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Condylar Hyperplasia: Classifications over the years

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Condylar Hyperplasia: Classifications over the years

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Abstract

Background: Condylar Hyperplasia (CH) is a pathological condition characterized by progressive overgrowth involving the condylar head or neck, mandibular body, ramus, or a combination of these. Several classifications were proposed over the years. Aim of this review is to illustrate proposed classifications, underlining specific features of each one. Methods: A systematic review on principal medical databases was performed. Results: Both histological and clinical classifications were proposed over the years. Obwegeser and Makek described two clinical entities on the basis of the direction (vertical or horizontal) of growth. Silvestri and colleagues proposed a classification on the basis of growth direction and involvement of only condyle or also mandibular ramus and body, identifying condylar hyperplasia, hemimandibular elongation and hemimandibular hyperplasia. Wolford and colleagues proposed a classification based on the frequency of occurrence, the type of jaw deformity created and the surgical treatment needed. Conclusions: Over the years, several classifications were proposed in order to better understand, diagnose and treat condylar hyperplasia.

Introduction

Condylar Hyperplasia (CH) is a pathological, self-limiting, condition characterized by progressive overgrowth involving the condylar head or neck, mandibular body, ramus, or a combination of these.[1] This condition commonly leads to significant functional and aesthetic jaw and facial deformities.

It was first described by Robert Adams in 1836[2]; since then, there have been many reports referring to this clinical condition[3-5].

The overgrowth of the mandibular condyle causes facial asymmetry, occlusal alteration and joint dysfunction. Main characteristics are an enlarged mandibular condyle, elongated condylar neck, outward bowing, and downward growth of the body and ramus of the mandible on the affected side, causing fullness of the face on that side and flattening of the face on the contralateral side. Some patients also may present with symptoms from the temporomandibular joint (TMJ) such as pain, clicking and limitation of mouth opening.[6]

The structural displacement produces canting of the maxillary plane and, subsequently, canting of the occlusal plane due to dentoalveolar supraeruption on the affected side. The most common sequelae are ipsilateral Class III molar and canine relationships, midline deviation to the contralateral side, crossbite, and edge to- edge bite and negative torque of the lower crowns on the normal-growth side.[7]

Methods

Aim of this study was perform a systematic review in order to illustrate different classifications of condylar hyperplasia proposed over the years, describing their specific features. A secondary objective was to highlight etiology, epidemiology and diagnosis of this condition. The review was conducted using principal medical databases (Pubmed, Scopus, Google Scholar).

Used keywords were: â€œcondylar hyperplasiaâ€•, â€œclassificationâ€•, â€œunilateral condylar hyperplasiaâ€•. After a careful analysis, 28 articles were selected.

Results and discussion

Etiology

The etiology and pathogenesis of CH remain uncertain. The identification of sex hormone receptors in and around the TMJ and the pubertal onset of CH type 1 strongly suggest a hormonal influence in the etiology[1]. Other suggested theories include trauma followed by excessive proliferation in repair[8-9], infections[10], arthrosis, intrauterine factors[11], hypervascularity[12], a possible genetic role.[13-14] Another possible cause is an increase in functional loading of the TMJ.[15]

Epidemiology

Some studies reported that CH is more frequent in females than in males (reported female/male ratios of 25:11, 7:2, 3:1)[16-18], while some other authors have indicated that this condition is equally frequent in males and females[19-20] or more common in males.[21]

With regard to preferential laterality, some authors reported that the right side is more frequently affected than left side[17-18], while other authors found that CH is

more common in left side. [22] An equal side distribution is reported by some other authors. Villanueva-Alcojol and colleagues reported a right/left side ratio of 11:7.[18] Iannetti and colleagues reported a right/left ratio of 4:8.[22] Nitzan and colleagues found that the preferential laterality was highly gender dependent, with the right side predominating in female patients and the left side predominating in male patients.[17]Â The study of Villanueva-Alcojol and colleagues didnâ€™t confirm this hypothesis.[18]

The age at diagnosis of most patients is between 16 and 30 years, although cases of older patients are reported.[1,17-18]

Diagnosis

The diagnosis of CH can be performed by a combination of clinical and radiologic findings. Various methods have been used, including radiographic studies (orthopantograph, transpharyngeal and transcranial radiographs of the TMJ in the closed-mouth and open-mouth positions, cephalometric x-rays in anterior-posterior and lateral views), bone scintigraphy, and histopathologic assessment.

