Clinical changes obtained with the use of the MFS "open bite device" in patients with anterior open bite

Abstract

Anterior open bite is a characteristic of patients with functional problems. In this study we evaluate the "MFS" open bite device, which has shown to be effective in reducing anterior open bite.

Key words: Anterior open bite. "MFS" open bite device. Functional re-education.

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Introduction

Functional re-education is an important element in the control of the functional matrix[1,2], and is key in the achievement of post treatment[3,4] stability. It must therefore be taken into account in the diagnosis[5,6] and subsequent treatment of patients. Coding the different functions is essential for both steps (diagnosis and treatment)[7,8].

The anterior open bite is an occlusal feature of patients with a well-defined functional, dental and skeletal problem[9]:

- Mouth breathers.
- Lax muscle pattern.
- Vertical growth of the face.
- Posterior mandibular rotation.
- Anterior tongue thrust.
- Abnormal swallowing.
- Dental open bite.
- Lip incompetence.

Anterior open bite is defined as an absence of overbite between the upper and lower incisors. In most cases, the only occlusal contacts present are at the level of the molars and second premolars[10,11].

MFS "open bite device"

It is a device made of elastic material (Figure 1) with the following morphological characteristics:

- It has a horseshoe-shaped base, in different sizes. This is the supporting element for the rest of its parts. Inside the mouth, the base takes on a lingual position in the dental arch.

- Laterally, it presents occlusal extensions, in the form of posterior bite planes. The bite planes rest on the occlusal surfaces of the molars and premolars.

- In the anterior portion, the base of the device is projected upwards, like a shield. This is to prevent the free anterior projection of the tongue, both in the resting position as well as during swallowing.

- At the bottom of the anterior shield, at the level of the lingual surface, at the base of the device, there are rough spots that act as stimuli to attract the tongue to a position where it is "protected" by the shield, thereby preventing tongue thrust at the level of the anterior open bite.
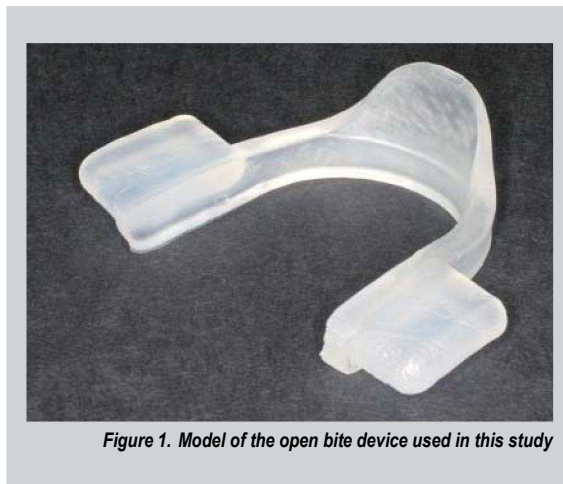

Figure 1. Model of the open bite device used in this study

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Figure 2.
Different sizes of
open bite devices
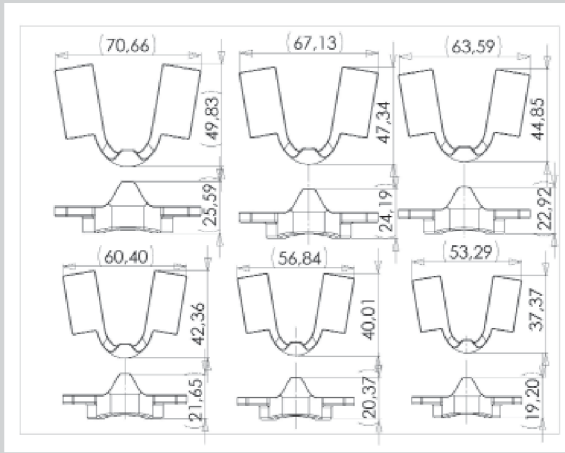
Working basis of the MFS "open bite device"

The design itself of the device (Figure 1) hints to its possible function in the mouth:

– Posterior bite planes that lead the patient to continuously bite on them while the device is being used. The mandibular closing exercises will exercise the masticatory muscles, thereby favouring arcial growth of the mandible.

