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SURGICAL RECONSTRUCTION OF TMJ

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MOTS CLES: *prothèse du JTM, prothèse de Christensen, greffes osseuses autologous, greffes costochondrales, greffes de tête iliaque.*

ABSTRACT

Certain situations and pathological processes that arise with temporomandibular joint destruction can only be resolved with surgical reconstructive procedures in order to attempt a functional and anatomical rehabilitation of this joint. Many of these situations can be surgically treated with the patient's own autologous tissues. However, in some patients reconstruction is complex and the use of autologous tissues is unadvisable whereas reconstruction utilizing alloplastic materials may be an appropriate alternative. The following report describes 4 clinical cases in which autologous grafts or Christensen joint prothesis are employed intemporomandibular joint reconstruction.

RESUME

Certaines situations ou processus pathologiques qui mènent à la destruction du joint temporo-mandibulaire rendent nécessaires des interventions chirurgicales de reconstruction qui redonnent au joint fonction et anatomie. La plupart de ces situations peuvent être traitées chirurgicalement en utilisant des tissus du patient. Toutefois, chez certains patients, la reconstruction est complexe et l'usage de ses propres tissus peut être déconseillée. Une reconstruction faite avec des matériaux aloplastiques peut être une alternative valable. Notre expérience dans le domaine de la reconstruction du joint temporo-mandibulaire avec greffes de tissu des patients ou avec pose de prothèses de Christensen est illustrée ici à travers la description de quatre cas cliniques.

INTRODUCTION

The temporomandibular joint can be affected by diverse pathological processes provoking its destruction and causing a major loss of function, pain and either limitation or hypermobility of the buccal opening. In order to solve these problems, conservative reconstructive surgical procedures are sometimes required. Situations demonstrating the necessity for TMJ reconstruction are: ankylosis or fibrotic ankylosis, severe degenerative pathology, congenital or developmental deformities, advanced rheumatoid arthritis, traumatic condylar loss. In TMJ reconstruction autologous tissues may be used (anatomical and biological reconstruction), or prostheses in alloplastic or inert materials (anatomical rather than biological reconstruction) however, regardless of the material employed, the procedure aims at a recovery of functionality and anatomy, elimination of clinical symptoms, and the maintanence of an aesthetic and correct occlusal relation for the rest of the patient's lifetime (Mc Bride K.L. 1994).

Although the joint's reconstruction is achieved using a wide variety of autologous tissue grafts, the most commonly used are costochondral's grafts, sternum-clavicular grafts, and grafts from metatarsus or the iliac crest. There definitely exists a greater experience with costochondral grafts, which possess an inner growth potential and adaptive features similar to those of the mandible condyle (Shira R.B. 1984).

Among trailed alloplastic materials there exist different metals or alation, such as titanium or chrome-cobalt alation and a wide variety of polymer materials such as proplast-teflon, polimethylmethacrylate and, recently, dense polyethylene with an ultra-high molecular weight (van Loon J.-P. et al. 1995). The variety of prostheses possible to construct with these

materials can be classified in two main groups: preformed prostheses, available in different shapes and sizes, from which the surgeon chooses the most adequate for each patient; and individualised prostheses preformed on a plastic model which reproduces the patient's joint and the other adjacent bony structures. In the latter group, the Christensen articular prosthesis, designed in 1963, has consistently provided positive results throughout these years of experimentation. Christensen's prosthesis is composed of two portions: a condyle prosthesis formed by a vastagus chrome-cobalt alation with an acrylic condylar head, available in different lengths (40, 50 and 55 mm), which is attached to the ascending mandibular ramus utilising 5 to 7 screws; and a fossae prosthesis made of chrome-cobalt alation (vitalism), available in 33 models and shapes, with a minimum anterior extension to the articular eminence's crest, which is attached to the root of the zygomatic's arch utilising 3 or 4 screws (Mc Bride K.L. 1994).

