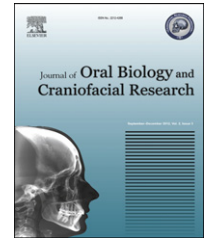


Available online at www.sciencedirect.com

SciVerse ScienceDirect

journal homepage: www.elsevier.com/locate/jobcr

Original Article

Retrospective study of absorbable gelatin sponge soaked in triamcinolone acetonide as interpositioning material in temporomandibular joint ankylosis in 350 patients

U.S. Pal^{a,*}, Nimisha Singh^b, Laxman R. Malkunje^b, R.K. Singh^c, Satish Dhasmana^d, Arvind Kumar Yadav^b, Sharad Chand^b

^a Associate Professor, Dept of Oral and Maxillofacial Surgery, King George's Medical University, Lucknow 226003, Uttar Pradesh, India

^b Senior Resident, Dept of Oral and Maxillofacial Surgery, King George's Medical University, Lucknow 226003, Uttar Pradesh, India

^c Professor, Dept of Oral and Maxillofacial Surgery, King George's Medical University, Lucknow 226003, Uttar Pradesh, India

^d Assistant Professor, Dept of Anaesthesiology, King George's Medical University, Lucknow 226003, Uttar Pradesh, India

ARTICLE INFO

Article history:

Received 14 August 2012

Accepted 27 November 2012

Keywords:

Absorbable gelatin sponge

Temporomandibular joint

Ankylosis

Interposition materials

Triamcinolone acetonide

ABSTRACT

Aim: To evaluate the feasibility and usefulness of absorbable gelatin sponge soaked in triamcinolone acetonide as an interposition material in the treatment of temporomandibular joint (TMJ) ankylosis.

Materials and methods: This retrospective study was conducted in 350 patients of TMJ ankylosis who visited our outpatient department between 2000 and 2010, and were treated by the same surgeon. Patients were randomly divided into two groups, where in group 1, absorbable gelatin sponge soaked with triamcinolone acetonide was interposed in the surgical gap created after arthroplasty and in group 2, temporalis fascia was interposed. Preoperative assessment included history and physical examination, along with cause of ankylosis, Postoperative observation were undertaken for maximum mouth opening (MMO), facial nerve paralysis and recurrence.

Results: At one year follow-up, in group 1 MMO ranged from 35 to 45 mm with no case of re-ankylosis while in the other group 25–43 mm, with re-ankylosis in 20 patients (13.69%).

Conclusion: The findings of this study showed successful management of TMJ ankylosis using absorbable gelatin sponge soaked in triamcinolone acetonide in cases which did not require condylar reconstruction.

Copyright © 2012, Craniofacial Research Foundation. All rights reserved.

* Corresponding author.

E-mail addresses: uspalkgmc@yahoo.co.in, drumashankarpal@gmail.com (U.S. Pal).

2212-4268/\$ – see front matter Copyright © 2012, Craniofacial Research Foundation. All rights reserved.

<http://dx.doi.org/10.1016/j.jobcr.2012.11.006>

1. Introduction

Temporomandibular joint ankylosis results from fusion of bones within the joint or calcification of the ligaments around it, and presents with difficulty in mouth opening, mastication and speech, disfigurement, compromised air way and psychological stress.^{1,2} Treatment comprises of arthroplasty; simple resection of the bony fusion^{3,4} or interposition arthroplasty, with interposition of alloplast^{5,6} or autologous material,^{7,8} and reconstruction of condyle only or the glenoid fossa as well.^{9–12}

Anatomically, a cartilaginous layer on the normal condyle surface separates the condyle from adjacent tissues of the joint but after gap arthroplasty, there is a fresh wound on the bone surface, where fibrosis and ossification may occur. A range of materials are used for interposition like autogenous, the temporalis fascia or muscle, cartilage grafts, dermis fat graft and alloplastic material such as acrylic, proplast, teflon, silastic, etc. to avoid this. Temporalis muscle flap is the most commonly used interposition material because of the minimal morbidity of donor site.¹³

