Treatment of a class 2 skeletal malocclusion with degenerative arthritis of the condyles using custom-made temporomandibular joint replacements and genioplasty

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INTRODUCTION

Juvenile Idiopathic Arthritis (JIA) is a chronic autoimmune, non-infective, inflammatory disease affecting up to 4 in 1000 children and adolescents (Ramanan and Grom, 2005). It is one of many types of arthritis including psoriatic arthritis and ankylosing spondylitis and the common forms of adult arthritis (osteoarthritis and rheumatoid arthritis). The majority of JIA cases are rheumatoid factor negative whilst pain and restriction of movement are not always reported by patients, particulary when affecting the TMJs. JIA can affect any of the joints in the spine, sacroiliac joints, shoulder, hip and temperomandibular joint (TMJ) along with the arms, legs, hands and feet. JIA can affect a few joint (oligoarticular JIA), several joints (polyarticular JIA) of be generalised (known as systemic JIA). The symptoms of systemic JIA are non-specific, and include lethargy, reduced appetite and lower levels of physical activity where joints in the long bones are affected (Hoffart and Sherry, 2010). These symptoms are rarely present in the oligoarticular and polyarticular forms where swelling and erosion of the joint cartilages can be difficult to detect, and as a result, imaging is essential for accurate diagnosis. JIA should be suspected in children and adolescents presenting with condylar degeneration. Referral to a Rheumatologist for further investigation, accurate diagnosis and a coordinated approach to managing the condition is essentail particularly where there are multiple joints involved. Some children with JIA will develop other more serious problems such as uveitis sacroiliitis and spondyloarthropathy and may require input from other specialties.

HISTORY

A 14 year old girl was referred to the Orthodontic Department at [redacted] by a Speech and Language Therapist due to difficulty in pronunciation of sibilant sounds thought to be related to the malocclusion. Clinical examination revealed a crowded Class 2 division 1 malocclusion and a retrognathic mandible. Radiographs revealed bilateral absence of the mandibular condyles. There was no history of facial trauma and following further imaging and rheumatological investigations, the provisional diagnosis of Juvenile Idiopathic Arthritis was confirmed.

ASSESSMENT

The patient's main complaint was the appearance of her teeth and lack of chin point, as well as an inability to bite her front teeth together. (Figure 3)

Extra-oral examination revealed marked mandibular retrognathia, a reduced lower face height and a micrognathic chin. Intra-orally an anterior open bite was noted with buccal crowding of both permanent maxillary and the permanent mandibular right canines.

The patient had mouth opening of 37mm with no clicks or crepitus or any deviation of the mandible on opening. No other joint symptoms were reported , but as treatment progressed, bilateral arthralgia was controlled by non-steroidal anti-inflammatory medication.

A dental panoramic tomogram and lateral cephalometric radiograph revealed the absence of both mandibular condyles, an increased gonial angle, an exaggerated antegonial notch, steep mandibular plane angle with reduced posterior facial height. (Figures 1,2) Although magnetic resonance imaging can be useful for assessing the TMJ, the extent of condylar destruction required assessment with cone-beam computed tomography (CBCT). These were suggestive of a provisional diagnosis of JIA (Mandall et al. 2010).

The radiographic features were in keeping with a degenerative arthropathy and the patient was referred to a Rheumatologist for further investigation. Whilst she was seronegative for all rheumatoid markers, the diagnosis of oligarticular JIA was confirmed and was fortunately limited to the temporomandibular joints. There were no ocular or systemic symptoms or signs of significance.

TREATMENT

After full consideration of the risks and benefits of camouflaging orthodontic treatment, a camouflaging genioplasty, conventional orthodontics-orthognathic surgery or TMJ replacement surgery with a simultaneous mandibular advancement, the patient elected for the latter due to the extent of condylar destruction.

The maxillary right permanent canine and the first premolars in the other quadrants were extracted in order to create space for arch alignment and decompensation of the arches using a standard 0.022x0.028 inch-slot pre-adjusted edgewise fixed appliance system with an MBT prescription (3M-Unitek, Monrovia, California).