TMJ radiographs can detect abnormalities in the size and morphology of the condylar head and/or neck. Bone single photon emission computed tomography (SPECT) scan is a fundamental diagnostic tool for detecting hyperactivity in the condyle. Several studies showed the clinical utility of this technique in such patients because this technique identifies those with persistent unilateral condylar activity.[6,23]

The radioactive isotope can be technetium 99 methylene bisphosphonate or technetium-99m pyrophosphate. Increased radionuclide uptake by the hyperplastic condyle can be an indication of continued abnormal growth. It has been reported that a difference in uptake of 55%:45% or more between the condyles can be indicative of CH, because the affected condyles had a relative uptake of 55% or more.[24]

Classifications

Several classifications have been proposed over the years. Most classifications of CH are based on clinical features; Slootweg and MÃ¼ller proposed a histological classification, describing 4 histologically different types of mandibular CH and dividing hyperplastic condyles into 4 types (Table 1) depending on the arrangement and morphology of the various layers of the condyle (fibrous articular layer, undifferentiated mesenchyme proliferative layer, transitional layer, and hypertrophic cartilage layer).[25]

No significant association between age and histologic type or between bone SPECT and histologic type are described[18]. However, Villanueva-Alcojol and colleagues reported a significant association between histologic type and temporomandibular joint symptoms (patients with type II CH had clinical manifestations such as pain and joint sounds).

The first important clinical classification was proposed by Obwegeser and Makek in 1986.[26]

They classified the asymmetry associated with CH into 3 categories: hemimandibular elongation, with a horizontal growth vector (type 1); hemimandibular hyperplasia, with a vertical growth vector (type 2); and a combination of the 2 entities. They postulate also the existence of mixed forms.

Type 1 is associated with chin deviation toward the contralateral side and mandibular midline deviated to the unaffected side. On the other hand, type 2 is characterized by an ipsilateral open bite or compensatory vertical overdevelopment of the maxilla on the involved side with canting of the occlusal plane. Most commonly, the mandibular midline is straight and the chin is less deviated. The third type is a combination of the type 1 and type 2.

Silvestri and colleagues in 1997, presenting facial asymmetries from unilateral mandibular development, classified them into three types: condylar hyperplasia, hemimandibular elongation and hemimandibular hyperplasia.[27]

The condylar hyperplasia, most commonly unilateral, is characterized by an increase in the unilateral mandibular vertical size, due to the condylar overgrowth. The vertical overgrowth also determines the lowering of ipsilateral gonial angle. In addition to changes in vertical direction, there is also sagittal asymmetry with probable development of mandibular prognathism and deviation toward the contralateral side. Also soft tissues are deformed: the ipsilateral labial commissure is lowered with tilting of the lips.

Most evident abnormality from the occlusal point of view is the canting of the occlusal plane with ipsilateral open bite and Class III relationship and contralateral crossbite.

Integrated imaging with orthopantograph, cephalometry, SPECT and 3D CT is essential for a correct diagnosis.

The second clinical entity cited by Silvestri and colleagues is the hemimandibular hyperplasia that is described as always unilateral. Itâ€²s characterized by tridimensional enlargement of affected mandibular side with involvement of condyle, ramus and body.

Also in this malformation, as in condylar hyperplasia, there is a vertical overgrowth determining asymmetry on frontal plane with greater deformation of soft tissues and significant downward tilting of lips on affected side. An overgrowth is sagittal direction can coexist causing mandibular protrusion.

Analyzing the occlusion, we can find an ipsilateral openbite if there was a fast growth not allowing a compensatory growth of maxilla. Teeth of contralateral hemiarch present a lingual inclination while anterior teeth have an inclination toward affected side with a III class relationship. Itâ€™s essential a differential diagnosis between this primitive condition and a secondary condition due to muscular hypertrophy of masseter that involves the mandibular angle.

Also in this condition the integrated imaging is fundamental; orthopantograph shows elongation and thickening of mandibular ramus and neck, enlarged and sometimes deformed condyle. The vertical overgrowth is made even more evident by the increase in the distance from dental roots and mandibular canal that is lower than the contralateral.

The third clinical entity described by Silvestri and colleagues is the hemimandibular elongation in which there are evident transversal and sagittal alterations, more than vertical alterations.

This condition can be bilateral in a good percentage of cases.

Clinically, itâ€™s possible to see a prevalent mandibular horizontal displacement toward the healthy side and a wider gonial angle in the affected site.

From the occlusal point of view, there is a mandibular midline deviation toward the healthy side and an anterior contralateral crossbite and ipsilateral Class III relationship.

Differing from other types, in hemimandibular elongation there arenâ€™t canting of occlusal pain and homolateral openbite.