Absorbable gelatin sponge is non-toxic, non-allergenic, non-immunogenic, and non-pyrogenic. It is gamma-sterilized and provided with double packing. The sponge is easily cut to fit the surgical cavity. It may be applied dry to the wound using pressure. It absorbs 40 times its weight of well agitated oxalated whole blood or 50 times of water and adheres easily to the bleeding site. It rapidly controls capillary and venous bleeding, forming a stable adherent coagulum. The uniform porosity of absorbable gelatin sponge is good for favorable hemostasis. When implanted in vivo, it is completely absorbed within 3–5 weeks.¹⁴ The rationale for using this as interposition material following gap arthroplasty is firstly, to fill the ample dead space created within the joint cavity after arthroplasty, to avoid bleeding and to prevent direct bony contact between condyle and glenoid fossa for prevention of further recurrence. Triamcinolone has been added to gelatin sponge to reduce inflammation and thus reduce the potential for osteogenesis and fibrosis.

This study aims to determine the efficacy of our protocol for TMJ ankylosis that entailed resection of ankylotic mass and interposition of absorbable gelatin sponge soaked in triamcinolone acetone with early mobilization and physiotherapy.

2. Material and methods

This retrospective study was conducted in 350 patients of TMJ ankylosis who visited our outpatient department from 2000 to 2010 and treated by the same surgeon. Informed consent was taken from all patients, or their parents. A detailed history of the age, mode of onset, duration, and gender was recorded. Pre and postoperative examination of TMJ was done by clinical assessment of jaw movement and measured, inter-incisal distance on maximal mouth opening (MMO). Radiological examination was carried out on orthopantomogram and computed tomography scan (axial and coronal view) of both joints to observe any complications such as fibrosis and ankylosis (Figs. 1–3).



Fig. 1 – Preoperative mouth opening of patient with TMJ ankylosis.

Patients were divided into two groups randomly. In group 1, absorbable gelatin sponge soaked with triamcinolone acetone was interposed to fill the gap and in group 2 temporalis fascia was used as interposition material.

All surgical procedures were carried out under general anesthesia by naso-tracheal intubation using fibroscopy. The joint was exposed through Al-Kayat Bramley incision and gap arthroplasty was done to create a minimum of 1 cm gap. Re-contouring of glenoid fossa was also done. MMO was measured, if it was less than 35 mm, ipsilateral and/or contralateral coronoidectomy was done to achieve minimal mouth opening of 35 mm. In group 1, unilateral coronoidectomy was done in 77 cases and bilateral in 74 cases, while in 24 cases coronoidectomy was not performed. In group 2,

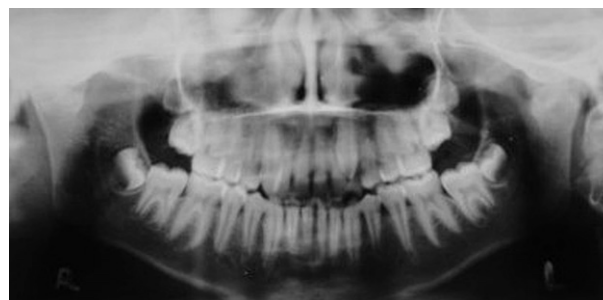


Fig. 2 – Preoperative orthopantomogram of patient with TMJ ankylosis.



Fig. 3 – Preoperative axial CT scan of patient with TMJ ankylosis.

unilateral coronoidectomy was done in 36 patients and bilateral in 11 patients. Absorbable gelatin sponge soaked with triamcinolone acetonide (Fig. 4) was interposed to fill the gap created after arthroplasty in all the cases of group 1. In group 2, temporal fascia was rotated and interposed in the gap. The joint was closed layer by layer. A firm pressure dressing was applied, and maintained for 72 h in all patients.

