

# A one-year follow up treatment of an 8-year old child with thumb sucking habit using a new habit breaking appliance: A Case Report

## ABSTRACT

This report describes the management of an 8-year-old male child with thumb sucking habit and anterior open bite. Comprehensive diagnosis was performed and patient's records were taken (Extra-oral and intra-oral photographs, lateral cephalometric and panoramic radiographs, and study models) along with impression for appliance's fabrication. When received from the laboratory, the appliances were disinfected, fitted, then cemented and adjusted in the patient's mouth. The patient and his parent were enlightened about the advantages of the appliances, which entailed cessation of thumb sucking habit thus allowing tooth eruption and open bite closure, and giving them the instructions at time of appliance insertion. A questionnaire to test patient compliance was given to the parents every follow up. Treatment was consummated once the child ends 12 months of follow up regardless the fact that it could be achieved.

Treatment effects were evaluated by comparing pre and post treatment records along with the questionnaire answers. The report showed the patient was compliant with the appliance, with significant increase in overbite and the maxillary intercanine width. This might be the result of stop of thumb pressure on the palate. It also showed a significant reduction of lower anterior facial height. The maxillary incisors had been uprighted. The interlabial gap greatly reduced after treatment while the nasolabial angle recorded no significant change. It was concluded that the magnetic habit breaker was effective to stop the habit and help bite closure due to the appliance's dual effect and good patient acceptance.

*Keywords: Anterior open bite; thumb sucking; habit breaking appliance; abnormal oral habit*

## 1. INTRODUCTION

Thumb sucking is the most common oral habit with a prevalence between 13 to 100% in some communities[1]. This habit is accompanied by damaging dento-facial effects; anterior open bite, poor esthetics, speech difficulties and bad psychological impact[2,3]. This entails careful examination of the habit for proper diagnosis and treatment plan. Treatment of thumb sucking habit was suggested to be carried out early in the mixed dentition for control over the adverse effects on the dentofacial components, hence improve the possibility of success, stability as well as restricting or redirecting vertical growth. Moreover, the patient can benefit from an improved mastication, esthetics and speech[4,5].

Management of thumb sucking habit can be done by many habit breaking appliances such as palatal crib, palatal spurs and blue grass appliance, that act as a mechanical barrier to thumb to encourage discontinuation of the habit and bite closure [6]. However, these appliances have many drawbacks such as difficulty of speech and eating, poor esthetics due to their bulky size[6-8]. Moreover, some clinicians stated that using spurs appliance may result in negative patient or parent reactions due to injury to tongue or thumb from the metal spurs[9]. These shortcomings might affect patient compliance and call for a new habit breaking appliance that can efficiently break the habit with better patient acceptance.

## 2. CASE PRESENTATION

An 8-year old male child and his parent with no relevant medical or social history came to the clinic with a chief complain of difficult speaking, and annoying jaw appearance due to Anterior Open bite as a result of a history of thumb sucking habit. His mother reported that he is constantly bullied by his classmates at school. There was a previous trial with a habit breaking appliance that failed to stop the habit because the child wasn't compliant with the appliance's metal appearance and bulky size, so he continued to practice thumb sucking during day and night. Clinical examination showed lip incompetence and Anterior Open Bite.

Diagnostic records were taken for the child including extra-oral and intra-oral photographs (Fig.1), obtained by digital camera (*Canon 750D digital camera, Japan*) with ring flash (*Yongnuo model YN-14EX-C, China*) and 100 mm macro lens (*Canon EF 100mm f/2.8 Macro USM Lens, Japan*), study models using an alginate impressions (*Hydrogum soft-Zhermack-Italy*) for the maxillary and mandibular arches with fitted sized perforated trays. The impressions were immediately disinfected, sent to the lab, and poured with orthodontic stone material (*super white, hard orthodontic stone –whipmix, Louisville, USA*), then properly trimmed to obtain orthodontic study casts. Digital Panoramic and lateral cephalometric radiographs were taken using panoramic and cephalogram machine (*VaTech x-ray system, South Korea*). The exposure parameters for the digital Panorama were set on 80 kV, 14 mA and 14 seconds while the exposure parameters for the digital cephalography were 70 kV, 10 mA and 14 seconds.

The obtained case history and clinical and radiographic examination data were summarized in the diagnostic chart. Habit history was taken through a questionnaire answered by the parent and child.



