

## Facial Symmetry Improves After Treating Malocclusions with the Myobrace™ System

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### Abstract

This study evaluated the effect of the Myobrace System™ on facial symmetry. Twenty-five children were included in the study. The horizontal facial index, vertical facial index, and labio-mental angle were determined before and after treatment. The Myobrace™ appliances produced more symmetrical faces while balancing the activity of the craniofacial muscles.

**Keywords:** Facial Symmetry; Masticatory; Muscles; Facial Muscles; Myofunctional Appliance; Myobrace

### Introduction

Facial asymmetry refers to a state of imbalance: the size, form, and arrangement of the facial tissues and structures on the left and right sides of the face, at rest or during movement, are not identical [1,2]. In order to have facial symmetry, the left and right sides of the craniofacial complex, which are made up of identical structures, must grow and develop in a similar manner [1]. It has been generally accepted that asymmetries may be normally present in some areas of the face at some ages [3,4]. When expressing emotion, facial asymmetries are more easily observed, possibly due to a hemispheric asymmetry favouring one side of the brain for the control of the muscles of the face [5]. It has been suggested that systems in the right hemisphere make a larger contribution to emotional processing through contralateral hemispheric enervation of the left side of the face [6].

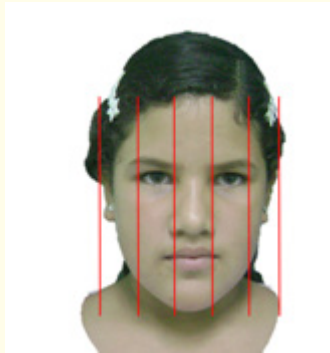
Multiple factors can contribute to facial asymmetry, including anatomical, physiological, and neurological factors [2]. It has been reported that disruptions in the harmonious interplay of the masticatory muscles due to temporomandibular joint fractures may result in facial asymmetries [7]. Although expressive movement asymmetries may be due to multiple influences, at rest it can be argued that facial asymmetry is more related to the asymmetric functioning of the masticatory and facial muscles [6,8].

The Myobrace System™ (Myofunctional Research Co., Australia) is a series of myofunctional appliances that have demonstrated the ability to improve oral function and harmonize the activity of the masticatory and facial muscles [9,10]. In general, these myofunctional appliances improve the posture of the tongue, release the force delivered by the buccinator muscles on the molars and premolars, release the force delivered by the buccinator and orbicularis oris muscles on the cuspids, improve lip seal, balance the force delivered by the orbicularis oris muscles on the facial aspect of the incisors, and, change the posture of the mandible [10-15]. Based on the literature supporting the use of the Myobrace System™ for harmonizing masticatory and facial muscle activity, it was postulated that these appliances could improve facial symmetry. Therefore, the purpose of this study was to evaluate the effect of the Myobrace System™ of appliances on facial symmetry.

## Materials and Methods

Patients in this study were being treated for either a Class I or Class II, division 1 malocclusion associated with a lack of transverse development, low positioning of the tongue, and unsealed lips at rest. Patients were treated with appliances from the Myobrace System™. It was recommended that appliances be worn for 1-2 hours prior to bedtime and overnight (10-12 hours), every night for 18-24 months. Parents and children signed an informed consent following the ethical standards of the University of Manitoba and in accordance with the Helsinki declaration signed in 1975, and revised in 2000.

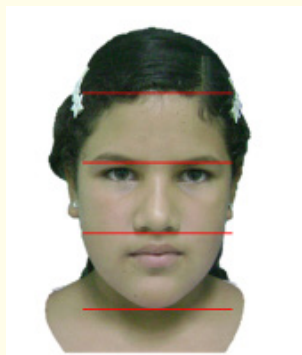
Frontal and profile photographs of each patient were taken before and after treatment with the Myobrace System™. Using these photographs, the horizontal facial index (HFI), the vertical facial index (VFI), and the labio-mental angle were determined, to measure facial symmetry.



**Figure 1:** A patient with horizontal facial symmetry (i.e., five equal horizontal facial divisions).

## Vertical facial index

In a vertical direction on the frontal photograph, the face was divided into three equal portions: upper, middle, and lower. The VFI was calculated as the height of the middle section divided by the height of the lower section. A VFI of one was considered ideal, implying vertical facial symmetry.