The following four cases describe TMJ reconstructions performed utilising grafts from costochondral autologous tissues, from the iliac crest or utilising the Christensen articular prosthesis.

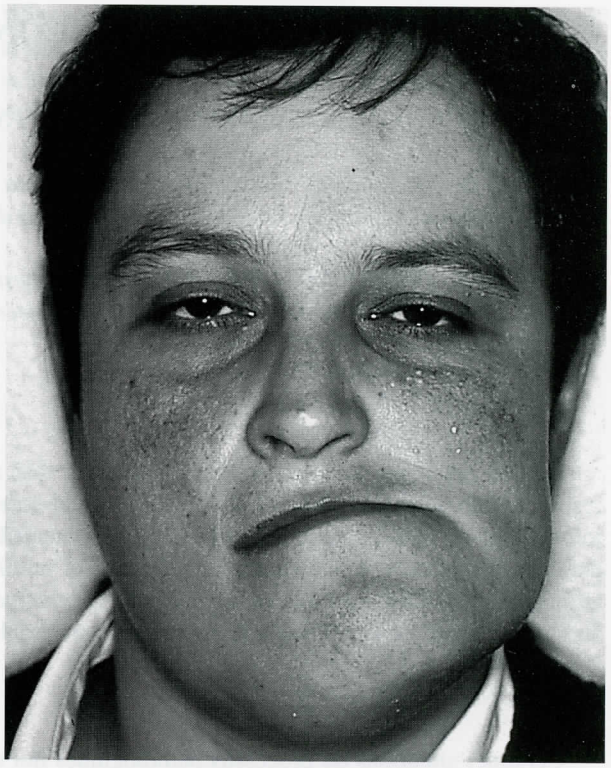

Fig. 1: *35-year-old patient who has facial asymmetry which depends basically upon the inferior third causing an aesthetic, functional and psychological severe problem (case 1).*

CLINICAL CASES

CASE 1

A 35-year-old woman without important systemic or traumatic pathologies presents a facial asymmetry of the inferior third, that has increased with time and presently impedes the mouth from opening, she also presents a severe depressive syndrome (Fig. 1). An examination reveals a deviation of the middle line towards the left and a total absence of occlusion (Fig. 2). Due to the patient's severe facial deformity it is impossible to qualitatively execute a panoramic radiography. The computerised tomography reveals a neoformation that affects the right condyle (Fig. 3). This tumour is surgically extirpated at the level of the right condyle, consequently reconstructed with a complete articular Christensen prosthesis (Fig. 4), thus correcting the patient's facial deformity (Fig. 5) and permitting her an occlusion and correct biting position (Fig. 6).

A histological study of the extirpated bone fragment demonstrates the normal features of a condyle hyperplasia. Post-operative complications were absent.

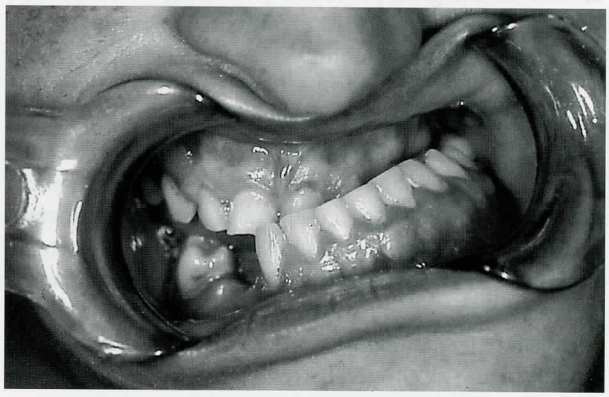

Fig. 2: *Severe malocclusion with deviation of the medial mandibular line contra-laterally to the condyle affected by hyperplasia (case 1).*

