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Research Article

Discectomies: A Short-Term Retrospective Study

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ABSTRACT

Objective: To retrospectively analyze the outcome of patients operated with discectomy and to compare the short-term results to results in the available literature.

Materials and method: Patients who underwent discectomy at the Department of Oral and Maxillofacial Surgery, Umeå University hospital in Sweden, between 1988 and 1998 were included (n=64). Mean age: 37 years. 55were women and 9 were men. 48 patients underwent unilateral surgery and 16 patients underwent bilateral surgery (14 women/2 men), totally 80 individual discectomies.

Results: Six months after the surgery, 70 % of the patients reported no pain from the Temporomandibular Joint (TMJ) area, compared to 10 % pre-surgery (P-value < 0.001). Mean opening increased from 36,7 mm before surgery to 41,8 mm after surgery (P-value = 0.001). TMJ crepitation was found in 36 % of the joints before surgery respectively 34 % of the joints six months after surgery (P-value = 0.125). TMJ clicking was found in 43 % joints before surgery and in 6 % after surgery (P-value < 0.001). Locking occurred in 59 % of the TMJ prior to surgery and in 11 % after surgery (P-value < 0.001).

Conclusion: Surgical removal of the disc in the temporomandibular joint reduces pain and increases mouth opening. The result from our study is consistent with other studies and recognizes discectomy as an effective treatment of persistent pain and/or limitation of mouth opening.

ABBREVIATIONS

TMD: Temporomandibular Dysfunction; TMJ: Temporomandibular Joint

INTRODUCTION

About 5-15% of the adult population have some kind of dysfunction in the temporomandibular area (Temporomandibular dysfunction, TMD) that needs treatment [1]. The term TMD is an umbrella term which includes various conditions causing pain and/or dysfunction of the jaw muscles and jaw joints [2]. Internal derangement of the Temporomandibular Joint (TMJ) is when the condyle, disc and fossa of the TMJ have an abnormal relation causing TMJ pain and dysfunction including difficulty in mouth opening, locking and joint noise. It can be classified into

different stages and encompasses anterior disk displacement with reduction and anterior disk displacement without reduction [3]. Most patients with TMD symptoms are treated effectively with non-surgical treatment such as splints, physical therapy, pharmacotherapy and/or intra-articular injection [4-7]. But not all nonsurgical therapy is successful and 5 % of the patients will continue with surgical procedures [8]. For over a century, TMD has been treated with discectomy when nonsurgical treatment has failed [9]. Surgery as treatment is therefore indicated when conservative treatment has failed and when pain in joint or/and functional impairment occur [5,10]. Different surgical procedures have been used during the last 40 years; discectomy, discectomy with replacement [11], repositioning of the disc [12], eminectomy [13], high condylectomy [14], modified condylotomy and arthroscopic lysis and lavage [15,16].

For discectomy, long-term studies [17-19] have indicated good results/success rates [20] and a few complications [16]. These findings are reinforced by a number of short-term follow-up studies and indicate discectomy to be a highly effective operation [10,16,20-22]. A success rate of 80 % - 90 % had been reported in a few prospective studies [10,20-22].

Success criteria

To be able to analyze the surgical result must be based on a classification. The success rate reported by Eriksson and Westesson [20], is based on a modified version of the American Association of Oral and Maxillofacial Surgeons (AAOMS) criteria [20,23]:

- "**Good result:** No pain or only mild pain occurring sporadically and range of motion 35 mm or more for vertical and 5 mm or more for protrusive and lateral excursions
- **Acceptable result:** No pain or only mild pain occurring sporadically and range motion ≥ 30 mm and <35 mm for vertical or <5 mm for protrusive and lateral excursions
- **Bad result:** Pain constantly or moderate or more severe pain in association with mandibular movements or maximal opening <30 mm".

Two of the other short-term studies [10,21] are also using a modified AAOMS (successful or unsuccessful result) where a successful operation is equal to good result according to the modified version of AAOMS by Eriksson and Westessons study [20], (good, acceptable and bad result).

The three long-term follow-up studies [17-19] are defining good result as a patient with no pain or occasional mild pain in the operated joint. Two of the studies [17,18] includes maximum opening over 35 mm as a criterion for good result.

Characteristics of Other Studies

The follow-up time, as well as the number of patients, varies in different studies [4,6,10,16-22,24-26]. The follow-up time ranges between nine months [16] and 33.8 years [19]. The number of patients varied between 8 and 87 [4,6,10,16-22,24-26]. Four studies with a follow-up time longer than ten years had a number of 8-39 patients [4,17-19].

