

# Evaluation of Temporomandibular Disorders in Children Using Limited Cone-beam Computed Tomography: a case report

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*Considerable advances have been made in dental and orthodontic diagnosis resulting from the development of a device known as a limited cone beam dental compact-CT (3DX). This report documents the diagnostic procedures and treatment performed on an eight year old female patient who presented with clinical signs and symptoms of a temporomandibular disorder (TMD). Evaluation of a bony abnormality of the temporomandibular joint (TMJ) using the limited cone-beam CT (3DX) proved to be of considerable value. A three-dimensional image of the right TMJ showed erosion and flattening of the condyle. Following treatment, there was marked alleviation of the clinical symptoms while considerable improvement of the bony abnormalities was clearly evident on a three-dimensional image.*

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## INTRODUCTION

Various studies have reported a relationship between temporomandibular disorders (TMD) in children and facial dysmorphology such as retrognathia and mandibular asymmetry.<sup>1-4</sup> The general consensus is that more accurate evaluation of TMD is necessary in children than adults. Unfortunately, no consistently reliable method has yet been established for the morphological observation of the bony components of temporomandibular joint (TMJ) in children.<sup>5-7</sup>

A relatively new limited cone beam dental compact-CT (3DX) (Morita Co., Japan) has been used for clinical diagnosis by the Maxillofacial and Orthodontic specialties. It has been reported that images obtained using this apparatus are clearer than conventional dental radiographs and CT images.<sup>8-11</sup>

This report, documents an evaluation of a bony abnormality of TMD in a pediatric patient using 3DX images.

## CASE REPORT

An eight year, eight months old female patient presented to the Department of Pediatric Dentistry, Nihon University School of Dentistry Dental Hospital with a chief complaint of pain in the TMJ region. Additional symptoms included clicking during eating and limitation of mouth opening. Clinical symptoms had initially

appeared at the age of 7 years with reported inability to yawn widely. No history of traumatic injury was reported. Reported oral habits included bruxism, tooth clenching, resting her cheek on her hand, and nail-biting. Lateral and frontal cephalograms revealed no evidence of facial developmental disorders. Maximal mouth opening was 32.5 mm. When requested to “open wide”, the patient experienced pain and clicks. Tenderness was evident in the TMJ region, masseter muscles and temporal muscles. Panoramic radiography revealed no apparent abnormalities (Figure 1). 3DX images revealed severe erosion and flattening of the condyle of the right TMJ. No abnormalities were observed in the left TMJ and condyle was seen to be convex (Figure 2). Based on these findings, a diagnosis was made of Osteophyte formation with limitation of mouth opening.”

Treatment consisted of a fixed stabilization-type splint,<sup>12,13</sup> accompanied by guidance regarding the oral habits. Three months after the initiation of treatment, 3DX images showed definite improvement in the erosion and flattening of the right condyle. No abnormalities were observed in the left TMJ (Figure 3).

The temporomandibular pain and clicking resolved approximately one year after initiation of treatment with maximal mouth opening increasing to 46.6 mm. An additional benefit was disappearance



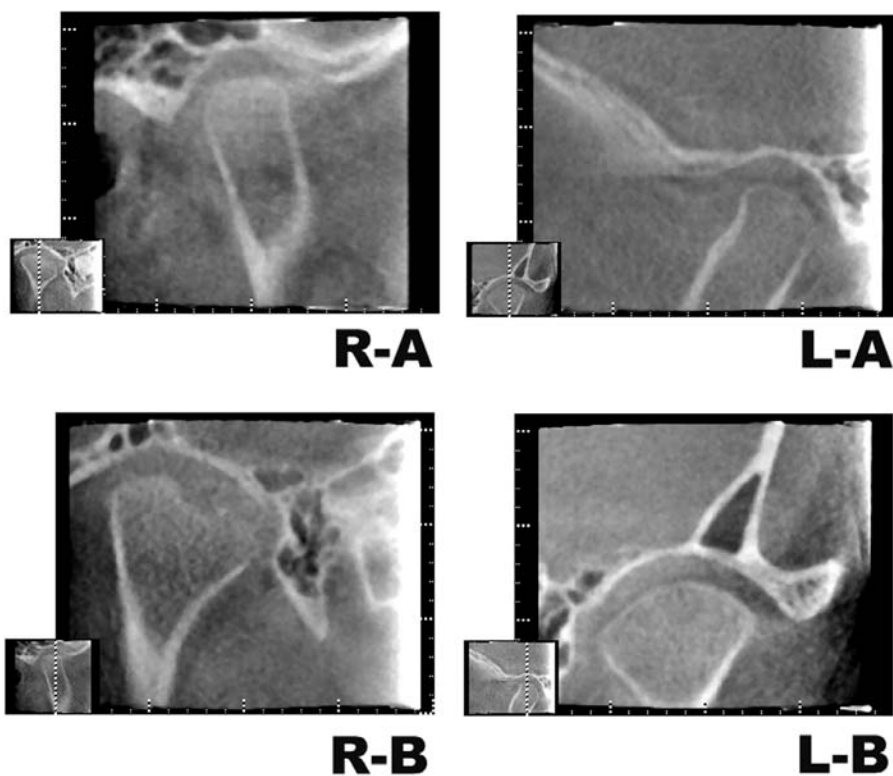
**Figure 1:** Panoramic radiograph before treatment. Both temporomandibular joints interpreted as normal.

