



Spect bone scintigraphy in the diagnosis of unilateral condylar hyperplasia: a systematic review

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Abstract

Unilateral condylar hyperplasia is an uncommon condition with unknown aetiology which causes overdevelopment of condyle leading to facial asymmetry, mandibular deviation, malocclusion, and articulation dysfunction. The comparison of radiographs and clinical photographs is considered the current accepted standard for the diagnosis of active condylar hyperplasia in patient with facial asymmetry. Single photon emission computed tomography (SPECT) has recently been proposed as an alternative method. SPECT can be interpreted using three reported methods: absolute difference in uptake, uptake ratio, and relative uptake. The sensitivity and specificity of the three methods range between 32.4% and 67.6% and 36.1% and 78.3%, respectively. With such low sensitivity and specificity values, it is not justifiable to use SPECT in place of serial growth assessment for the determination of condylar hyperplasia.

Introduction

Condylar hyperplasia is an unusual malformation of the mandible involving a change in the size and morphology of the condylar neck and head. Skeletal asymmetries of the mandible caused by condylar hyperactivity can pose serious functional, esthetic, and psychosocial problems for the patients. Unilateral hyperplasia of the mandibular condyle is generally characterized by a slowly developing, progressive enlargement of the condyle and elongation of the mandibular neck resulting in facial asymmetry and shifting of the midline of the chin to the unaffected side. The aesthetically and functionally unsatisfactory condition has an unknown aetiology, although possible causes including trauma, functional influence, developmental causes, and heredity or genetics factors. The condition may present in early childhood at 6-7 years of age, or at any time during the patient's adolescence growth period, and even after the cessation of skeletal bone growth. This makes the timing of treatment commencement crucial and possibly difficult to predict. Epidemiological data have suggested that there is a female predominance in

UCH (unilateral condylar hyperplasia), which theories suggest is related to oestrogenic influences. Based on the clinical and radiological findings, some authors proposed the division of condylar hyperplasia in three pathological subtypes. Hemimandibular elongation (type I), represents the major part of case. It is characterized by an increase in the length of the neck of the condyle and mandibular body shifting. Patients present with contralateral chin deviation, interincisal midline deviation and lateral crossbite on the healthy side. Hemimandibular hyperplasia (type II), the condyle grows in length and diameter. There is an increase in mandibular body height without laterodeviation. There is a typical "hack sign" in the mandibular symphysis to abruptly change the height of a horizontal branch to another. Condylar hyperplasia such as a combination of the two entities (type III). On the other hand, Sloohtweg and Muller (1986) classified hyperplastic condyles into 4 different types depending on the arrangement and morphology of the layers of the condyle. For the diagnosis of condylar hyperplasia, in addition to the medical history, it is essential to carry out a good physical examination with special emphasis on symptoms related to possible TMJ dysfunction. As complementary tests, an orthopantomography may be useful, to allow study of the condyle morphology and size. Other interesting tests are computed tomography (CT) or magnetic resonance imaging (MRI). Radioisotope test play an important role in the diagnosis of CH by providing information regarding the activity of the lesion, which will be crucial in deciding the type of treatment to perform. These tests are based on measuring the uptake of the radioisotope at the TMJ level to identify areas of increased osteoblastic activity. There are many references to be found in the literature that discuss the role of radioisotope diagnostic tests in CH, but few authors have investigated the possible relationship of these tests with osteoblastic or growth activity. Treatment of CH is primarily surgical, with or without orthodontic treatment. There are two different procedures, the indication for which depends on the level of activity that shows the affected condyle. During the active phase, a subtotal condylectomy for excess growth stop is mandatory. Once growth has finished, or in the inactive phase, there is a need to correct facial asymmetry or residual malocclusion by means of orthognathic surgery procedures; mainly

maxillary and mandibular osteotomies. For all this, one needs to know exactly in which situation is growing activity at the condylar level and especially whether this has ceased.

Methods

The authors searched PubMed, Web of Science, Embase, Scopus, Medline computerized literature database, supplemented by manual searching of reference lists from each relevant paper identified. The selected articles were evaluated according to the following criteria: patients with mandibular asymmetry caused by condylar hyperplasia, who underwent SPECT bone scintigraphy for pre-treatment assessment. The main search terms were - condylar hyperplasia - SPECT bone scintigraphy - serial radiograph tracing - sensitivity - specificity - TMJ - facial asymmetry - condylectomy - orthognathic surgery -.