Complications after discectomy: The complications described in the literature vary widely. Some studies [17,18,20] show no complications after surgery, while other articles report persistent pain after discectomy [24]. Holmlund has in several studies reported about palsy of the temporal branch of the facial nerve and disturbed function of the auriculotemporal nerve. Holmlund et al, 1993 reported that three out of 72 patients suffered from a temporary palsy of the temporal branch of the facial nerve. The nerve branch fully recovered within three months for all three patients. In another study, temporary anaesthesia of the temporal branch of the facial nerve was noticed in 8/61 operated joints [16]. Two out of 40 patients demonstrated a palsy of the temporal branch of the facial nerve postoperatively [10]. The nerve branch was fully recovered after three weeks respective after three months. Bjørnland and Larheim (2003) reported that four out of 29 patients suffered from temporary post-operative facial nerve paresis after discectomy. Six out of the 29 patients suffered from postoperative auriculotemporal nerve anaesthesia, temporary in all cases except for one, who developed permanent anaesthesia of the auriculotemporal nerve. Holmlund et al. [21] reported about the result after discectomy in72 patients. All patients experienced sensory disturbance in the area of the auriculotemporal nerve after surgery and 15 patients still had some degree of anesthesia at the one year follow up. Widmark et al. [26] reported three of the 20 patients with transient palsy lasting for four to eight weeks as well as an affected frontal branch of the facial nerve. Twelve of the 20 patients experienced a sensory disturbance in the skin area in front of the incision. In a 30-year follow-up, 1/5 patients had a small impact of the frontal branch of the facial

nerve and one patient still had a disturbed sensation in the preauricular skin [19].

Aim

The aim of this study is to retrospectively analyze the outcome for patients operated with discectomy in Umeå between 1988-1996 and to compare the short-term findings to results in the literature.

MATERIAL AND METHODS

Patients

Between 1988-1998, discectomy with preauricular incision was performed in 67 patients at the Department of Oral and Maxillofacial Surgery, Umeå University Hospital, Sweden. All patients were referred from the Department of Clinical Oral Physiology, Umeå University. Three patients were excluded due to missing data, resulting in 64 included patients with a mean age of 37 years (range 19-74). A majority (86%) of the included patients were women. Forty-eight patients underwent unilateral surgery and 16 bilateral surgery. In total, 37 left joints and 43 right joints were operated. Five patients (3 women, 2 men) were re-operated resulting in 85 discectomies to analyze. Patient data is presented in (Table 1).

Table 1: Characteristics for included patients.

Patients (number (n))	64
Male/female (n)	9/55
Mean age (year (yr)±SD)	37.1 (±12.3)
Duration of TMJ symptoms before surgery (yr)	6.6
Unilateral/bilateral discectomy (n)	48/16
Left joint/right joint (n)	37/43
Reoperated (n)	5

Almost all patients (98%) were treated conservatively prior to the surgical movement of the disc. The nonsurgical treatment included an occlusal splint, occlusal adjustment, physical therapy and intra-articular injection of corticosteroids. The mean duration of TMJ symptoms prior to surgery was 6.6 years (range 5 months to 27.8 years).Most of the patients (59 %) had disc displacement without reduction, 36 % with reduction and in 7 % of the patients, the disc position was unknown. Radiographic examination and medical charts indicated that 23 of the operated discs were perforated whereas 43 discs had no perforation, 14 were unknown.

The patient information was collected from journals. All data were anonymously treated by identification number technique. The identification key was stored in a locked safe during the study and destroyed upon completion of the study. All data was catalogued to contain patient background information such as gender, operation date, joint, pain and maximum opening before/after surgery. The protocol also contained: if and which non-surgical treatment the patients had been treated with; if the patients had undergone arthrography or lateral tomography and the findings from this, reciprocal clicking or closed lock, nerve complication, other medical histories of value and subjective evaluation of the last inspection.

Discectomy

All discectomies were performed at the Department of Oral and Maxillofacial Surgery, Umeå University Hospital by different oral and maxillofacial surgeons.