**Figure (1):** Extra-oral and Intra-oral photograph

## 3. TREATMENT AND APPLIANCE FABRICATION

This appliance is called magnetic habit reminder which is a custom made fixed-removable appliance, consisting of two parts (fixed intraoral part and removable extraoral part) having two poles of gold-coated disk shaped neodymium and iron boron magnets (*first4magnets™, UK*) [10].

The appliance was fabricated through the following steps [10]:

- i. Separators (*Oramco corporation, orange, USA*) were placed two days before seating the bands on the first permanent molars, then alginate impressions for the maxillary arch and the thumb were taken, the bands were

removed from the patient's mouth, then repositioned and secured in the impression before being sent to the lab for pouring.

- ii. The intraoral acrylic part was constructed from cold cured acrylic resin (*Orthocryl® - Dentaaurum, Germany*), enclosing 12mm diameter x 2mm, thick, rare earth magnet and a 0.9mm stainless steel wire soldered to the bands. It is finished and polished and kept in water for 24 hours before cementation intraorally (Fig.2).
- iii. The extraoral part (thumb cover) was constructed from transparent soft 1.5 mm thick vacuum formed sheet (*ethylene vinyl acetate sheet, 3A MEDES company, South Korea*) enclosing a 4mm diameter x 1.5mm thick rare earth magnet. It was fabricated using vacuum forming machine (*Jintai Dental Vacuum Forming Machine, china*), to press the sheet over the thumb model which is fixed on the machine table. The thumb model was then removed, and the cover was dislodged from the model, trimmed to the drawn design and finished (Fig.3).
- iv. A child watch (Watch house company, Cairo, Egypt) was attached to the thumb cover via transparent string. This watch act as an additional support for the extraoral part (thumb cover), and also as an esthetic component for the child to improve the compliance (Fig.3).

At the delivery day, after the proper disinfection, dryness of the appliance and the intraoral isolation, its intraoral part was cemented with glass ionomer (Medicem, PROMEDICA, Germany). The fitness of the extra-oral part (clear thumb cover) was checked on the thumb. The patient was given the instructions particularly using plastic spoon during eating.



Figure (2): Intra-oral part



Figure (3): Extra-oral part (Thumb cover)

#### 4.FOLLOW UP AND OUTCOME

The first follow up visit was scheduled after one week of appliance insertion to check the appliance fit. Then follow up visits were scheduled at a monthly interval for 12 months, to assess how well the patient was tolerating the appliance, to stress on the importance of breaking their habit, take intra-oral photographs to monitor the progress and Fill in the questionnaire of the habit

After 12 months of treatment, post-treatment records were taken the same as pre-treatment records to evaluate treatment outcomes (Fig.4).The Ortho Analyzer software (3Shape Co., Denmark) was used to measure the overbite and the maxillary inter-canine width on the digital models[8][11] (table 1).WebCeph™ software( version 1.5.0.) was used to measure jarabak ratio(PFH/AFH), upper incisor inclination (U1/PP), naso-labial angle and inter-labial gap on the lateral cephalometric radiographs and to observe the changes after treatment through lateral cephalometric superimposition(Fig.5,6) (table 1).

The questionnaire given to the parents,was prepared to measure patient compliance. It combined two different questionnaires[12,13] to test patient compliance. It consisted of nine questions measuring the variables that test patient acceptance in term of eating, pronunciation, esthetics, and breakage,through the whole 12 months.