**Figure 2:** A patient with vertical facial symmetry (i.e., the vertical facial thirds are equal).

### Labio-mental angle

This study also evaluated the labio-mental angle of the study participants using the patient profile photographs. To measure this angle, a line was drawn from the most external point of the lower lip (indicating the vermillion border) to the deepest point of the groove above the chin (i.e., the labio-mental fold), and a second line was drawn from this point to the mental point on the soft tissue on the chin. Once marked on the photograph, the angle was measured with a protractor. A normal labio-mental angle is from 110-130 degrees.



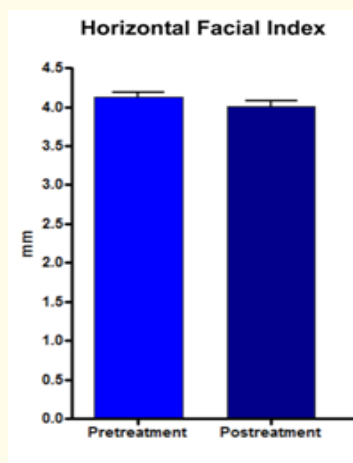
**Figure 3:** A profile view of a patient showing the labio-mental angle (highlighted in green) measured during the study. The normal range for this angle is 110 to 130 degrees.

### Statistical analysis

The mean and standard error of the mean for HFI, VFI, and labio-mental angle were calculated before and after treatment with the Myobrace™. A paired t-test statistical analysis was used to compare the population means before and after treatment to determine whether a significant change (significance level of 0.05) occurred in any of the measured variables. The statistical analysis was done using GraphPad Prism 4 software (GraphPad Software Inc., La Jolla, CA).

### Results

There were 25 patients in the study (14 girls and 11 boys), with a mean age of 9.4 years ( $\pm 3.6$  years). The mean HFI results before treatment with the Myobrace™ myofunctional appliance were not ideal ( $4.2 \text{ mm} \pm 0.86 \text{ mm}$ ), indicating there was some asymmetry in the faces of the study subjects. After treatment, the mean HFI value was  $4.0 \text{ mm} (\pm 0.42 \text{ mm})$ .

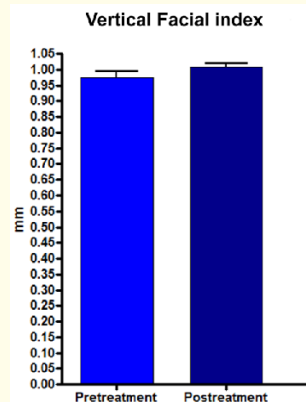


**Figure 4:** Results of the study showed that the horizontal facial index changed with treatment, decreasing to  $4.00 \text{ mm} (\pm 0.42 \text{ mm})$  after using the Myobrace System™. The error bars represent the standard error or the mean.

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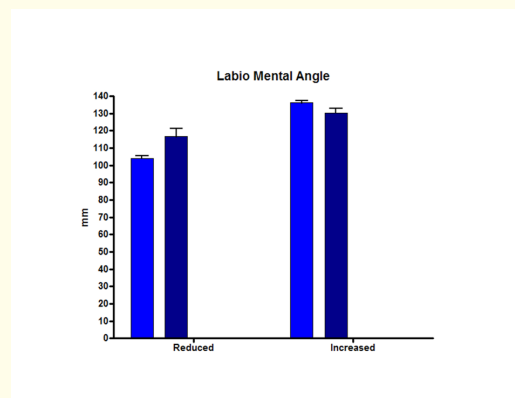
which was significantly different from the mean pre-treatment HFI value ( $p = 0.0417$ ). These results showed that the Myobrace™ myofunctional appliance equalized the five horizontal portions of the face, improving facial symmetry.

Similar to the HFI results before treatment, the mean VFI before treatment was not equal to the ideal value ( $0.96 \text{ mm} \pm 0.71 \text{ mm}$ ). After treatment with the Myobrace™ myofunctional appliance, the VFI was equal to  $1.00 \text{ mm} (\pm 0.23 \text{ mm})$ , which was significantly different from the VFI prior to treatment ( $p = 0.0195$ ).