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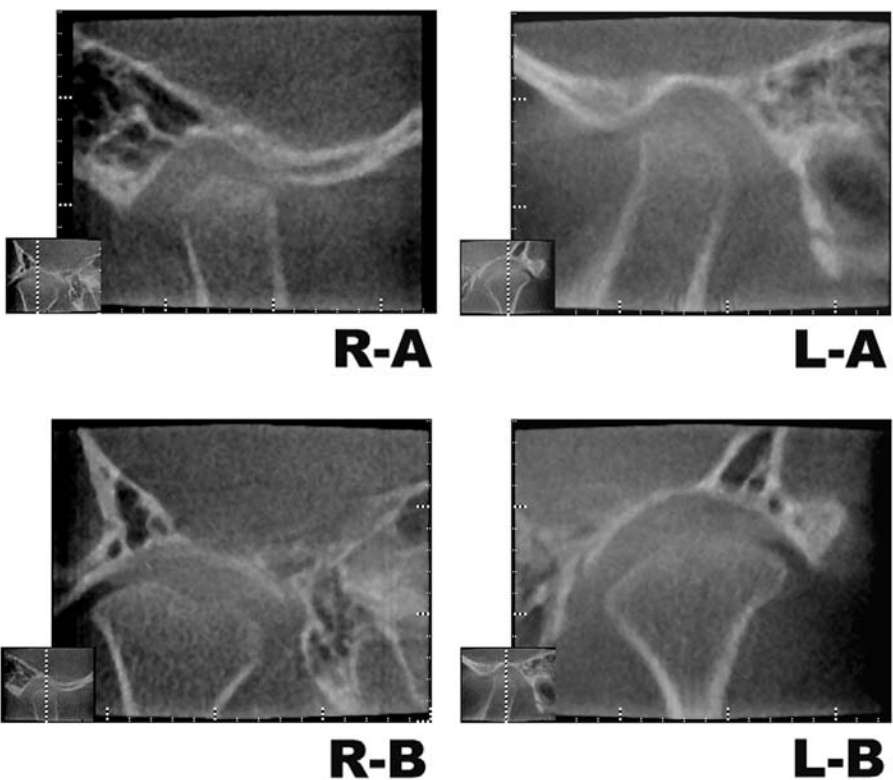
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**Figure 2:** 3DX images before treatment (R-A: right sagittal, R-B: right frontal, L-A: left sagittal, L-B: left frontal) In these images, severe erosion and flattening were observed in the condyle of the right TMJ. In the case of the left TMJ, no abnormalities were observed, and the outline of the condyle was convex.