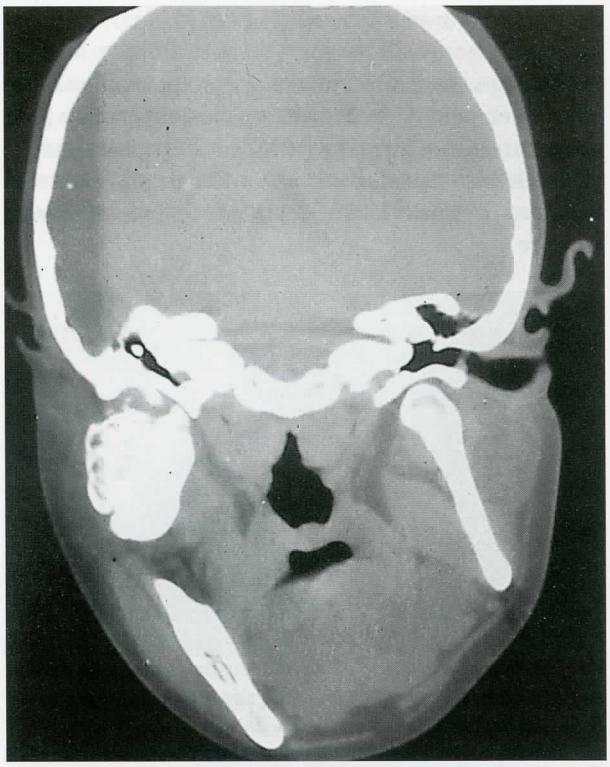

Fig. 3

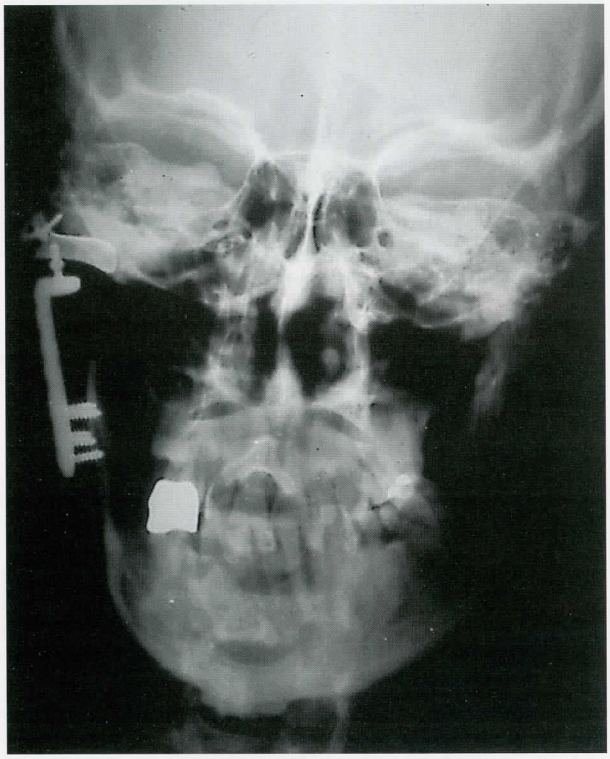

Fig. 4

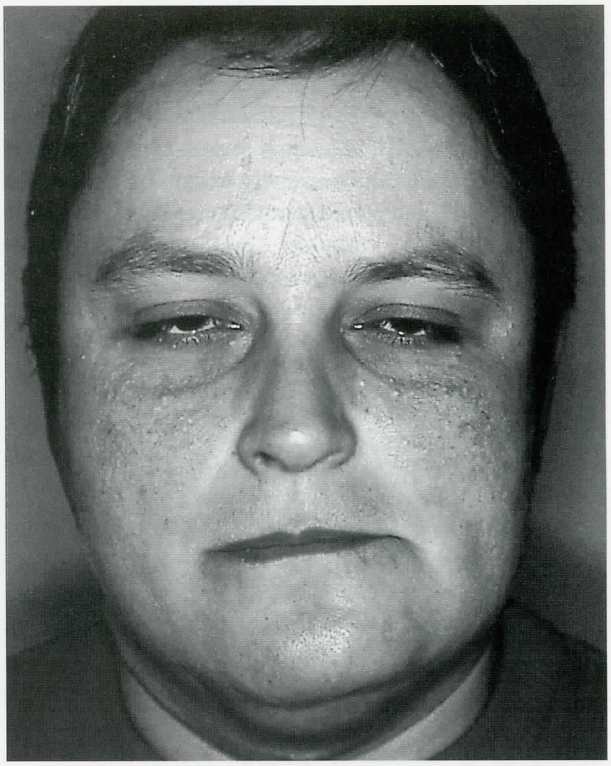

Fig. 5

Fig. 3: *Computerised tomography in which is observed the hyperplasia of the right condyle (case 1).*

Fig. 4: *Radiographic aspect after the resection of the bone fragment affected and the reconstruction with a complete Christensen's articular prosthesis (case 1).*

Fig. 5: *Post operatory aspect of the patient in which we observe how facial asymmetry and aesthetics have been regained (case 1).*

Fig. 6: *After the TMJ reconstruction with Christensen's complete articular prosthesis a correct occlusal relation is attained (case 1).*

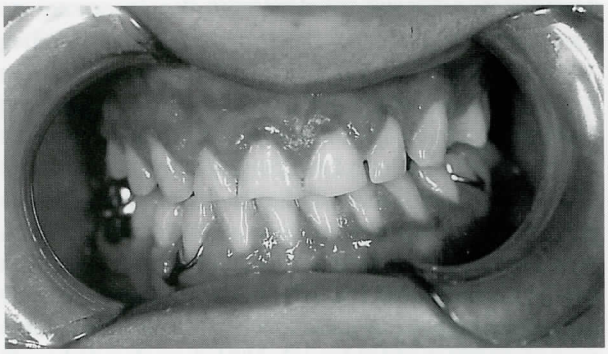

Fig. 6

CASE 2

A 45-year-old man who experienced mandibular traumatism during his childhood presents a bony ankylosis of the left TMJ which impedes his opening of the mouth (Fig. 7). It is