Mouth opening exercises were started after 7 days. Patients were discharged after 10 days with proper instructions and training. Follow-up assessment was performed at 1, 3 and 6

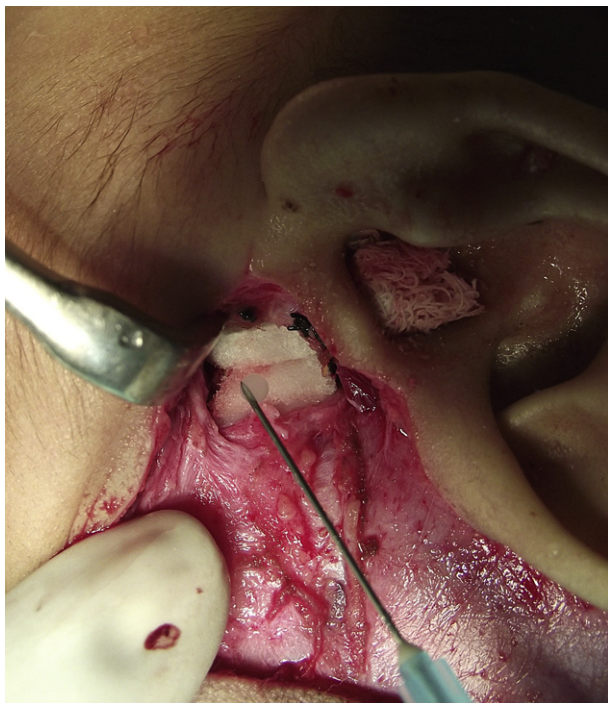


Fig. 4 – Gelatin sponge soaked in triamcinolone acetonide interposed into the joint space.

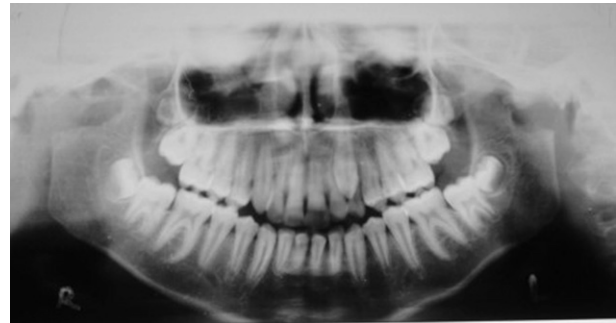


Fig. 5 – Immediate postoperative orthopantomogram.

months; then after every year further follow-up was performed for periods up to minimum of 3 years (3–9 years) (Figs. 5–8). Postoperative observation were assessed for pain, swelling, infection, paresthesia, mouth opening, midline deviation, TMJ movements on palpation, occlusion and recurrence.

3. Results

This study comprised of 350 patients of TMJ ankylosis with total 417 joints. There was a slight female preponderance. Duration of ankylosis ranged from 1 to 19 years. Ankylosis was bilateral in 61 cases (34.85%) and unilateral in 114 cases (65.14%) in group 1. In group 2, 36 (20.57) cases were of bilateral ankylosis and 139 (79.42%) cases were unilateral ankylosis. In both groups, trauma was the most common cause of ankylosis.

Preoperative MMO ranged from 0 to 10 mm; immediate postoperative 35–45 mm in both groups. At one year follow-up, group 1 MMO ranged from 35 to 45 mm with no case of re-ankylosis while in group 2, MMO was reduced (25–43 mm) and 20 (13.69%) patients had re-ankylosis (Table 1).

4. Discussion

The therapeutic objective in TMJ ankylosis is to provide form and function with prevention of recurrence. Different



Fig. 6 – Immediate postoperative CT scan.



Fig. 7 – CT scan after one year.

treatment modalities include osteoarthrectomy with interposition of temporalis muscle,^{15,16} temporalis fascia, buccal pad of fat, or alloplasts. There is a general consensus of opinion that recurrence is less likely with interposition arthroplasty.¹⁷ Arthroplasty without interposition requires a gap of 10 mm or more¹ which may result in contralateral open bite and deviation on opening,¹⁸ so it is advisable not to create a gap of more than 10 mm to avoid occlusal, and deviation problems. In adults, interposition arthroplasty is the only treatment required but in children, total joint reconstruction with costochondral graft or sternoclavicular graft is needed to restore function, form and future jaw growth.