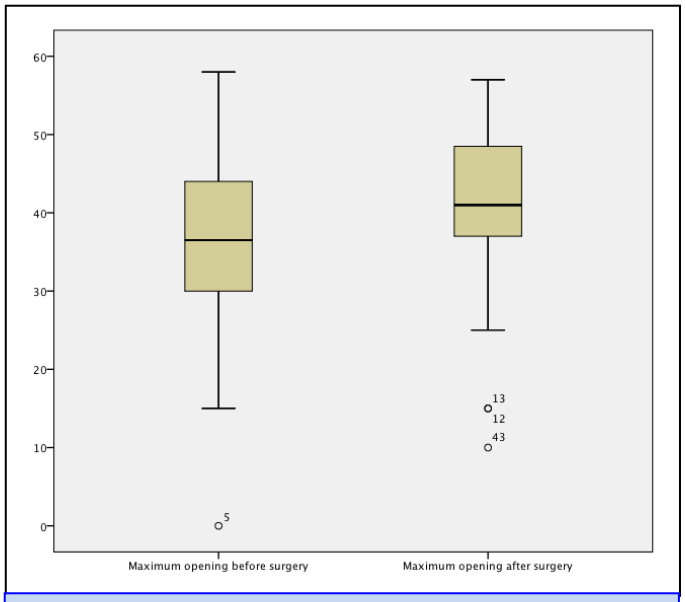

Figure 1: Maximum opening before and after surgery (millimetres).

A significant increase in mouth opening was seen after surgery, (Wilcoxon matched pairs test (P-value = 0.001))

The disc was removed with a preauricular approach under general anaesthesia and intravenous single dose of antibiotics (2g Ekvacillin). Cotton was placed in the external auditory canal for protection. To reduce the visible scar, the skin incision was placed in a preauricular skin fold (Supplemental Appendix, Figure 1A). The temporalis fascia was exposed, vessels were ligated or cauterized, and the temporalis fascia was followed down to the zygomatic arch. If the temporal artery or vein interfered with the incision these

vessels were ligated. The dissection continued with an incision of the superficial layer of the temporalis fascia in an anterosuperior direction. After exposure of the zygomatic arch, the lateral capsule was exposed. To expand the capsule local anesthesia was placed in the joint space. A horizontal incision in the superior part of the capsule provided access to the upper joint space. The lateral disc attachment to the capsule was cut for access to the inferior joint space (Supplemental Appendix, Figure 1B). The disc was removed by cutting the disc attachment to the capsule while holding the disc with a clamp and sent for histopathological examination (Supplemental Appendix, Figure 1C).

After removal, the joint space was irrigated thoroughly, and any haemorrhage was controlled before closure. Closure of the incision was made layer by layer with resorbable sutures. The skin incision was closed with non-resorbableetilone 5.0 (Supplemental Appendix, Figure 1D). A pressure dressing was applied on the first postoperative night. All patients were hospitalized on the first post-operative night. At discharge, analgetics (paracetamol and non-steroidal anti-inflammatory drugs) were provided together with instructions for jaw movements as well as dietary advice. One week after surgery, sutures were removed. Patients continued their post-operative treatment under the supervision of specialists in clinical oral physiology.

STATISTICAL METHODS

Data was catalogued in an Excel-file (Microsoft® Excel® for Mac 2011, Version14.0.0). Excel calculating program was used to calculate descriptive data. All tests were done with SPSS version 23. Wilcoxon matched-pairs test was used when comparing maximum jaw opening before and after surgery because of the non-normal distribution in the maximum opening after surgery. McNemar test was used when comparing pain before and after discectomy, clicking before and after surgery, crepitation before and after surgery and locking before and after surgery. The level of significance was set at 5 %.

Ethical consideration

The study was performed in accordance with the principles of the Helsinki Declaration.

RESULTS

Discectomy was performed in 80 Temporomandibular Joints (TMJ); Forty-eight patients had a unilateral discectomy and 16 patient's bilateral discectomy. Five patients were re-operated within three years post-operation due to persistent pain and/or limited mouth opening. In four of the five re-operated joints, lingering pieces of the disc were found. One reoperation was performed due to fibrous ankylosis. All the statistical analysis is based on the first operation.

Changes in pain post discectomy

A significant decrease in pain was seen six months after surgery compared to pre-operative status. (McNemar (P-value < 0.001)). (Table 2 and Supplemental Appendix, Table 1).

Changes in jaw movement

There was a statistically significant increase in maximum mouth opening six months after surgery (mean 41.8 mm) compared to pre-surgery (mean 36.7 mm), (Wilcoxon matched pairs test (P-value=0.001)). (Figure 1) summarizes the pre- and post-operative status on group level and (Figure 2) the change of mouth opening for the individual patient.