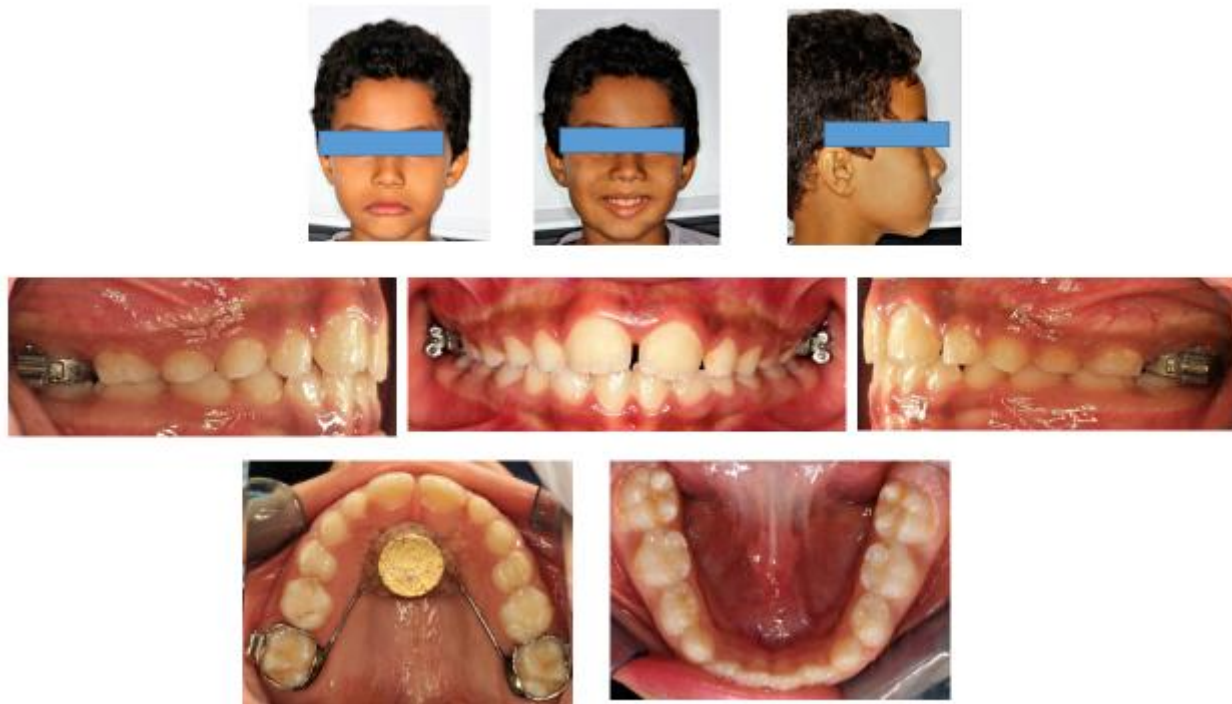


Figure (4): After 12 months of follow up



Figure (5): Pre-treatment (on the left) and post-treatment (on the right) lateral cephalometric radiographs

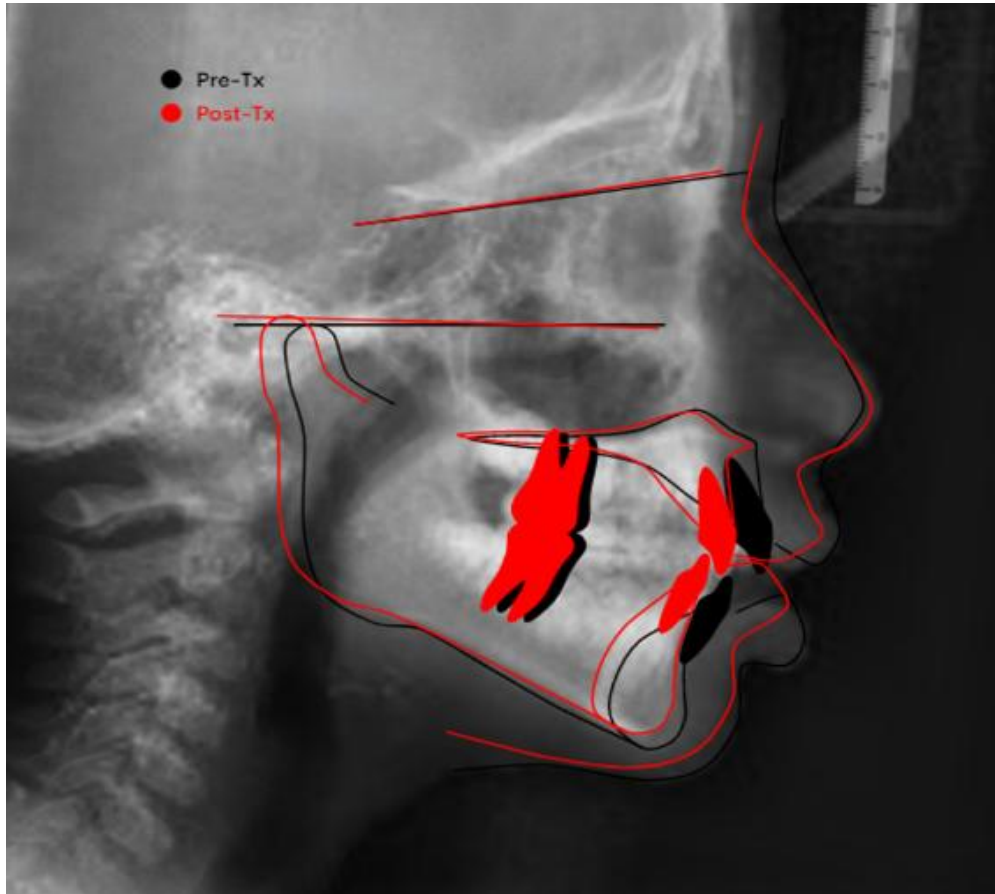


Figure 6: superimposition of pre and post treatment lateral cephalometric radiographs