– An anterior shield that regulates the position of the tongue and prevents thrusting at the level of the open dental bite. That way, by not putting the tongue between the upper and lower incisors, extrusion is promoted in favour of closure of the anterior open bite.

Different-sized open bite devices were used (Figure 2) to select the most appropriate one for each case, according to the dimensions of the dental arches. Currently, a few small changes to the design of the MFS open bite device have been made (Figures 3 and 4) as a result of the clinical experience of the present study.

Working hypothesis

The design of the MFS "open bite device" allows for the combined use of elements that are usually used separately for the orthodontic treatment of anterior open bite.

– Back bite elevation planes, to encourage the patient to exercise the masticatory muscles and promote the control of the eruptive factor of teeth in the posterior areas.

– The anterior tongue shield is a morphological element used in the context of functional devices, sometimes as a shield and sometimes as a grid. Regardless of the design of the element used, the primary objective is to contain the tongue, both in its forward postural movement as well as in the placement of the tongue at the anterior level of the occlusion area.

– Stimuli have been used as factors to "trick" the tongue regarding its position and mobility, and also in the design of many other functional devices.

According to these previously analysed criteria, we can consider that the MFS open bite device has an optimal design for the early treatment of anterior open bite.

Objectives

The sole objective of this study is to

– determine the anterior changes, as related to the open dental bite, after clinical use of the MFS open bite device for six months.

Materials and methods

A sample of thirty patients with an anterior open dental bite was selected, between the ages of 7 and 9 years of age and in accordance with the following criteria:

– Between the ages of six and nine years of age.

– Have an anterior open bite of more than one millimetre.

– Do not have severe malocclusion.

  – Have a class I molar and canine.
  – Do not have an accentuated projection at the level of the incisors as this could support continued lip incompetence.
  – Do not have a bone-dental discrepancy greater than three millimetres.

– Do not have agenesis or supernumerary teeth.

– Do not have otorhinolaryngology problems which might be the cause of open bite.

The degree of anterior open bite was clinically measured with a millimetre gauge.

The size of the "open bite device" was selected for each patient and he/she was told how to use it during the day and at night.

After six months, a new clinical measurement of the existing anterior open bite was carried out, using the millimetre gauge.

Subsequently, the recorded results were analysed statistically.

Results

Of the thirty patients who began the study, eight were excluded due to lack of collaboration in the use of the device or because they stopped using it. The following results were obtained:

The three variables studied have been described by means of minimum and maximum value, arithmetic mean and standard deviation (Table 1).

The contingency table of the values of the initial bite and the bite at 6 months has been compiled. The Pearson correlation coefficient has been calculated and no relationship was found between the initial values and those at 6 months (p= 0.138).

A 6m decrease in the value of the bite is observed (Tables 2 and 3), except for in two patients.

When making the comparison of the average values of the bite at the beginning and at 6 months, applying the test to compare means using the Student's t-test for paired data, we found significant differences. There is a significant decline in the bite values. Our probability of error in making this assertion is less than 0.0001 (Table 4).

Since the sample is small and does not meet the conditions for applying the Student's t-test, we have applied the non-parametric Wilcoxon T test. Its result allows us to make the same claim that there is evidence of differences between the initial values and those at 6 months, with the same certainty (Table 5).

To determine the value of this difference we have calculated the Confidence Interval of 95% of the average difference between the initial value and the value at 6 months. The interval lies between the values 0.962 and 1.538. These two values have a confidence level of 0.95 of containing the true average of the differences (Table 6).

Discussion

The results obtained in the present study show marked improvement of anterior open bite through the clinical use of the MFS open bite device.