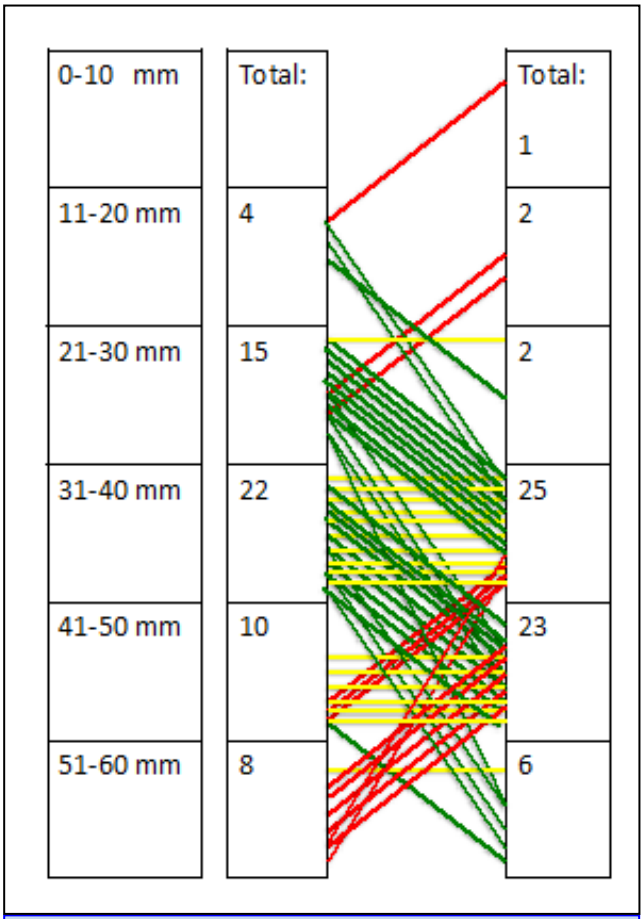

Figure 2: Summary of patients' maximum opening before and after surgery.

Every line represents one patient prior to and after surgery. Green colour indicates increased mouth opening, Yellow colour unchanged mouth opening and Red colour reduced mouth opening.

TMJ sounds

Before surgery, clicking dominated in the patient cohort. A significant decrease in the number of joints clicking was seen after surgery (McNemar test (P-value < 0.001)). No statistical difference between crepitation before surgery and after surgery (McNemar test (P-value = 0.125)). After surgery crepitation or no sound from the TMJ dominated in the patient cohort (Table 2).

Table 2: Clinical findings before and after discectomy.

Findings Numbers (%)	Number of TMJ[a] undergoing surgery (n = 80)	
	Before surgery	After surgery
Pain	63 (79%)	12 (15%)
No pain	4 (5%)	55 (69%)
Missing data	13 (16%)	13 (16%)
Crepitation	29 (36%)	27 (34%)
Clicking	34 (42%)	5 (6%)
No sound	16 (20%)	44 (55%)
Missing data	3 (4%)	11 (14%)
Locking	47 (59%)	9 (11%)
Missing data	1 (1%)	2 (2%)
Maximum opening <35 mm	30 (37%)	8 (10%)
Maximum opening ≥35 mm	44 (55%)	56 (70%)
Missing data	6 (8%)	16 (20%)

[a]Temporomandibular joint

Locking

After surgery, a significant decrease in locking of the TMJ´s was seen (McNemar test (P-value < 0.001)). More than half of the TMJ (59%) showed locking prior to surgery compared to 12% six months after surgery (Table 2).

Complications

Twelve (15%) of the operated joints had a temporary palsy of the temporal branch of the facial nerve directly after surgery. Two patients developed fibrous ankylosis.

Radiographic findings

Before surgery, 73/80 temporomandibular joints were examined by lateral tomography. 40/73 joints had a structural hard tissue change in the temporal bone or in caput mandibulae. After surgery, 29 joints were examined by lateral tomography where 23 joints showed new changes in the temporal bone or in caput mandibulae.