Treatment was sequenced so that surgery took place at age 18. Accurate placement of the custom joints was aided by the use of an intermaxillary surgical wafer (Biomet, Jacksonville, USA) (Figure 4). The TMJ implants were composed of two parts, a fossa component made of Arcom® Ultra High Molecular Weight Polyethylene (UHMWPE) and a Cobalt Chromium alloy condylar component. The fossa implant was placed via an extended preauricular incision and the condylar implant was placed via a submandibular incision. Simultaneously, a bilateral sagittal split osteotomy with the Dal Pont-Hunsuck-Epker modifications (Monson, 2013) was undertaken to advance the mandible. Post-surgically, the occlusion was refined and standard orthodontic retainers were provided for long-term wear. To improve chin

projection further a genioplasty was subsequently performed, advancing the chin point by 6mm. (Figure 5)

There were no post operative complications and on review at 3 years post-surgery, the occlusion remained stable, with the patient being pleased with the improvement in dentofacial aesthetics and resolution of the arthralgia. Whilst mouth opening was reduced at 32mm compared to the pre-operative measurement, she maintained good function and is able to enjoy a normal diet and lifestyle. (Figure 6) There was no facial nerve damage and Orthodontic retention is ongoing.

DISCUSSION

The most appropriate treatment option for dentofacial deformity resulting from condylar destruction in JIA is determined clinically (Von Bremen et al, 2011). The indications, sequencing, complications and stability of each treatment option should be discussed with the patient in order to gain informed consent. These include orthodontic camouflage, surgical camouflage with a genioplasty, and conventional orthodontics-orthognathic surgery. TMJ replacement surgery (and a simultaneous mandibular advancement) was undertaken for this patient due to the extent of the condylar destruction, even though she was seronegative for rheumatoid markers. This is in line with the NICE guidance (NICE, 2014).

It was anticipated that this approach would be more stable as a conventional orthodontic-orthognathic surgery approach would not only be associated with occlusal relapse but an increased risk of further condylar destruction leading to greater surgical relapse. Autografts, such as costochondral tissue, have the added risks of complication at the donor site, resorption of the graft itself and, unpredictable growth in growing patients (Svensson B et al, 1998). TMJ implants overcome these problems and are constructed from well tolerated,

biocompatible materials such as titanium or cobalt chromium. We therefore selected custom prostheses which have been shown to have good long-term success rates of up to 10 years post-surgery in a recent study (Leandro et al 2013). The risk of a prosthetic TMJ, particularly in a young patient is the possibility of fatigue requiring re-replacement, with the consequence of facial nerve damage.

The other disadvantage of prosthetic TMJs is that the ginglymoarthrodial (sliding and a hinging) action of the TMJ cannot be replicated in a prosthetic joint. The prosthesis selected for this patient was a spheroidal joint, which does not permit lateral movement of the mandible. Nevertheless, the patient reported improved masticatory function, which resulted in part due to establishment of a Class I occlusion. In doing so, the vertical ramus height required to be lengthened, which is associated with post-operative instability due to an anticlockwise rotation of the mandible and lengthening of the pterygomasseteric sling (Profitt and Bell, 1980). Increasing the vertical ramus height was required to restore the mandibular morphology and in doing so, the steep mandibular plane angle was reduced leading to normal vertical facial relationships and an overall improvement in dentofacial aesthetics in conjunction with a genioplasty. The pre-surgical and post-surgical orthodontic treatment involved standard orthognathic biomechanics along with a standard retention protocol. .

This case presents a method of simultaneously undertaking TMJ replacement surgery and orthognathic surgery with adjunctive orthodontic treatment for a patient with degenerative arthropathy arising from Juvenile Idiopathic Arthritis. It highlights the importance of onward referral to a Rheumatologist for a full JIA assessment before starting any treatment due to the variable presentation of the condition.

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