The reason for failure of temporalis fascia may be incomplete coverage of raw surface of resected margins of ramus. Suturing of fascia into ramus stump is not always possible and there are chances of slippage of fascia from the bony stump. Also pain during physiotherapy is more with temporalis fascia, which may be due to vitality of the fascia, causing pain



Fig. 8 – Postoperative mouth opening of patient.

Table 1 – Comparison of mouth opening in two groups.

	Group 1	Group 2
Intraop mouth opening (mm)	38.86 ± 2.12	38.74 ± 2.64
Mouth opening after 1 week (mm)	37.09 ± 1.66	36.21 ± 3.38
Mouth opening after 1 year (mm)	39.74 ± 1.45	32.74 ± 9.74

Mouth opening after 1 year was more in group 1 when compared to group 2.

during active physiotherapy, leading to re-ankylosis in absence of physiotherapy.

Ideal interposition material should be such that it can help in growth, restore ramal height without causing any morbidity at donor site and prevent the ankylosis. But till date no such interposition material is available. Blood clot formed within the space created by arthroplasty can lead to formation of fibrous and or bony mass, which may cause limited mouth opening. Quantity of clot is directly related to partial or complete re-ankylosis. Factors such as bleeding, amount of surgical created gap, vascularity of the bony ends (mandibular condyle and glenoid fossa), smoothness of the bony ends and age, along with active physiotherapy are important factors contributing re-ankylosis.

Gelatin sponge is extracted from animal tissue, and is mainly animal collagen. It is hydrophilic and multi-porous to concentrate blood components by absorbing water in the blood to arrest bleeding.¹⁹ Interposition of absorbable gelatin sponge is suggested with the idea that it will minimize the clot formation, with the separation and covering of both the ends, condyle as well as glenoid fossa. Without soaking it in triamcinolone, gelatin sponge alone may act as a scaffold²⁰ for osteoblasts so as to reduce the potential for osteogenesis. Soaking it in triamcinolone acetonide, it is likely to be resorbed²¹ within 4–6 weeks of placement with minimal scarring and foreign body reaction.²² Within this period (4–6 week after placement) healing will take place in the joint region with the establishment of pseudo-joint in place of temporo-mandibular joint.

Although gel foam neither can help in growth, nor it restores the normal ramus height, it seems to be a good option for prevention of re-ankylosis as it reduces the amount of hematoma formation, causes lesser fibrosis and less pain during postoperative physiotherapy. It also completely covers the newly created raw bone surfaces. It resorbs within 4–6 weeks, during this period, bony ends get eburnated and chances for further bone growth between both (ramus side as well as glenoid fossa side) bone ends are reduced. First four weeks are very important for the formation of hematoma and its consolidation which contribute to the chances of developing re-ankylosis. If hematoma formation is less and bony ends are covered with gel foam soaked in triamcinolone acetonide, proper physiotherapy is established, there are fewer chances of re-ankylosis.

The logic behind using triamcinolone acetonide is that it is a most potent, intermediate acting glucocorticoid. Glucocorticoids inhibit cytokines and thereby attenuate osteoblast differentiation, which accounts, in part, for bone loss during glucocorticoid therapy.²³ Also glucocorticoids act directly on osteoblasts and osteocytes to induce apoptosis and reduce

bone formation.²⁴ It was, therefore, used with the intention to reduce chances of bone formation and hence re-ankylosis.

5. Conclusion

Gelatin sponge along with triamcinolone acetonide is effective and successful as interposition material in treatment of TMJ ankylosis, it not only simplifies the procedure, but also seems to be safe to obtain function and prevent relapse. However, It may require further insight into how gelatin sponge and its modification affect disease outcome. A long term study may be required to establish the use of absorbable gelatin sponge along with triamcinolone in TMJ.

Conflicts of interest

All authors have none to declare.

