascular infarction and ischemic heart disease. The association of snoring with such diseases is controversial [5]. Snoring is encountered in almost all patients with obstructive sleep apnea (OSA), therefore this may be considered as a basic sign of this disorder [6].

OSA is a common sleeping disorder, characterized by repeated collapse of the upper airway during sleep, with cessation of breathing. OSA subjects are at the risk of developing a range of severe medical complications, ranging from respiratory and cardiovascular problems to pathologic sleeping [7]. Suggested treatment modalities available for the management of OSA and snoring, could be divided into four categories:

1. Behavior modification [8].
2. Medication, the role of drug therapy is still unclear, ranging from minor changes in some subjects to no changes in others [9,10].
3. Surgical procedures [8].
4. Mechanical procedures including oral

appliance therapy and continuous positive airway pressure (CPAP).

These procedures do not provide definitive treatments; they are only effective as long as they are used [8]. Oral appliances are tools inserted in the mouth during sleep and function through prevention of airway obstruction [8]. Considerable variation exists in the design of these appliances; some cause mandibular advancement, a number are repositioning devices (MRD or MAD) or tongue retaining devices while others are palatal lifting appliances [8]. The splints designed in this study were from the MRD type [2].

Numerous studies investigating the effects of MRD splints on the elimination or reduction of snoring [7,12-15] and also reports on the effectiveness of these appliances on treating OSA, improvement of sleep quality, airflow velocity and widening of the upper airway, have considered these appliances to be successful. [16-19].

The purpose of this study was to evaluate the effectiveness of a modified type of MRD splint on the elimination of snoring.

## MATERIALS AND METHODS

In this before and after interventional study, 15 patients with a history of snoring, who had been referred to the School of Dentistry, Isfahan University of Medical Sciences, were examined by an ENT specialist in order to rule out any kind of airway obstruction. Four of patients were females and 11 were male, with the age range of 19 to 58 years. None of them had an obstruction and all the patients accepted this treatment option and written consents were received from each patient. Before the initiation of treatment, the patients were classified in terms of their snoring severity and Mallampati scores were assessed for each subject. The Mallampati score is the level of upper airway obstruction, produced by the tongue. It is classified into 4 grades, I, II,

III, IV; such that grade IV demonstrates the larger tongue sizes and the highest amounts of upper airway obstruction [20]. Maxillary and mandibular arch impressions were prepared using alginate (Alginoplast-Bayer Dental, D-5090 Leverkusen, Germany), and cast models were made with a dental stone (Dental Model Stone type III- Kheyzaran. Co. LTD, Tehran, Iran). Relief and block out followed by duplication were carried out on the casts. Wax-up (De Trey Division-Dentstply limited, Weybridge, Surrey, England) was performed and an orthodontic wire No 1 (Dentaram 75104 Pforzheim, Fed.Rep, Germany) was positioned on the lower cast which was followed by flasking. Finally splints were processed using clear heat-cure acrylic resin (Meadway Dental supplies LTD., GU22 9JX, England). The special screw designed for this appliance was connected to the anterior portion of the maxillary splint (Fig. 1). On the second appointment, the splints were tried in the mouth and relined with Molosil softliner (DETAX-GmbH&Co., KG-Postf., Ettlingen, Germany), and were then inserted in the mouth. Afterwards the screw was set while the mandible was placed in position (CR position). Post-insertion instructions were provided and the patients were advised to activate the screw by ¼ turns in a clockwise direction once a day. This procedure was recommended to be continued until the snoring was fully eliminated. Mandibular protrusion



Fig. 1: The Maxillary and mandibular MRD splints.

was achieved by this appliance. After 3 weeks, all patients were re-examined and the new snoring grades were assessed. The data were analyzed by the Wilcoxon test and descriptive statistic.

**RESULTS**

Snoring grades before and after treatment are presented in Table I. A significant difference was observed in snoring severity before and after treatment (P=0.002).

**Table I:** Snoring severity before and after of the treatment

Snoring grade	Before		After	
	No.	%	No.	%
I			10	76.9
II			1	7.7
III	5	33.3	1	7.7
IV	2	13.3	1	7.7
V	8	53.3	0	0
<b>Total</b>	15	100	13	86.67

Mallampati scores are shown in Figure 2. The mean mandibular protrusion measured after the elimination of snoring ranged between a maximum of 8mm and a minimum of 0 mm.

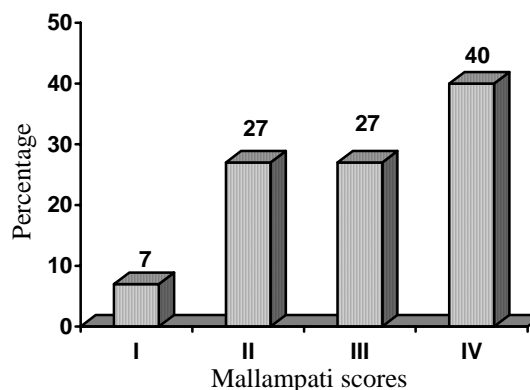


Fig. II: Mallampati score in the samples

## DISCUSSION

In this study, a modified type of MRD was used to set the mandible in a protruded position. In posturing the mandible forward, the tongue and soft palate are moved anteriorly with consequent opening of the oropharyngeal airway. Treatment modalities for snoring and OSA consist of both surgical and nonsurgical methods. The nonsurgical approaches to treatment include simple behavior modifications such as sleep position, use of sedatives, weight loss, reduction in smoking and alcohol consumption, and mandibular advancement splints [3]. Behavior modification is usually the first line of approach and if snoring is eliminated, there would be no further need for more aggressive procedures [2].