**Figure 3:** 3DX images taken 3 months post-initiation of treatment (R-A: right sagittal, R-B: right frontal, L-A: left sagittal, L-B: left frontal) Although erosion and flattening of the right condyle are still present, there is a definite lessening of the erosion. No abnormalities are evident in the left TMJ

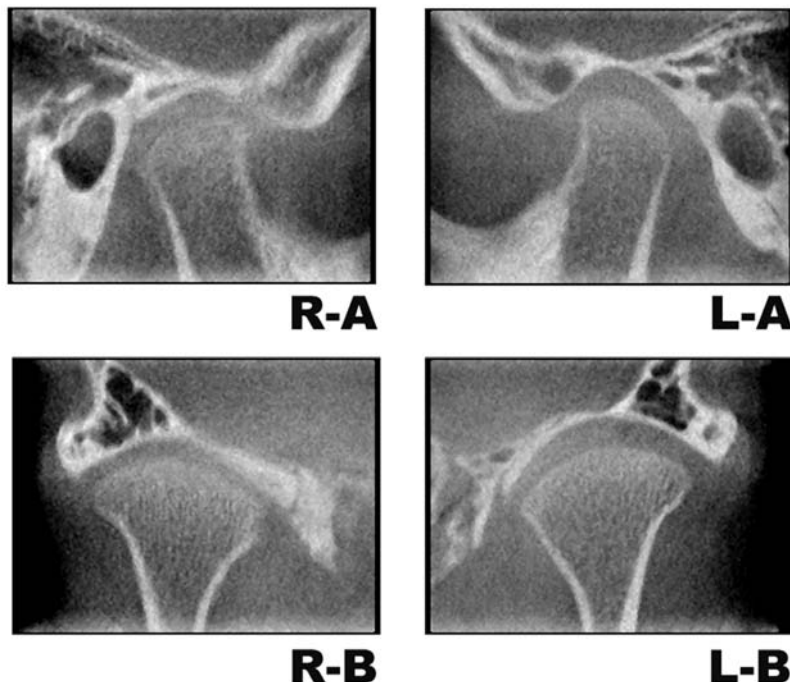
of the jaw deviation that occurred during mouth opening and closure. 3DX images revealed minor erosion of the surface of the right condyle which was now convex in outline. No abnormalities were observed in the left TMJ (Figure 4).

**DISCUSSION**

Tomography, CT and panoramic radiography are generally used for morphological observation of the bony components of the TMJ. However, no single technique currently provides accurate imaging of the complex anatomy of the TMJ.<sup>5-7</sup> In the current case, panoramic radiography failed to reveal the bony abnormalities whereas erosion of the right condyle was clearly visible on the 3DX images. We diagnosed the patient as having osteophyte formation.

The 3DX apparatus developed in 2000, uses a small conical beam to produce a computer generated reconstruction of three-directional images.<sup>8-11</sup> The resolution of images obtained using this apparatus was about 2-fold higher than that of a medical helical CT image.<sup>10</sup> It has been reported that 3DX images are of higher diagnostic quality than conventional TMJ imaging.<sup>10,11</sup> Furthermore, 3DX is based on low-exposure conditions, with imaging time of 17 seconds and effective dose of 23.0 uSv at a single 360° scanning (85 kVp, 5 mA).<sup>8-11</sup> These numbers are considerably lower compared with conventional CT.<sup>10</sup> As a consequence, 3DX is considered very useful for the morphological observation of the hard tissues of the TMJ in children. In this particular case, bony abnormalities of the condyle were detected by 3DX before treatment, with improvement of these abnormalities clearly visible on 3DX following improvement of the clinical symptoms. While a number of studies have described the effects of using cone beam CT on TMD,<sup>7-11</sup> none have previously reported the improvements of bony abnormalities on the images.

Since the patient had severe erosion of the right condyle, as observed by 3DX, together with pain in the TMJ region, a fixed stabilization-type splint was fabricated to stabilize the occlusion and reduce stress on the TMJ.<sup>12,13</sup> In addition, we provided guidance for daily life in which the patient avoided stress on the TMJ. Improvement in the bony abnormalities was observed on the 3DX images 3 months after initiation of treatment. Thus we were able to confirm, in



**Figure 4:** 3DX images post-treatment (R-A: right sagittal, R-B: right frontal, L-A: left sagittal, L-B: left frontal) The surface of the right condyle, is now convex. No anatomical defects are evident in the left TMJ.

the early stage of treatment, the effectiveness of the course of treatment.

Since it was possible to evaluate the disorder, not only by assessing the clinical symptoms but also by examination of the bony components of the TMJ utilizing 3DX imaging, appropriate treatment could readily be performed.

In conclusion, this case report demonstrates the usefulness of evaluation of the bony components of the TMJ by 3DX in treating TMD in children.

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