surgically treated by removal of the right TMJ and consequent reconstruction of this articulation with a complete Christensen's prosthesis (Fig. 8), obtaining a correct aperture of the mouth.

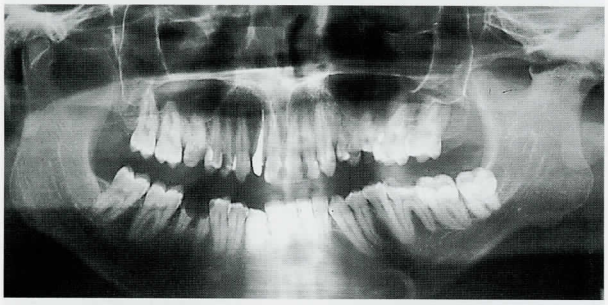

Fig. 7: *Ortopantomography in which left traumatic TMJ bony ankylosis is observed in a 45-year-old patient (case 2).*

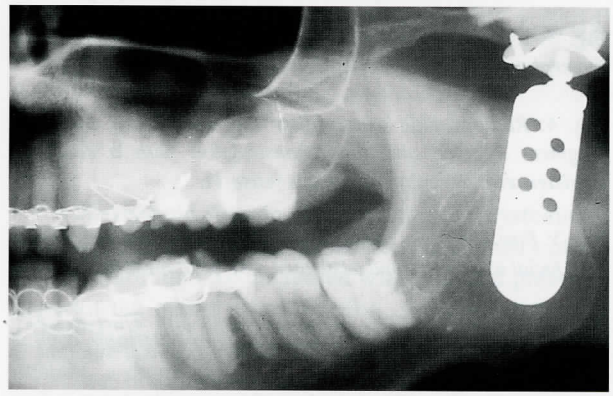

Fig. 8: *Radiographic image of the left TMJ reconstruction with a Christensen's articular prosthesis (case 2).*

CASE 3

A 36-year-old man with no salient pathological precedents is diagnosed with an ameloblastoma at the level of the left ascending mandibular branch. In this case, an exeresis of the affected bony fragment with temporomandibular disjoint was performed followed by a reconstruction with an autologous costochondral graft from the sixth right rib, and attached to the mandibular body utilising osteosynthesis (Fig. 9).