Surgical intervention in the management of snoring and OSA is presently the treatment most commonly selected by physicians. Because of the increased incidence of tonsillar inflammation and adenoids in children, surgery is usually indicated for youngsters with upper airway sleep disorders. For morbidly ill patients, tracheostomy may be the only available treatment, but due to its depressing effects, it is not performed routinely [2].

Treatment of snoring and OSA in dentate patients with mandibular advancement splints is well documented. Oral appliances are recommended as a treatment of choice for patients who don't respond to or are not appropriate candidates for treatment with behavioral measures, and also for patients who are intolerant of or refuse treatment with nasal CPAP (continuous positive airway pressure), or subjects which are not appropriate candidates for surgical procedures [2]. All MRDs reduce snoring or OSA through widening of the upper airway. The Herbst splint is the most common mandibular advancement device in the treatment of snoring and OSA. This appliance uses the

crowns of the first molars and consists of two separate upper and lower full coverage clear acrylic clasp retained splints, which are connected with bilateral rods and tube devices [21]. Intermaxillary elastic bands are used for mandibular advancement and prevention of jaw movement [22].

A modified type of the MRD splint was fabricated in this study which was not an imitation of other splints and had a new design. However, the overall mechanisms of all MRD splints are similar. The results showed that this splint is effective in the treatment of snoring. Snoring severity decreased or was nearly eliminated in all subjects. Johnston et al (2001) evaluated the effect of a maxillary placebo appliance and a MAD device on 28 patients with snoring problems for a period of 4 to 6 weeks. Eighty four percent of the patients reported a reduction in snoring loudness and 76 per cent reported snoring on fewer nights per week, during use of the device. [19]. Li et al (1999) assessed the effect of oral appliances on the treatment of OSA and reported upper airway widening and improved respiration [17]. Schmidt et al (1995) reviewed 21 publications describing 320 patients treated with oral appliances for snoring and obstructive sleep apnea. They reported that despite considerable variation in the design of the appliances, the clinical effects were remarkably consistent and both snoring and OSA improved in almost all patients who used the oral appliances [7]. O'Sullivan (1995) investigated the effectiveness of MAD on the treatment of snoring in 51 patients and reported significant improvement in all the subjects [15]. Nakazawa (1992) studied 12 patients with snoring problems, which were treated by a MAD appliance and showed that the device was quite effective [14]. Ichioko [13] and Lowe [12] also reported MAD to be effective on the treatment of OSA.

The results of the current study are in

agreement with the previous reports. Eighty seven percent of the patients in this study were successfully treated, which shows a higher percentage as compared to the 79%, reported by Menn et al in 1996 [16]. Similar to the results obtained by Lowe et al [18], our patients also used the MRDs during the night. Mallampati scores (MS) were used in the present study to evaluate the degree of upper airway obstruction, caused by the tongue. Considering the fact that OSA patients have a MS of III or IV, and OSA and snoring are related phenomena, it would be expected that two thirds of our patients, demonstrated a MS of III and IV. About 80% of the patients had large tongues. Since the tongue is shown to have a considerable role in upper airway obstruction, the size of the tongue may be a possible explanation for snoring.

## CONCLUSION

Within the limitations of the present study, it may be concluded that:

1- Application of the MRD splint used in this study can successfully reduce or eliminate snoring; and may be a simple and easy approach for the treatment of snoring in selected cases.

2- This appliance can be recommended for patients who do not suffer from upper airway obstruction.

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# اثر بخشی یک وسیله تغییر یافته Repositioning فک پایین

## در حذف Snoring

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### چکیده

**بیان مسأله:** خرخر کردن (snoring) یکی از اختلالات شایع خواب است که در جوامع انسانی تنها به عنوان یک مزاحمت در اجتماع مطرح است؛ اما به طور بالقوه می‌تواند نشانگر مشکلات پزشکی چون افزایش فشار خون، آپنه انسدادی هنگام خواب، انفارکتوس عروق مغزی و بیماری ایسکمیک قلبی باشد.

**هدف:** مطالعه حاضر با هدف ارزیابی اثربخشی یک وسیله تغییر یافته repositioning فک پایین (MRD splint) در درمان خرخر انجام شد.

**روش تحقیق:** مطالعه مداخله‌ای حاضر به روش قبل و بعد بر روی ۱۵ بیمار (۴ زن و ۱۱ مرد) مبتلا به خرخر انجام شد. هیچ کدام از بیماران مبتلا به انسداد راه هوایی فوقانی نبودند. اسپلینت‌های فک بالا و پایین از رزین اکریلی شفاف سخت‌شده با گرما تهیه شدند. یک پیچ خاص در بخش قدامی اسپلینت فک بالا تعبیه شد؛ همچنین سیم ارتودنسی شماره ۱ در اسپلینت فک پایین قرار داده شد. وسیله‌ها در داخل دهان امتحان شدند و با یک لایه نرم reline شدند. این وسیله جهت جلو آوردن فک پایین به کمک پیچ مورد نظر، طراحی شده است. درجه خرخر قبل و سه هفته پس از استفاده از MRD تعیین شد. داده‌ها با استفاده از آزمون Wilcoxon مقایسه شدند.

**یافته‌ها:** اختلاف معنی‌داری بین شدت خرخر بیماران، قبل و پس از استفاده از اسپلینت‌ها وجود داشت ( $P=0/001$ ).

**نتیجه‌گیری:** وسیله استفاده شده در این مطالعه در کاهش یا حذف خرخر مؤثر است. تأثیر این وسیله را می‌توان به نقش آن در عریض کردن مسیر هوایی فوقانی نسبت داد.

**واژه‌های کلیدی:** خرخر کردن؛ وسیله repositioning فک پایین؛ شدت خرخر؛ اسپلینت

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