REFERENCES

- Rowe NL. Ankylosis of temporomandibular joint. *J R Coll Surg Edin.* 1982;27:67–79.
- Topazian RG. Comparison of gap and interposition arthroplasty in the treatment of temporomandibular joint ankylosis. *J Oral Surg.* 1966;24:405–409.
- Qudah MA, Qudeimat MA, Al-Maaita J. Treatment of TMJ ankylosis in Jordanian children – a comparison of two surgical techniques. *J Craniomaxillofac Surg.* 2005;33:30–36.
- Matsuura H, Miyamoto H, Kurita K, Goss AN. The effect of autogenous costochondral grafts on temporomandibular joint fibrous and bony ankylosis: a preliminary experimental study. *J Oral Maxillofac Surg.* 2006;64:1517–1525.
- Karaca C, Barutcu A, Baytekin C, Yilmaz M, Menderes A, Tan O. Modifications of the inverted T-shaped silicone implant for treatment of temporomandibular joint ankylosis. *J Craniomaxillofac Surg.* 2004;32:243–246.
- Güven O. A clinical study on temporomandibular joint ankylosis in children. *J Craniofac Surg.* 2008;19:1263–1269.
- Krishnan B. Autogenous auricular cartilage graft in temporomandibular joint ankylosis- an evaluation. *Oral Maxillofac Surg.* 2008;12:189–193.
- Maki MH, Al-Assaf DA. Surgical management of temporomandibular joint ankylosis. *J Craniofac Surg.* 2008;19:1583–1588.
- Saeed N, Hensher R, McLeod N, Kent J. Reconstruction of the temporomandibular joint autogenous compared with alloplastic. *Br J Oral Maxillofac Surg.* 2002;40:296–299.
- Driemel O, Carlson ER, Müller-Richter U, et al. New condylar head system for temporary condylar reconstruction in ablative tumour surgery. *Mund Kiefer Gesichtschir.* 2007;11:193–199.
- Lei Z. Auricular cartilage graft interposition after temporomandibular joint ankylosis surgery in children. *J Oral Maxillofac Surg.* 2002;60:985–987.
- Medra AM. Follow up of mandibular costochondral grafts after release of ankylosis of the temporomandibular joints. *Br J Oral Maxillofac Surg.* 2005;43:118–122.
- Dimitroulis G. The interpositional dermis-fat graft in the management of temporomandibular joint ankylosis. *Int J Oral Maxillofac Surg.* 2004;33:755–760.
- Guralnick WC, Berg L. Gel foam in oral surgery; a report of 250 cases. *Oral Surg Oral Med Oral Pathol.* 1948;1:632–639.
- Murphy JB. Arthroplasty. *Ann Surg.* 1913;57:593–647.
- Blair VP. Operative treatment of ankylosis of mandible. *Surg Gynecol Obstet.* 1914;19:436.
- Popescu V, Vasiliu D. Treatment of temporo-mandibular ankylosis with particular reference to the interposition of full-thickness skin auto transplant. *J Maxillofac Surg.* 1977;5:3–14.
- Topazian RG. Etiology of ankylosis of temporomandibular joint: analysis of 44cases. *J Oral Surg Anesth Hosp Dent Serv.* 1964;22:227–233.
- Jenkins HP, Janda R, Clarke J. Clinical and experimental observation on the use of gelatin sponge or foam. *Surgery.* 1946;20:124–132.
- Rohanizadeh R, Swain MV, Mason RS. Gelatin sponges (Gel foam) as a scaffold for osteoblasts. *J Mater Sci Mater Med.* 2008;19:1173–1182.
- Treves N. Prophylaxis of postmammectomy lymphedema by the use of gelfoam laminated rolls; a preliminary report, with a review of the theories on the etiology of elephantiasis chirurgica and a summary of previous operations for its control. *Cancer.* 1952;5:73–84.
- Barnes AC. The use of gelatin foam sponges in obstetrics and gynecology. *Am J Obstet Gynecol.* 1947;54:105–107.
- Rauch A, Seitz S, Baschant U, et al. Glucocorticoids suppress bone formation by attenuating osteoblast differentiation via the monomeric glucocorticoid receptor. *Cell Metab.* 2010;11:517–531.
- O'Brien CA, Jia D, Plotkin LI, et al. Glucocorticoids act directly on osteoblasts and osteocytes to induce their apoptosis and reduce bone formation and strength. *Endocrinology.* 2004;145:1835–1841.