Review

The treatment of patients with condylar hyperplasia is determined by the progression of the individual's condylar growth. There are advantages and disadvantages to both commencing treatment earlier and adopting a watch-and-wait approach in the management of such patients. The condition tends to present during the patient's adolescence period and may continue even after the cessation of skeletal bone growth. This gradual dentofacial asymmetry and its attendant dental malocclusion will not doubt result in some negative impact on the patient's self image and confidence. A statistically significant female predominance was observed. Vertical forms were more represented than transversal forms. The use of serial observation of growth and serial cephalometric and dental model comparisons is considered as the current accepted standard for the determination of condylar growth status. This technique requires a minimum period of time between observations (6 months - 1 year) in order to determine the status. Bone scintigraphy has been used to aid to determination of bone growth activity since the early 1980. The initial method of scintigraphy involved capture in planar view. In recent years, single photon emission computed tomography (SPECT) has been proposed. However, it has been reported that bone scans are sensitive but no specific, and that conditions affecting the joints, such as healing bone, infection, inflammation, and neoplastic changes, can result in a

positive scan value. The reported sensitivity and specificity of SPECT scans has varied amongst studies. The absolute difference in uptake yielded the lowest sensitivity at 32.4% and the uptake ratio had the highest sensitivity at 67.6%; the sensitivity of relative uptake was 41.2%. With regard to specificity at 36.1%, relative uptake had a specificity of 67.5%, and absolute difference in uptake had the highest specificity at 78.3%. the sensitivity and specificity of all three methods are considered to be low. Based on the findings of the primary outcome of sensitivity and specificity the three SPECT analysis methods proposed (absolute difference in uptake, uptake ratio, and relative uptake) are not suitable to be used as a diagnostic tool for condylar hyperplasia.

Conclusions

Facial asymmetry in an aesthetically and functionally unsatisfactory condition that may arise from a number of causes, such as joint resorption, infection-related growth disturbances, and neoplastic changes, among others. SPECT has recently been proposed for the diagnosis of condylar hyperplasia, but when compared to serial growth assessment using cephalometric radiographs and clinical photographs, SPECT bone scintigraphy did not achieve an acceptable sensitivity and specificity, and it is therefore not justifiable to use this for the routine assessment of growth in patients with CH.

References

1. Chan WL, Carolan MG, Fernandes VB, Abbati DP. Planar versus SPECT imaging in the assessment of condylar growth. *Nucl Med Commun.* 2000;
2. Eslami B, Behnia H, Javadi H, Khiabani KS, Saffar AS. Histopathologic comparison of normal and hyperplastic condyles. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2003;
3. Gray RJ, Horner K, Testa HJ, Lloyd JJ, Sloan P. Condylar hyperplasia: correlation of histological and scintigraphic features. *Dentomaxillofac Radiol.* 1994;
4. Gray RJ, Sloan P, Quayle AA, Carter DH. Histopathological and scintigraphic features of condylar hyperplasia. *Int J Oral Maxillofac Surg.* 1990;
5. Henderson MJ, Wastie ML, Bromige M, Selwyn P, Smith A. Technetium-99m bone scintigraphy and mandibular condylar hyperplasia. *Clin Radiol.* 1990;
6. Hodder SC, Rees JI, Oliver TB, Facey PE, Sugar AW. SPECT bone scintigraphy in the diagnosis and management of mandibular condylar hyperplasia. *Br J Oral Maxillofac Surg.* 2000;

