

ESTROGEN AND IDIOPATHIC CONDYLAR RESORPTION IN ORTHODONTICS-A REVIEW

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ABSTRACT

Idiopathic condylar resorption (ICR) is a condition with no specific cause. Condylar resorption occurs more frequently in women because of the pathogenesis of sex hormones. Cone-beam computed tomography and magnetic resonance imaging are vital imaging methods for diagnosis of Idiopathic condylar resorption. The symptoms of ICR overlap with osteoarthritis, inflammatory arthritis, physiologic resorption/remodeling, congenital disorders affecting the mandible. Thus a thorough medical and physical history is essential in understanding the pathogenesis of idiopathic condylar resorption. Idiopathic condylar resorption can be active or passive.. This review provides an early glimpse of low estrogen and idiopathic condylar resorption.

INTRODUCTION

Condylar resorption is characterized by loss of condylar mass and volume. It leads to malocclusion, TMJ dysfunction and pain. The reason contributes mainly to the estrogen receptors in the synovial membrane, articular disc and mandibular condyle of females. Estrogen deficiency can occur in bone loss in vertebra resulting in postmenopausal osteoporosis. A strong incidence between condylar resorption and the cytokines TNF- α , IL-6 and receptor activator nuclear kappa-beta ligand factor (RANKL), its severity in accordance with its concentration 1. Osteoprotegerin (OPG) is an inhibitor of RANKL and is more in areas of repair and homeostasis 2. TNF- α , IL-6 and RANKL aid in the osteoclast formation and other cell groups to produce matrix metalloproteinases (MMPs) which degrade extracellular matrix molecules such as collagen and elastin 3 followed by formation of osteoclast activating cytokines. It has been shown that 17 β - estradiol hampers TNF- α release, thus leading to condylar resorption 4. Pre-existing Class II occlusion,

thumb-sucking/pacifier use habit, or tongue thrust can contribute to Idiopathic condylar resorption.

Authors have found ICR to be more common in females (9:1 female predominance compared to male), in the age group of 10–40 and is more common in patients with Class II skeletal and occlusal relationships. 4,5

INCIDENCE AND ETIOLOGY

This condition does not have an etiology, thus the term “idiopathic condylar resorption.” In some cases, it could occur spontaneously. Others occurs during orthodontic therapy or as sequelae of orthognathic surgical procedures.

NATURAL HISTORY

ICR increases at a rate of 1.5 mm/year 6. The clinical presentation of ICR varies case-by-case. However, it has been hypothesized that it does not progress

beyond the condylar neck⁷

EPIDEMIOLOGY

Studies published between 1990 and 1998 reveal the incidence of ICR following orthognathic surgery ranged from 5.8% to 20%.^{8,9} Studies reveal condylectomies and costochondral grafts for

Idiopathic Condylar Resorption¹⁰. Studies reveal that 71% of their 21 ICR patients correlated the initiation of Idiopathic Condylar Resorption with active orthodontics, a significant amount of this slowly progressive condylar resorption should occur before the patient notices a clinical change¹¹.

THEORIES

The first theory was put forward by Wolford which states sex hormones cause hyperplasia of the synovial tissue, stimulating the production of destructive substrates, leading to instability in the TMJ. Arnett hypothesized that condylar resorption is caused by dysfunctional condylar remodelling. There is inhibition of fibrocartilage synthesis and extracellular matrix degradation with a net loss of tissue¹²

MECHANISMS

Studies differentiated the effect of estrogen on inflammation of the TMJ. Results showed estrogen prevents bone resorption by upregulating osteoprotegerin (OPG) production in the OPG–RANKL pathway and increases inflammation in women. Studies revealed in the early follicular phase, ER β was expressed at lower levels in patients with TMD¹³.

MECHANISMS

Idiopathic condylar resorption occurs between 17-40 years. These patients have a common facial morphology including:

- (1) high occlusal and mandibular plane angles
- (2) progressively retruding mandible
- (3) Class II occlusion (4) open bite.

In cases of unilateral Idiopathic condylar resorption, a decreased posterior facial height and skeletal Class II. Occlusion and wear on the posterior teeth

ipsilateral to the ICR. The ipsilateral posterior teeth results in crossbite. The contralateral posterior teeth may become nonoccluding.¹⁴

Bilateral Idiopathic condylar resorption results in an anterior open bite. The loss of occlusal wear estimates the onset of ICR. Mamelons indicate the early eruption of the permanent incisors. Decreased vertical ramus height and posterior facial height, mandibular plane angle is high, dental and skeletal Class II and anterior open bite. The overjet is increased with angulated lower incisors. Backward rotation of the mandible may result in decreased oropharyngeal airway space¹⁵.