**Figure 5:** Results of the study showed that the vertical facial index changed after treatment with the Myobrace System™, becoming  $1.00 \text{ mm} (\pm 0.23 \text{ mm})$ . The error bars represent the standard error of the mean.

Patients with a labio-mental angle greater than 130 degrees prior to treatment, showed a reduction in the angular value after treatment with the Myobrace™ appliance, bringing the labio-mental angle into the normal range (i.e., between 110 and 130 degrees). Patients with a labio-mental angle lower than 110 degrees before treatment showed an increase after treatment, reaching values within the normal range. The labio-mental angle was significantly different after treatment with the Myobrace™ appliance compared with this value before treatment ( $p = 0.0457$ ).



**Figure 6:** Results of the study showed that the labio-mental angle changed, becoming normal after treatment with the Myobrace System™. Patients with a labio-mental angle less than 110 degrees or greater than 130 degrees before treatment were normalized after treatment. The error bars represent the standard error of the mean.

## Discussion

Craniofacial symmetry occurs when the structures on opposite sides of the median sagittal plane have corresponding size, form, and arrangement [3]. Patients included in this study presented with some facial asymmetry, although not severe asymmetry. Nonetheless, treatment with appliances from the Myobrace System™ produced patients with more symmetrical faces as reflected in the ideal mean HFI and VFI scores after treatment. The effect of the appliance on the labio-mental angle also contributed to improve the symmetry of their faces [15].

Facial alteration and asymmetries may result from disturbances to the masticatory muscles as well as asymmetric functioning of the masticatory and facial muscles [7,8]. Changing the activity of the facial muscles by injecting them with botulinum toxin has been shown to correct facial asymmetries [16,17]. In patients with facial palsy, paralysis of the facial muscles occurs on the affected side of the face, leaving muscles on the unaffected side without opposing forces, producing asymmetry. Injections of botulinum toxin into the normal lower facial complex was effective in improving symmetry by balancing the palsied muscles against the action of the unopposed muscles [16].

The Myobrace System™ was designed to change and harmonize the activity of the masticatory and facial muscles that perform various oral functions, such as mastication and swallowing, as well as to encourage the patient to maintain nasal breathing and lip seal [10,14]. When the appliance is in the patient's mouth it stimulates a change of posture of the mandible and stimulates transverse development in a similar way to that described in the literature for Frankel's functional regulator [13,18-21]. By acting on the masticatory muscles, the Myobrace™ appliances can change the posture of the mandible in patients with a Class II, division 1 malocclusion by holding the mandible in a different position [13]. This effect is similar to that reported in the literature for rigid maxillofacial orthopedic appliances, such as the Bionator and Monoblock appliances [22,23]. In addition, by acting on the masticatory muscles, the Myobrace™ appliances stimulate transverse development of the dental arches [12].

Additional scientific studies have shown an effect of the Myobrace™ appliances on lip seal, by acting on the muscular activity of the temporalis, masseter, orbicularis oris, and mentalis muscles of patients with Class II, division 1 malocclusions [10,14,15,24]. In patients with disto-occlusion and deep bite, the results of these studies showed that the muscular activity of the masseter and temporalis muscles were reduced to normal levels at rest and during clenching [10]. More importantly, the activity of the mentalis muscles was significantly reduced, whereas the activity of the orbicularis oris muscles was significantly increased, both having an effect on lip seal [10,14]. Therefore, the Myobrace™ appliances stimulate a natural lip seal by reducing the activity of the mentalis muscles, which must be quiet when the mouth is closed, while improving lip seal through the action of the orbicularis oris muscles.

The children in the current study were treated with Myobrace™ appliances for Class I and Class II, division 1 malocclusions. By balancing the activity of the masticatory and facial muscles, the Myobrace™ appliances corrected malocclusions and, at the same time, improved facial symmetry.

## Conclusion

The modus operandi of the Myobrace™ appliances is to change and harmonize the activity of the masticatory and facial muscles, which improves the posture of the mandible in patients with Class II division 1 malocclusions and stimulates transverse development of the dental arches. In this study, children presenting with malocclusions and some facial asymmetries were treated with Myobrace™ appliances, which resulted in more symmetrical faces.

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