Table (1) pre-treatment and post-treatment measurements of cephalometric and cast analysis

<b>Digital Cephalometric Analysis</b>	Measurements	Pre-treatment	Post-treatment
<b>Skeletal measurements</b>	PFH/AFH	60.3%	63%
<b>Dental measurements</b>	U1/PP	112°	105°
<b>Soft tissue measurements</b>	Nasolabial Angle	78°	80°
	Interlabial gap	5 mm	1 mm
<b>Digital Cast Analysis</b>	Overbite	-2.16 mm	+1.68 mm
	Maxillary inter-canine width	33 mm	35 mm

## 5. DISCUSSION

The current habit breaking appliances have many drawbacks such as tongue irritation, difficulty to maintain good oral hygiene, difficulty of speech and eating, negative emotional reactions and self-inflicted trauma[2,14]. Moreover, they are of low evidence at improving sucking cessation in children, highlighting the need for a high quality intervention to stop thumb sucking habit[15].

The magnetic habit reminder depends on two barriers to stop the habit: a mechanical barrier which is the acrylic part and a physical barrier which is the repulsion force between both parts. This helps prevent the thumb from resting on the palate at day and night, thus giving the appliance a dual effect. On contrary to it, other habit breakers[13,16,17] include only mechanical barrier. However, the thumb cover, being removable, is considered a drawback that necessitates that the parents always remind their kid to wear it.

In this study, greater improvement of open bite by 3.84 mm was observed with an increase of the maxillary inter-canine width by 2mm, that might due to the combination of mechanical and physical barrier of the appliance (dual effect). Also there was significant Increase in Jarabak ratio (PFH/AFH) by 2.7% after treatment with magnetic habit breaker, this might be because habit cessation and bite closure bring about counterclockwise mandibular rotation leading to reducing anterior facial height[18](Fig.6). The proclined maxillary incisors have been uprightened by 7° because the repulsion force stopped the thumb pressure on upper incisors. Moreover, there was significant improvement in the interlabial gap by 4mm as a result of bite closure, while the nasolabial angle showed little significant change.

Parents reported in the questionnaire that their children didn't receive any comments on appliance appearance during talking, laughing and playing with their classmates in school. This may be because the appliance was invisible during different activities, in contrast to other habit breaking appliances[6,7] which had esthetical problem due to their visibility to others during smiling. Slight discomfort and speech difficulty was noted during insertion of our appliance. Otherwise, no difficulty reported during eating and speaking till the end of treatment. On the other hand, there were discomfort, speech and chewing difficulties with palatal crip[13][17] and the palatal spurs caused irritation to tongue and injury to the thumb, with speaking, swallowing, eating impairments and risk of aspiration of debonded palatal spurs[6][9].

It is worthy noting that introduction of rare earth magnets made it applicable to make use of the magnetic force in field of dentistry, especially in orthodontics as they are smaller and more powerful and have more corrosion resistance, in comparison to the traditional larger magnets[19]. In our appliance, the incorporation of these magnets have introduced new barrier- repulsive force between the palate and the thumb- to enhance appliance action in cessation of thumb sucking habit, in addition to an attractive cartoon watch, that act as a kid toy to enhance patient acceptance.

## 6. CONCLUSION

Treatment with the magnetic habit reminder was effective to stop thumb sucking habit by its dual action- a combination of mechanical and physical barrier. The magnetic habit reminder had excellent patient acceptance. The anterior open bite was significantly improved with correction of the maxillary intercanine width. Correction of the proclined upper incisors had occurred after cessation of thumb sucking. Improvement of soft tissue profile by decreasing the interlabial gap.

### COMPETING INTERESTS

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

## CONSENT

The parents have signed an informed consent/assent and received a copy, after they were told about the advantages and disadvantages of our appliance.

## ETHICAL APPROVAL

As per international standards or university standards written ethical approval has been collected and preserved by the author(s).

## ABBREVIATIONS

AFH: anterior facial height  
PFH: posterior facial height  
U1: upper incisors  
PP: palatal plane

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UNDER PEER REVIEW