STUDIES CORRELATING ESTROGEN AND IDIOPATHIC CONDYLAR RESORPTION:

Studies reveal estrogen receptors are more expressed in females, independent of the effect of oestrogen deficiency on the condyles. Studies reveal the differences in estrogen receptor expression could be related to age and the stage of mandibular growth. Studies reveal low circulating 17 β estradiol makes it impossible for the natural reparative capacity of the condyle to take place in the face of local inflammatory factors²⁵. A prospective cohort study done in 16 females with idiopathic condylar resorption reveal lower serum levels of 17 β estradiol in patients with preoperative Idiopathic Condylar Resorption¹⁶ Studies reveal the temporomandibular joint pain was highest in the menstrual and secretory phases; positional changes of the disc and the menstrual cycle may play a role in the degree of joint pain and inflammatory pathology of the posterior disc attachment.¹⁷

Studies reveal the presence of estrogen receptors in the TMJ discs of both symptomatic and asymptomatic men and women. Studies also reveal lack of estrogen receptors in TMJ discs¹⁸.

STUDIES NOT CORRELATING ESTROGEN AND IDIOPATHIC CONDYLAR RESORPTION

Studies showed no association between oral contraceptive use and the development of aggressive condylar resorption after orthognathic surgery in patients with TMJ Osteoarthritis. Studies done

by Nogami showed no association between oral contraceptive use and the development of aggressive condylar resorption after orthognathic surgery. Studies done by Kim showed no association between estrogen receptor polymorphism and idiopathic condylar resorption.¹⁹

DIAGNOSIS

Diagnosis of Idiopathic Condylar Resorption is made through imaging. Imaging would differentiate thumb-sucking habit, tongue thrust habit, osteoarthritis (OA), inflammatory arthritis, physiologic condylar resorption, and Idiopathic Condylar Resorption . Studies describe synovial hyperplasia of the condylar head is detected on the MRI. MRI is the most conclusive imaging method for diagnosing ICR.

Technetium-methylene diphosphonate (99m TC-MDP) is useful to identify ICR is either active or passive. The major disadvantage with 99m TC- is the amount of radiation involved, which is approximately 4–6 mSv. CBCT and MRI, allow assessment of all surfaces of the condyle, all locations of resorption are identified and quantified. CBCT measures condylar head volume, which is efficient method for recognizing and quantifying condylar resorption.

CBCTs and MRI are mandatory in diagnosing ICR. A loss of volume means Idiopathic Condylar Resorption was active between the capture dates. Close monitoring between six months to 1 year is needed for evaluation.

The role of Panoramic radiographs is questionable in monitoring ICR. Only gross changes in the loss of condylar mass is detected. While clinical measurements may be used to monitor the progression of ICR between serial images, they are not adequate alone. Occlusal wear on the fulcrum teeth will compensate for the resorption of the condyles, lessening the amount of resultant overbite. Therefore, imaging is needed to measure actual condylar volume loss²⁰.

TREATMENT

Once Idiopathic Condylar Resorption is diagnosed, splint is essential to prevent progression of condylar degeneration, to relieve discomfort and muscle

hyperactivity. Occlusal treatment must be delayed till there are no signs of active condylar resorption. Orthognathic surgery helps to manage Idiopathic Condylar Resorption. Inactive condylar resorption can progress to active condylar resorption by inducing stress placed on TMJ by combined BSSO and Le Fort I osteotomy resulting from the stresses placed on the physiologically and pathologically compromised TMJ condyle. Long-term studies reveal resorption can proceed or be triggered if done preoperatively. Studies done by Posnick and Fantuzzo²¹ stated that orthognathic surgery, orthodontics, and/or restorative dentistry corrects condylar resorption is successful if the resorption is stable for 1 year and if an intact cartilaginous cap is evident covering the resorbed condyle. Teenagers should be advised to postpone definitive orthognathic surgery. In females, in cases of active idiopathic condylar resorption, replacement of the joint with an autologous costochondral graft or total alloplastic TMJ prosthesis would provide adequate postoperative stability. Studies reveal they found that at the longest time point (average, 36 months), all patients were without TMJ pain, had a normal opening range, and had clinically stable occlusion². Studies reported a treatment protocol for when the discs are still salvageable and would be stable for 4 years. The protocol includes 1) removing the bilaminar tissue pathology surrounding the condyle; 2) to the condyle with a Mitek anchor 3) performing maxillary and mandibular orthognathic surgery with counterclockwise rotation of the maxillomandibular complex; 4) performing other adjunctive procedures such as turbinectomy and genioplasty as indicated. Costochondral grafts are theoretically advantageous in reconstructing the TMJ for growing patients, but they have been reported to have multiple shortcomings. A secondary surgical site, with morbidity, chest wall deformity, scoliosis and 54% of patients showed the risk of unpredictable growth. Distraction Osteogenesis, rather than TMJ reconstruction techniques, to surgically reposition the mandible in Idiopathic Condylar Resorption to achieve a more stable long-term result²²

CONFLICT OF INTEREST

The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper.

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