DISCUSSION

The overall result of our study is consistent with findings in other studies reporting results after discectomies. Women (86 %) were overrepresented in our study and this is similar to other studies [4,6,10,16-22,24-26]. According to the modified AAOMS criteria by Eriksson and Westesson [23], we can conclude that the surgical procedure resulted in a good result for 73 % of the patients. Only 12/63 (19%) patients had some degree of pain after surgery, however, our data did not allow further pain classification than presence or absence of pain. In prospective studies, a success rates of 80% to 90 % has been reported [10,20-22]. The follow-up periods in these studies are short or have a limited number of patients [21]. If we compare the result of the change of pain with other techniques, repositioning with Mitek anchors also led to a statistically significant decrease in TMJ pain (from VAS score of 7.70 (SD 2.7) to 2.25 (SD 2.9) [12]. Disc Replacement Using Viable Osteochondral and Umbilical Cord Allografts also leads to a significant decrease in VAS scores from 9.0 ± 2.0 preoperatively to 3.0 ± 3.0 postoperatively (P = .001) [11]. Disc repositioning, as well as disc repositioning with temporal eminectomy, also decreases the number of patients with pain post-operatively [13]. However, direct comparacy between the result from Perez et al. [12] and Connelly et al. [12] and the result from our study is difficult due to different ways of registering pain.

The mean age of surgery was 37 years, which is comparable to other studies [4,6,10,16-20,22,24-26]. Almost all patients in this follow up had non-surgical treatment before surgery, as recommended. The mean duration of TMJ symptoms prior to surgery was 6.6 years (range 5 months – 27.8 years). One can speculate about the impact a long pre-surgical treatment has on the surgical outcome itself. The results clearly indicated that discectomy was beneficial as a treatment of TMD. The results of our study showed that there was a significant decrease in pain after discectomy. This is comparable to the results from

Bjørnland and Larheim [4] who also showed a reduction of pain postoperatively with approximately 80 % of the patients without pain after 10 years [4]. However, this indicates that even after 10 years, some patients are not pain-free.

The surgery improved maximum opening. Fifty-six out of 64 patients had a mouth opening ≥ 35 mm after surgery. The increase occurred especially in patients who had an opening ≤ 40 mm before surgery. The mean interincisal opening for the patient cohort increased to 41.8 mm post-op. This is similar to other studies [4,16,26,27], where mean interincisal opening increased over time.

In contrast, as seen in (Figure 2), when maximum opening before surgery was in the range 41-60 mm, over 50 % of the patients had their opening capacity reduced after surgery. They still had a good mouth opening ability but not to the level as before surgery. One can speculate about the reduced mouth opening in our study: the surgery itself with the formation of scar tissue can affect the range of mouth opening. Further studies are needed to confirm these findings, but the phenomenon should be taken into consideration when informing the patient before surgical treatment. With other methods also, an increase in jaw-movement is seen post-surgery: With Disc Replacement Using Viable Osteochondral and Umbilical Cord Allografts, the mean maximal incisal opening increased from 31 ± 5 mm preoperatively to 36 ± 5 mm postoperatively [11]. Similarly, disc repositioning and disc repositioning plus temporal eminectomy decreased the number of patients with restricted jaw movement [13].

Lateral tomography was performed in 70 joints before surgery and 55 % of the joints had some degree of hard tissue change. The reactive response of the surrounding bone tissues in the TMJ can to a certain degree be the result of the disc displacement. This condition can be painful for the patient and cause joint sound and locking [28]. For patients examined with lateral tomography before as well as after the surgery, the majority still had structural changes in the temporal bone or/and in caput mandibulae. After removal of the disc, the condyle and glenoid fossa remodels and adjusts to the new conditions. Changes after surgery are normal functional adaptive changes rather than pathological changes [17,23,26]. The lateral tomography can be considered as a complement to the clinical examination. The results indicate however that it is not a direct connection between clinical symptoms and radiographic findings for the patient with TMD. Prior to surgery, approximately 50 % of the TMJ (34/77 joints) had clicking. After surgery, crepitation or no sound from the TMJ dominated. The number of patients with clicking decreased significantly over time similar to results observed in Bjørnland & Larheim [4].

The crepitation after surgery may be considered as a result of the removal of the disc and the remodelation in the temporal bone and caput mandibulae that may occur after discectomy. In our study, there was no significant difference between crepitation before and after surgery, and 34 % of the TMJ had crepitation after surgery. The amount of patients differs from the literature that reports 45-81 % crepitation in TMJ after surgery [4,20,21,24,25]. One explanation can be that our study has a short follow-up time. The number of patients with no joint sounds increased significantly post-op. The results are similar to those measured by Björnland&Larheim after 10 years. Reduction in the number of patients with joint sounds has also been observed after disc repositioning with Mitek anchors [12].