The changes that have been measured are dental and do not specify whether this improvement has been determined exclusively by the repositioning of the teeth at the arch level, or if they are due to other factors not considered in the present study, such as:

– Muscle tone changes of the muscle groups that control the posterior vertical dimension of the dental occlusion.

– Functional changes related to breathing and swallowing patterns, regardless of the previously mentioned chewing pattern.

– Changes of jaw repositioning, by means of anterior rotation.

– Or, if the dental changes themselves have occurred in the anterior area (extrusion of the incisors) or in the posterior area (intrusion of the molars).
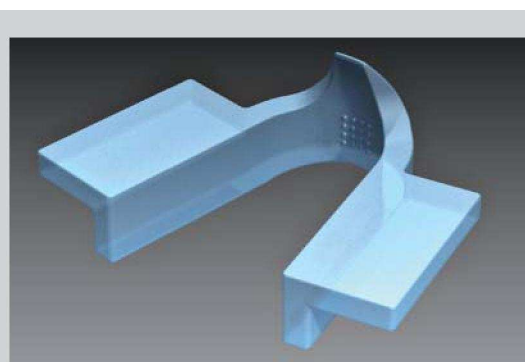

Figure 3.
New design of the "MFS" open bite device

Figure 4.
Lateral view of the new design of the "MFS" open bite device

	N	Minimum	Maximum	Mean	STD
Age	22	7	9	8.00	0.816
Initial bite	22	2.0	4.0	3.432	0.470
Bite at 6 months	22	0.5	3.5	2.182	0.628

Table 1.
Descriptive statistics

Conclusions

After evaluating the results obtained, we arrived at the following conclusions, in accordance with our initial objective:

– The changes that have appeared at the level of the open dental bite, after clinical use of the MFS open bite device for six months have been relevant and statistically significant, confirming a reduction of the anterior open bite of 1.25 millimetres, on average, in a population with an average initial anterior open bite of 3.43 millimeters.

Proposal for new lines of research

Given the results obtained, we ask ourselves the following questions:

– What changes have occurred at the level of the masticatory muscle straps?

Table 2.
Contingency initial bite *
bite at 6 months

		Bite at 6 months					
		0.5	1.5	2.0	2.5	3.5	Total
Initial bite	2.0		1				1
	3.0	1	1	1	2		5
	3.5			6	3	2	11
	4.0			3	2		5
Total		1	2	10	7	2	22

Table 3.
Correlations

	N	Correlation	Sig.
Initial bite and bite at 6 months	22	0.326	0.138

Initial bite − bite at 6 months				
Average	Typical Deviation	t	g.l.	Sig.
1.25	0.65	9.02	21	P<0.0001

Table 4. Comparison of averages with paired data

Table 5.
Wilcoxon test for
paired data

		N	Average range	Sum of ranges	z	Sig.
Bite at 6 months - initial bite	Negative ranges	20(a)	10.50	210.00	3.97	P<0.0001
	Positive ranges	0(b)	0.00	0.00		
	Draws	2(c)				
	Total	22				

a: Bite at 6 months < initial bite; b: Bite at 6 months < initial bite; c: Bite at 6 months = initial bite

Table 6.
Confidence Interval of 95% of
the average of the difference

Initial bite − bite at 6 months			
	Confidence Interval of 95% of the difference		
Mean	Typical Deviation	Lower limit	Upper limit
1.25	0.65	0.962	1.538

– Has the swallowing pattern changed?

– Has there been a decrease in the vertical posterior dimension or have the incisors extruded?

– Has there been any anterior rotation of the jaw?

Pursuant to the aforementioned, we propose future lines of research to evaluate each of the following points:

– Study the electromyographic changes of the masticatory muscles (masseter muscles).

– Study changes related to swallowing patterns (suprahyoid muscles) by electromyography.

– Cephalometric evaluation of dental changes.

– Evaluate the changes of mandibular position that took place, through lateral radiographs of the skull.

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