There were no postoperatory complications. A physiotherapeutic procedure was established which helped to attain a good aesthetic and functional result. 2 years later the buccal aperture was 40 mm, and there still remained a small latero deviation at the maximum aperture.

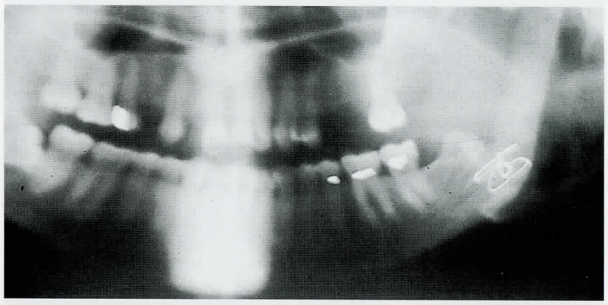

Fig. 9: *36-year-old patient with diagnosis of ameloblastoma in the left mandibular ramus. In the picture is noticed in the radiographic image after the resection of the affected bone fragment and the reconstruction with the costochondral graft obtained from the sixth right rib and attached to the mandibular body with osteosynthesis plates (case 3).*

CASE 4

A 40 year-old man with no salient systemic pathological precedents was diagnosed with an ameloblastoma at the level of the right mandibular angle (Fig. 10). The treatment consisted in a resectioning of the affected bony fragment, including the mandibular

Fig. 10: *Radiolucient image of the gonion and the mandibular ramuscorresponding to an ameloblastoma in a 40-year-old patient (case 4).*

condyles (Fig. 11). The reconstruction was performed with an autologous graft from the iliac crest (Figg. 12-13). Immediately after surgury a hematoma appeared in the surgical zone which healed spontaneously. Physiotherapy aided him in attaining a 38 mm buccal aperture with a small latero-deviation in a control done 3 years after the operation.

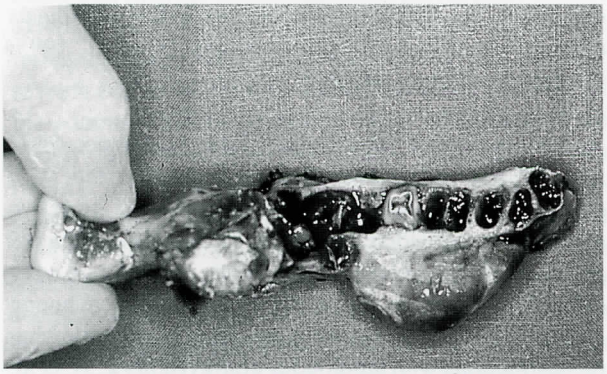

Fig. 11: *Resection of the affected fragment which includes the mandibular condyle (case 4).*

Fig. 12: *Obtainment of an autologous graft from the iliac crest (case 4).*

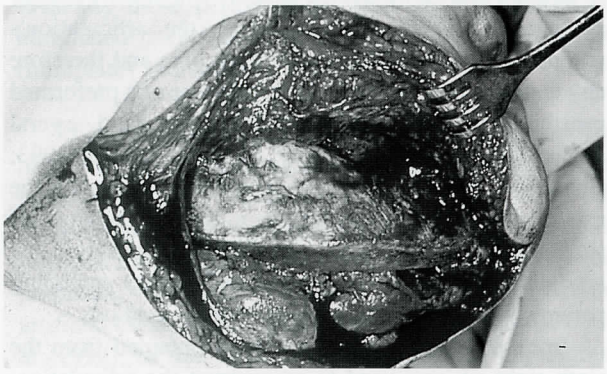

Fig. 13: *Intraoperatory aspect after the reconstruction of the articulation, ramus and mandibular body with an autologous bone graft from the iliac crest (crest 4).*

DISCUSSION

For many years, TMJ reconstruction has been performed either utilising autologous tissue grafts or prostheses constructed with inert material, without an acknowledgement of which of the two is the most effective (Mc Bride K.L. 1994).