Locking of the joint after surgery was found in 12 % in the TMJs, compared to 59% prior to surgery. When the disc is removed the possibility of locking in the joint is lowered. Twelve patients had temporary palsy of the temporal branch of the facial nerve directly after surgery. This is consistent with previously documented complications [10,16,19,21,26]. Two patients developed fibrous ankylosis. There are several possible reasons why fibrous ankylosis occurs. A traumatic surgical technique, avoidance of postoperative bleeding, and intensive training of mandibular movements immediately postoperatively are principally essential for optimal joint function after discectomy [24]. No specific reason for the fibrous ankyloses could be found in the current cases.

Limitations of this study and future studies

The result from our retrospective follow up is based on the registrations six months after the discectomy. We have reported the symptoms one by one but in a long time prospective follow up the focus should be not only the clinical results as pain and maximum opening but also the patient experience from the surgical intervention in the

temporomandibular joint and how changes of symptoms interact.

Implications of results

This patient cohort will be followed in a long-term follow-up concerning the effect of discectomies.

CONCLUSION

Surgical removal of the disc in the temporomandibular joint reduces pain and increases mouth opening. The result from our study is consistent with other studies and recognizes discectomy as an effective treatment of persistent pain and/or limitation of mouth opening.

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SUPPLEMENTAL APPENDIX

Table1: Pain before and after surgery in the joint.

Pain before surgery	Pain after surgery	
	No	Yes
No	4	0
Yes	51	12

A significant difference in the decrease of pain was seen after surgery, (McNemar (P-value < 0,001)).

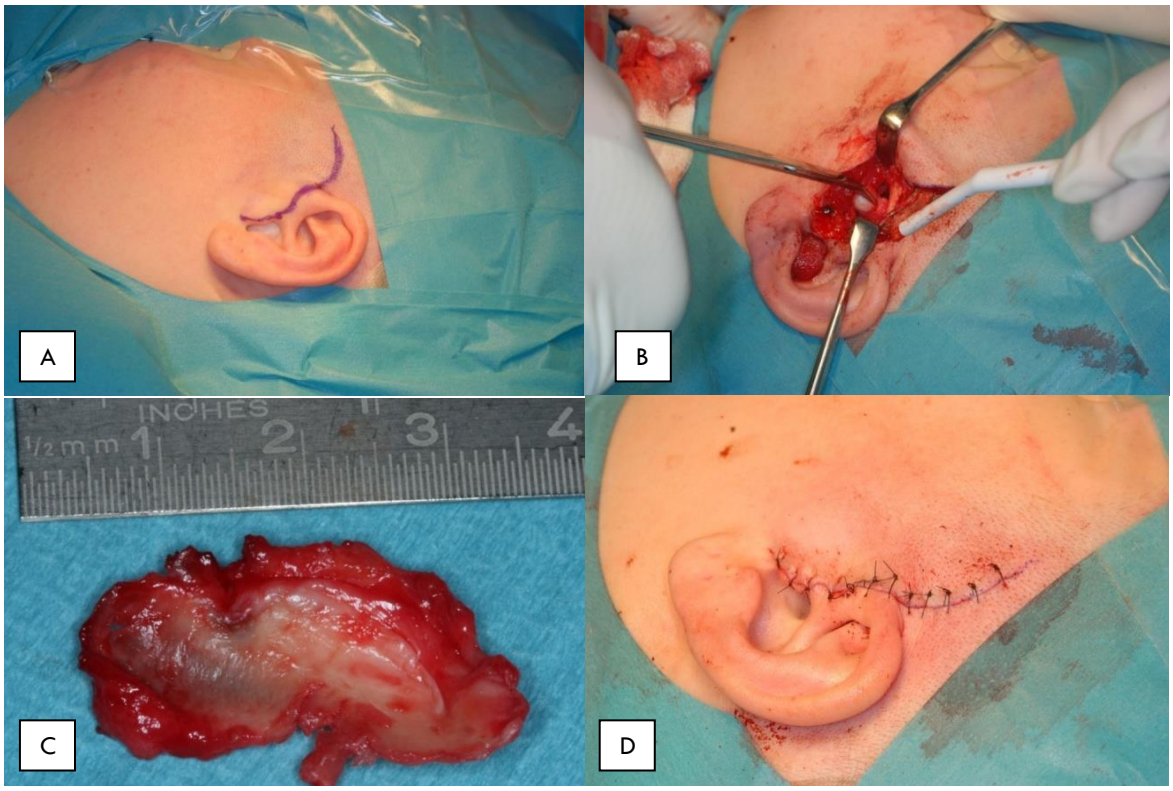

Figure 1: Discectomy, Surgical technique.

a) Preauricular incision, b) Exposure of the joint space, c) The removed disc, d) Closure of the incision.