Both orthopantograph and anteroposterior cephalography show unilateral mandibular elongation and wider ipsilateral gonial angle. The integration of classical X-rays with SPECT is essential also in this condition.

Unlike the classification by Obwegeser and Makek that has two clinical types and the mixed type, this classification contemplates three different clinical entities (two with a prevalent vertical growth, one with a prevalent horizontal growth).

The most recent classification was made by Wolford and colleagues and is based on the frequency of occurrence, the type of jaw deformity created, and the surgical procedures necessary to get the best treatment outcomes.[1,28]

They divided CH in 6 entities: type 1A, type 1B, type 2A, type 2B, type 2, type 3, type 4.

CH type 1 is described as the most frequently occurring form and involves an accelerated growth rate of the â€œnormalâ€• growth mechanism of the mandibular condyle with relatively normal architecture of the condyle but elongation of the condylar head, neck, and mandibular body. This type, with a predominant horizontal growth vector, causes the mandible to grow forward of the maxilla, creating a Class III occlusal and skeletal relationship, although occasionally a vertical growth vector may occur. Type 1A is the bilateral form of CH with symmetric growth or asymmetric growth (one condyle growing faster than the opposite side). The less common unilateral form, type 1B, involves only one condyle, creating a progressively worsening facial asymmetry. CH type 1 causes mandibular prognathism. Wolford and colleagues indicate the CH type 1 as highly underdiagnosed by clinicians; failure to recognize this pathological entity can result in unfavorable functional and aesthetic treatment results following orthodontics and orthognathic surgery if the CH factors are ignored.

CH type 2 occurs unilaterally and involves enlargement of the condylar head; usually the condylar neck increases in thickness and the vertical height of the mandibular ramus and body increases on the ipsilateral side, often accompanied by a compensatory downward growth of the ipsilateral maxilla. CH type 2 can occur at any age and is not self-limiting. CH type 2 can be caused by an osteochondroma, osteoma, or other rare forms of condylar enlargement (i.e., benign or malignant tumors of the mandibular condyle, hemifacial hypertrophy, etc.). CH type 2A is characterized by vertical growth vector and no horizontal exophytic growth off condyle while CH type 2B presents with enlargement of condyle with exophytic growth off the head.

CH type 3 and CH type 4 are described as conditions with unilateral facial enlargement and are caused respectively by benign tumors and malign tumors.

Treatment

Surgical treatment is indicated for CH, with or without orthodontics. Many studies showed that the best surgical option is the high condilectomy of the affected condyle, with about 5 mm cut from the medial to the lateral pole, usually by preauricular incision to arrest the abnormal growth and provides highly predictable long-term outcomes.[1,17-18] Wolford and colleagues showed that high condilectomy with articular disc

repositioning and orthognathic surgery is better than orthognatic surgery only. Treatment with orthognatic surgery only is burdened by an high incidence of reinterventions.[1] Orthodontic treatment for leveling and alignment of teeth can be performed before or after the surgery. Because open bite commonly occurs after condylectomy, with greater opening on the displaced side due to the reduced vertical dimension, orthodontic treatment should be initiated as soon as possible to provide adequate occlusal stability and guide healing of the condyle in relation to the articular tissues.

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Histologic Classification	Characteristics
Type I Â	Broad proliferation zone Underlying thick layer of hyaline growth cartilage Bone containing numerous cartilage islands Â
Type II Â	Patchy distribution (cell-rich areas alternating with nonproliferative, cell-poor zones) Cartilage islands in cancellous bone are less frequent than in type I
Type III	Great distortion Irregularly shaped masses of hyaline cartilage extending into cancellous bone of condylar neck or encroaching upward onto superficial articular layer Â
Type IV	Continuous subchondral bone plate covered by cell-poor fibrocartilaginous layer No proliferation layer of hyaline growth cartilage Burned-out appearance of condyle Â

Table 1. Histological classification of CH proposed by Slootweg and MÃ¼ller[25]

Conclusions

Unilateral condylar hyperplasia has unknown etiology and the epidemiology can differ between studies. Several classifications were proposed over the years, both histological and clinical. Obwegeser and Makek described two clinical entities on the basis of the direction (vertical or horizontal) of growth. Silvestri and colleagues proposed a classification on the basis of growth direction and involvement of only condyle or also mandibular ramus and body, identifying condylar hyperplasia, hemimandibular elongation and hemimandibular hyperplasia. Wolford and colleagues proposed a classification based on the frequency of occurrence, the type of jaw deformity created and the surgical treatment needed.

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