Autologous grafts are favorable due to the use of the patient's own tissues making rejection impossible and biocompatibility total. They also handle well and , being live tissues, can transform themselves and adapt to the receptor zone; and in the case of reconstruction failure, there rarely remains a situation worse than the original. The problems regarding autologous tissues are: the necessity of a donator zone so that two surgical fields are available, and the behaviour of live tissues is not exactly predictably (Mac Intosh R.B. 1994). Due to this last consideration Westermark et al. (1990), proposes the use of alloplastic materials for the treatment of ankylosis even in children who have not completed their development and growth.

Reconstructions utilising prostheses in alloplastic materials do not require a second surgical field because the anatomical restoration is immediate. Vascularization of the surrounding tissues, essential in autologous tissue reconstruction is not required with alloplastic materials (Mercury L.G. et al. 1995) which also permit a more rapid recovery of the masticatory function, shortening the length of the treatment and minimising the possibility of an ankylosis or re-ankylosis (Sonnenburg M. et al. 1990).

Reconstruction with prostheses in alloplastic materials can be performed simply by utilising a fossa's, condyle or a total prosthesis that includes fossa and mandibular neck. Eminence-fossa prostheses are used as an interpositional dispositive in the case of articular pathologies with little or no loss of condylar height, like a bony ankylosis; but when condylar height loss is present, as in severe osteoarthritis it becomes necessary to utilise condylar prostheses or total prostheses in order to restore condylar height (van Loon J.P. et al. 1995). In most cases in which alloplastic materials are used, the articular disc must be eliminated and the risk of bone reabsorption consequent to articular charge increases. Only the use of a total prosthesis can minimize this risk (van Loon J.P. et al. 1995; Sonnenburg M. et al. 1990; Sonnenburg I. et al. 1985; Kent J.N. et al. 1986). In case #1 we decided to use a Christensen's total prosthesis in

order to avoid possible bone reabsorption of the articular fossa and eminence. In case #2 a resectioning of the ankylosis block also forced us to use a complete prosthesis which permitted the reconstruction of both the glenoid fossa and mandibular condyle.

The utilisation of alloplastic materials for the treatment of severe TMJ pathologies began in 1946, but it was not until the 1960's that the first total TMJ prosthesis was used. Even though many companies produced articular prostheses, the production was discontinued because it did not comply with the FDA normative, except for those made in chrome-cobalt alation, and in polymeric material, polimethylmethacrilate (PMMA) in the articular surface of the condyle (Wolford L.M. 1997).One of the major causes of articular prosthesis failure is due to the presence of particles from prosthesis decay, fibrotic or bony ankylosis with formation of ectopic bone and lasting pain due to the above causes (Kent J.N. et al. 1993).

Alloplastic materials have been utilised at length for damaged articular disc substitution (Shira R.B. 1987; Kameros J. Et al. 1975) and for the construction of TMJ prostheses. The most commonly used materials for the substitution of articular discs were silicon and Proplast but subsequently evidence of severe problems emerged, like bone reabsorption, pain and disjunction leading to their substitution (Shira R.B. 1987; Timmis D.P. et al. 1986). The main cause of the unsuccessful out comes with those materials proved to be a fragmentation of the material with the formation of decayed particle contributing to the induction of an important foreign body reaction in the presence of giant multinuclear cells and macrophage (Timmis D.P. et al. 1986; Feinerman D.M. et al. 1993; Choung R. et al. 1993; Trumpy I.G. et al. 1993). A similar fragmentation of the material was observed with the use of prostheses made of alloplastic materials (Rooney T.P. et al. 1988; Amstutz H.C. et al. 1992; Friedman R.J. et al. 1993). A persistent and vast macrophagic reaction with a gross aggregation of histiocytes (foreign body of giant cells) and granulomatous tissues indicates the presence of polymers decayed particles and results in a rejection of the prosthesis (Kent J.N. et al. 1993). Hudson et al.(1993) performed a mechanical test in which the conditions of TMJ charge were simulated, and evaluated the prosthesis with the same articular condylar surface in PMMA present in Christensen's and Morgan's prosthesis, concluding that the decay, with this type of prosthesis, was minimum even in extreme conditions.

