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# Functional and orthopedic treatment in developing dentofacial growth deviation in juvenile idiopathic arthritis

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**Dentofacial growth in juvenile idiopathic arthritis (JIA) patients with temporomandibular joint (TMJ) arthritis will lead to deviations related to the joints, mandible, maxilla, and dentoalveolar parts, resulting in abnormal jaw relations and morphology caused by the inflammatory interaction with the growth process. One treatment modality of the deviating growth and development has been the use of functional or orthopedic appliances, traditionally used for the correction of limited growth deviations in normal growing individuals within the broad sense of variation.**

**Although, the evidence for functional/orthopedic treatment in JIA is limited, existing publications and personal clinical experience suggests the use of functional/orthopedic appliances in the treatment of dentofacial growth deviations in JIA.**

**The aim of the present article is to give a summary of treatment with functional/orthopedic appliance from the current literature. (Semin Orthod 2015; 21:134–139.) © 2015 Elsevier Inc. All rights reserved.**

## Introduction

**T**he dentofacial development has a vast variation in normal growing individuals, and in the orthodontic profession focus has for decades been set on mandibular growth and development. Both genetic and environmental factors contribute to the facial morphology.<sup>1,2</sup> Deviations in mandibular growth pattern constitute a majority of malocclusions and dentofacial anomalies. Mandibular growth pattern has, according to Bjork and Skieller,<sup>3</sup> roughly been classified as anterior (counter clockwise) or posterior (clockwise), and the issue of difficult treatable cases caused by insufficient mandibular growth and development are well-known in the orthodontic field.<sup>4</sup> In case of an additionally growth disturbance caused by a congenital

disorder or by a general disease, such as juvenile idiopathic arthritis (JIA), the complexity of the growth pattern increases. In particular, the lack of vertical growth of the mandibular ramus leads to a posterior rotation pattern with a consequent effect on the sagittal and vertical relationships, which gives, in extreme cases, the typical facial appearance also known as “bird face.”<sup>5,6</sup>

Functional or orthopedic appliance is routinely used for treating mandibular insufficiency, together with orthodontic-induced dentoalveolar compensations although only few studies has demonstrated a skeletal effect in growing individuals with deviating growth and development.<sup>7</sup> Despite the lack of evidence in abnormal growing individuals functional/orthopedic appliance has been suggested to address the growth deviation based on experience with insufficient or deviating growth of the mandible in children with JIA.<sup>8</sup> Since no data is available concerning the tissue reaction of condylar tissue to mechanical loading in JIA, one could speculate whether the effect of functional appliance is to support dentoalveolar development during a difficult growth pattern where development of the occlusion and the mandible is mutually uncoordinated.

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## Definition of functional–orthopedic appliances

Functional appliance has been described for a century in the orthodontic literature.<sup>9</sup> The term “functional” aims to describe a possible approach to influence the soft tissue function and mandibular functional position in order to support normal growth and development. Furthermore, a stimulating, enhancing, modifying, or supporting effect of the appliance in relation to the amount of mandibular growth as well as a change in growth pattern have been anticipated. Since this implies an orthopedic effect, the name functional–orthopedic appliance (FOA)<sup>10</sup> is a more appropriate description of such devices.

A FOA (Fig. 1) can be described as a removable appliance tooth- or soft-tissue borne, preventing a negative influence of soft tissue on mandibular growth, stretching muscles, training a favorable mandibular position and introducing mechanical environmental forces to possibly influence bone formation. Furthermore, a FOA allows for the control of tooth eruption and thereby of the vertical development of the dentoalveolar process. The following text is focusing on the possible treatment of mandibular insufficient growth and development in JIA patients, considering also the benefit on mandibular function.

## Functional–orthopedic treatment, the effect and level of evidence

The efficacy of treatment with FOA appliances to enhance mandibular growth has been discussed extensively. Only a few randomized clinical trials have been conducted to demonstrate correction in skeletal deviations. Tulloch et al.<sup>11</sup> found favorable change of mandibular length as a result of functional appliance, although the differences were small and barely clinically

relevant regarding the skeletal changes. They also emphasized the large variation in growth in both treatment and control groups.<sup>12</sup> Even though small skeletal changes are found, the treatment success of FOA is most likely due to dentoalveolar compensations.<sup>7,13</sup> However, the growth pattern in JIA patients is more complicated and difficult compared to the treatment groups in the above-mentioned studies. The pattern is not only characterized by a decrease in mandibular length, but also by a decreased ratio between the posterior and the anterior face height, due to a failure in the vertical growth of the condyles.<sup>14</sup> This will result in a posterior (clockwise) mandibular rotation and open bite. The favorable effect of FOA in JIA cases is therefore, besides advancing the mandible, an anterior (counter clockwise) rotation with a possible increase of the posterior face height, if possible. The efficacy of the FOA in the correction of open bite has been demonstrated by Ibitayo et al.,<sup>15</sup> although a review only found weak evidence for the effect of FOA.<sup>16</sup>

## Functional–orthopedic appliances and possible effect on skeletal deviation and malocclusion developing in JIA

Different types of appliances have been suggested in early treatment of skeletal deviations of JIA patients and FOA treatment is recommended although evidence of effect and efficacy are sparse.<sup>8–13,15–17</sup> Kjellberg et al.<sup>18</sup> treated a group of JIA patients with a Bow activator. This particular FOA was a modified twin-block (Fig. 2) where the two parts were connected with an elastic wire allowing the mandible lateral movements. The activator positioned the mandible mainly forward in order to correct the sagittal insufficiency. Vertically, the activator was in contact with the teeth in cases of open bite passively to prevent eruption of the teeth



**Figure 1.** A simple FOA appliance, an Ergenzinger activator, used for correction of a retrognathic mandible.

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