7. Munoz MF, Monje F, Goizueta C, Rodriguez-Campo F. Active condylar hyperplasia ~ treated by high condylectomy. *J Oral Maxillofac Surg.* 1999;
8. Obwegeser HL, Makek MS. Hemimandibular hyperplasiae hemimandibular elongation. *J Maxillofac Surg.* 1986;
9. B. H. Chan, Y. Y. Leung. SPECT bone scintigraphy for the assessment of condylar growth activity in mandibular asymmetry: it is accurate?. *Int. J. Oral Maxillofac. Surg.* 2017;
10. Rafael Martin-Granizo, JosÃ M Garcia-Rielo, Oscar De la Sen, Lourdes Meniegas, Alberto Berguer, Manuel De Pedro. Correlation between single photon emission computed tomography and histopatologic findings in condylar hyperplasia of the temporomandibular joint. *Journal of Cranio-Maxillo-Facial Surgery.* 2017;
11. Guillaume Mouallem, Zahia Vernex-Boukerma, Julie Longis, Jean-Philippe Perrin, Jean Delaire, Jacques-Marie Mercier, Pierre Corre. Efficacy of proportional condylectomy in a treatment protocol for unilateral condylar hyperplasia: A review of 73 cases. *Journal of Cranio-Maxillo-Facial Surgery.* 2017;
12. Rushton MA. Unilateral hyperplasia of the mandibular condyle. *Proc R Soc Med.* 1946;
13. Saridin CP, Gilijamse M, Kuik DJ, et al. Evaluation of temporomandibular function after high partial condylectomy because of unilateral condylar hyperactivity. *J Oral Maxillofac Surg.* 2010;
14. Saridin CP, Raijmakers PGHM, Tuinzing DB, Becking AG. Bone scintigraphy as a diagnostic method in unilateral hyperactivity of the mandibular condyles: a review and meta-analysis of the literature. *Int J Oral Maxillofac Surg.* 2011;
15. Shen G, Darendeliler MA. The adaptive remodeling of condylar cartilage e a transition from chondrogenesis to osteogenesis. *J Dent Res.* 2005;
16. Talwar RM, Wong BS, Svoboda K, Harper RP. Effects of estrogen on chondrocyte proliferation and collagen synthesis in skeletally mature articular cartilage. *J Oral Maxillofac Surg.* 2006;
17. Delaire J. The role of the condyle in the growth of the mandible and in facial balance. *Revue De Stomatologie Et De Chirurgie Maxillo-Faciale.* 1990;
18. Delaire J: Treatment of mandibular hypercondyles (argument for defense of the condylectomy). *Mondo Odontostomatologico.* 1977;
19. Villanueva-Alcojol L, Monje F, Gonzalez-Garcia R. Hyperplasia of the mandibular condyle: clinical, histopathologic, and treatment considerations in a series of 36 patients. *J Oral Maxillofac Surg.* 2011;
20. Wolford LM, Mehra P, Reiche-Fischel O, Morales-Ryan CA, GarcÃa-Morales P. Efficacy of high condylectomy for management of condylar hyperplasia. *Am J Orthod Dentofacial Orthop.* 2002;
21. Wolford LM, Movahed R, Perez DE. A classification system for conditions causing condylar hyperplasia. *J Oral Maxillofac Surg.* 2014;
22. Rodrigues DB, Castro V. Condylar hyperplasia of the temporomandibular joint: types, treatment, and surgical implications. *Oral Maxillofac Surg Clin North Am.* 2015;
23. Nitzan DW, Katsnelson A, Bermanis I, Brin I, Casap N. The clinical characteristics of condylar hyperplasia: experience with 61 patients. *J Oral Maxillofac Surg.* 2008;
24. Raijmakers PG, Karssemakers LH, Tuinzing DB. Female predominance and effect of gender on unilateral condylar hyperplasia: a review and meta-analysis. *J Oral Maxillofac Surg.* 2012;
25. Hodder SC, Rees JI, Oliver TB, Facey PE, Sugar AW. SPECT bone scintigraphy in the diagnosis and management of mandibular condylar hyperplasia. *Br J Oral Maxillofac Surg.* 2000;
26. Wolford LM, Movahed R, Perez DE. A classification system for conditions causing condylar hyperplasia. *J Oral Maxillofac Surg.* 2014;
27. Wen B, Shen Y, Wang CY. Clinical value of ⁹⁹Tcm-MDP SPECT bone scintigraphy in the diagnosis of unilateral condylar hyperplasia. *Sci World J.* 2014;
28. Naini FB, Donaldson AN, McDonald F, Cobourne MT. Assessing the influence of asymmetry affecting the mandible and chin point on perceived attractiveness in the orthognathic patient, clinician, and layperson. *J Oral Maxillofac Surg.* 2012;
29. Fahey FH, Abramson ZR, Padwa BL, Zimmerman RE, Zurakowski D, Nissenbaum M, Kaban LB, Treves ST. Use of (99m)Tc-MDP SPECT for assessment of mandibular growth: development of normal values. *Eur J Nucl Med Mol Imaging.* 2010;
30. Lo J, Yau YY, Yeung DWC, Cheung LK. Planar scintigraphy in assessment of mandibular asymmetry: Unilateral condylar hyperplasia vs asymmetrical mandibular hyperplasia. *J Biomed Sci Eng.* 2012;
31. Kaban LB, Cisneros GJ, Heyman S, Treves S. Assessment of mandibular growth by skeletal scintigraphy. *J Oral Maxillofac Surg.* 1982;
32. Melsen B. The cranial base: the postnatal development of the cranial base studied histologically on human autopsy material. *Acta Odontol Scand.* 1974;