In cases #1 and #2 preformed prosthesis were used. An alternative to preformed prosthesis is an individualised prosthesis similar to the one made with the Techmedica system or the Ostheomed system, which has the advantage of reproducing each patient's anatomy. Images obtained by computerised tomographies are used to produce a plastic model of the patient's articulation, on which is designed the custom-made prosthesis obtaining positive results (Mercury L.G. et al. 1995; Wolford L.M. et al. 1994).

Patients who have undergone numerous TMJ surgical operations or those previously treated with alloplastic materials who have encountered negative results are considered special cases. The decayed particles of the alloplastic materials prove to be very difficult to eliminate during the second surgery (Chuong R. et al. 1993) compromising the result of the following reconstructions with autologous grafts (Henry C.H. et al. 1993). In those patients and in the ones that have had numerous TMJ surgical operations in which the presence of retractile scars or anatomical alterations worsen the prognostic, the use of custom-made prosthesis with proven orthopaedic materials, is considered by some (Mercury L.G. et al. 1995; Wolford L.M. et al. 1994), the only adequate and predictable option for the articulation's reconstruction.

Although the role of biomaterial is important in TMJ reconstruction, alloplastic material prostheses are sometimes indicated (Kent J.N. et al. 1993; Kent J.N. et al. 1991; Kearns D.J. et al. 1995) only for cases in which other procedures, especially ones involving autologous tissues, are not justified or are discouraged, as in the case of a severe systemic pathology (Kearns D.J. et al. 1995). In cases#1 and #2 we treated patients without any history of systemic pathologies in which the articulation's reconstruction was done for the first time and therefore any negative prognostic factor for the use of a preformed prosthesis was inexistent. On the other hand several studies (Russel R. et al. 1993; McKay M. et al. 1993; Chase D.C. et al. 1995) also demonstrate that with the use of Christensen's prosthesis a high percentage of success can be reached in the reconstruction of articulations affected by severe pathologies including patients who have undergone previous operations.

In case #3 a costochondral graft obtained from the sixth right rib was used to reconstruct the articulation. Gillies used costochondral grafts for TMJ reconstruction for the first time in the 1920's (Nelson

C.L. et al. 1989), and since then they have been proven to be a method with a high percentage of success (Nelson C.L. et al. 1989; Obeid G. et al. 1988; Lindqvist C. et al. 1988). Costochondral grafts being anatomically and biologically similar to mandibular condyle, are the first choice in autologous graft for TMJ reconstruction (Lindqvist C. et al. 1988). The bony part is used to replace the condyle neck and to attach the graft to the mandible, whereas thecartilagineous part is placed in the existing glenoid fossa or reconstructed with bone reshaping (Shira R.B. 1984). Normally the fifth, sixth, or seventh contra-lateral rib is utilised, because the curve of the contra-lateral rib permits a better adaptation to the lateral surface of the ascendent mandibular ramus (Nelson C.L. et al. 1989; Obeid G. et al. 1988). Bone-cartilage union proves to be the area with the greatest potential for adaptation and unpredictable growth making this type of graft the ideal method for reconstruction in patients whose growth is not yet completed (Shira R.B. 1984). Another advantage that some recognize in this type of graft, compared to the alloplastic material prosthesis, is that in utilising the costochondral grafts it is possible to reproduce the reinsertion of the external pterygoid muscles permitting mandibular excursions. In addition, they can be utilised even in the absence of the articular disc, because the cartilage of the costochondral graft is more tolerant in the articular fossa than alloplastic material which may cause erosion of the glenoid fossa when a prosthesis of the mandibular condyle is placed (Nelson C.L. et al. 1989). One inconvenience encountered, despite the use of an autologous graft, was the necessity to make intermaxillar postoperatory blockings. When only the condyle was replaced the union appeared after 4 to 6 weeks; if the reconstruction of the mandibular ramus was performed the blocking had to be maintained during a period of 8 to 10 weeks (Nelson C.L. et al. 1989). Presently those periods have been greatly reduced or eliminated with the use of rigid bone attachments (miniplates and screws).

In cases in which the resection mandibular condyle had to be performed along with the ramus and part of the mandibular body as in case #4, the union of the costochondral graft can prove difficult, and in fact, other methods for the articulation's reconstruction have been proposed, varying from the use of metal plates with an artificial condyle (Schmoker R.R. 1983; Lindqvist C. et al. 1992), to the use of different types of autologous tissues. In our patient the reconstruction was executed utilising a free graft of autologous bone obtained from the iliac crest.

Complications that may appear after TMJ reconstruction are similar to those in any other surgical operation in this area and include nervous lesions, mainly of the facial and inferior dental nerves, haemorrhage, a faulty intermaxillar relation which results in malocclusion, mobility, displacement or fracture of the prosthesis' or graft's components, and also complications induced by the consequences of prosthesis decay (Mc Bride K.L. 1994; Kent J.N. et al. 1991; Kearns G.J. et al. 1995; Russel R. et al. 1993; McKay M. et al. 1993; Chase D.C. et al. 1995; Nelson C.L. et al. 1989; Obeid G. et al. 1988; Lindqvist C. et al. 1988; Schmoker R.R. 1983; Lindqvist C. et al. 1992; Mc Bride K.L. 1992). Generally, most of these complications can also arise after the reconstruction of the fossa and condyle using autologous materials (Kent J.N. et al. 1991).

Considering the objectives and the possible complications the parameters of success of TMJ reconstruction performed with alloplastic materials are pain reduction, increased functionality and greater aperture, a correct occlusal relation , acceptable facial aesthetics, stability of the prosthesis, and the radiographic absence of hard and soft tissues pathologies (Kent J.N. et al. 1993); the same parameters can also be applied for the reconstruction with autologous graft tissues. In all of our four cases these parameters have been attained, and therefore the reconstructions were successful. The ideal parameter of success in TMJ reconstruction should be that the duration of the reconstruction lasts for the patient's entire life without any symptomatology. The constant development of new biomaterials will probably permit the design of new prostheses and new systems permitting more predictable articulation reconstructions.

The choice of which surgical procedure to utilise for TMJ reconstruction should depend upon the condyle's condition, the loss of vertical dimension thereby produced, the presence or absence of the external pterygoid muscle function, the number of previous surgical operations, presence or absence of pain and the patient's preferences (Kent J.N. et al. 1991). For the moment, and in the absence of enough objective clinical data that demonstrate which of there constructive methods described above obtain the best results, the choice of technique greatly depend on the preferences of the surgeon based on his experience and on the costs(Mc Bride K.L. 1994).

Up to the present only alloplastic materials or

autologous grafts have been utilised, but perhaps the future of TMJ reconstruction will consist of new techniques such as bone distraction. Bone distractions entail a corticotomy in order to divide two bone fragments to which distraction or gradual separation forces are applied in small increments, resulting in the formation of new bone in the distraction space and creating an increase in the bone length that will permit the reconstruction (Molina F. et al. 1995). To date, new experimental studies are required before this technique can be used with predictability and security in human beings.

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