Master's Thesis in Science in Medicine

Use of Acellular Dermal Matrix in Treatment of Congenital Muscular Torticollis in Patients Over 8-Years-of-Age

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- ABSTRACT-

Use of Acellular Dermal Matrix in Treatment of Congenital Muscular Torticollis in Patients Over 8-Years-of-Age

Background: Treatment for neglected or recurred congenital musculartorticollis should be differentiated from primary patients dueto the long-standing adjacent tissue contracture. The aim of thisstudy was to evaluate the effect of acellular dermal matrix (ADM)on surgery of recurred and neglected patients of congenital musculartorticollis.

Methods: Forty-nine patients were included in the study.All patientsunderwent resection at the distal end of the sternocleidomastoidmuscle. In the study group of 18 patients (ADM group), the defectcaused bymyectomyand scar tissue removal was covered withADM.Passive range of neck motion, head tilt, cosmetic and functionalsatisfaction, and scar was evaluated and compared with the controlgroup of 31 patients (non-ADM group) during follow-up. Logisticand linear regression analyses with adjustment by propensity scorewere performed to determine the association between ADMimplantation and postoperative variables.

Results: The mean follow-up period was 18.8 months. No patientrequired further operation for recurrence during follow-up. Theimprovement of neck motion in ADM group was significantlysuperior to non-ADM group at the 1-year follow-up, and theoverall assessment score was significantly higher in the ADMgroup. Acellular dermal matrix implantation was not associatedwith increased discharge of total drain.

Conclusions: In patients over 8-years-of-age with recurred orneglected congenital muscular torticollis, use of dermal substituteto fill the defect caused by torticollis release is effective inachieving satisfactory neck motion. Surgical sectioning of thesternocleidomastoid muscle and ADM graft should be consideredin recurred and neglected torticollis.

Key words :Acellular dermal matrix, congenital musculartorticollis, neglected torticollis, recurred torticollis

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I. INTRODUCTION

Congenital muscular torticollis (CMT) is an idiopathic conditionthat begins in infancy, during which the sternocleidomastoidmuscle (SCM) shortens and contracts on the affected side. Thiscauses ipsilateral tilt and contralateral rotation of the chin and face.It is the third most common congenitalmusculoskeletal anomaly aftercongenital hip dysplasia and clubfoot, with a frequency in newbornsof 0.3%to 2%.(1)–(5) The etiology of CMT remains controversial; it hasbeen linked to birth trauma, intrauterine malposition, infection, andvenous occlusion. Skull and facial asymmetry or plagiocephaly mayoccur in the presence of prolonged uncorrected head tilt.(6)

Congenital muscular torticollis usually presents as a hard massof the SCM on the affected side, accompanied by a characteristictilt. Nonsurgical management of CMT includes physiotherapy suchas manual stretching and botulinum toxin injections. Surgicaloptions comprise open tenotomy of the SCM (unipolar or bipolar),resection, and Z-lengthening of the SCM muscle. The outcome of surgery is influenced by its timing. The optimaltime of intervention is between 1 and 4 years of age.(7) Earlydiagnosis and treatment are important, but if neglected, it maydelay treatment. While controversial, sternocleidomastoid releasemay still be beneficial in neglected patients, leading to cosmetic andfunctional improvements.(8),(9) In older patients the efficacy of surgeryis reduced due to irreversible craniofacial deformity, and the risk ofcomplications is greater than for younger patients.(7) Because completerelease of contracture by SCM release alone may not befeasible in patients of long-standing adjacent tissue contracture, theconcept of the disease and the approach needed is different,compared with infantile patients.

Dong and Yu(10) proposed the application of scar contracturerelease principle to CMT treatment, applying the complete removalof contractured parenchyma. The principle is theoretically based onthe histological findings of fibrosis and muscle atrophy in CMT,similar to scar contracture in plastic surgery. Tissue contractionresults from fibroblast proliferation and excessive collagen deposition.Consequently, the treatment of neglected and recurrenttorticollis is approached from the standpoint of contracted scarmanagement. However, removal of scar tissue alone is not sufficientto prevent recurrence.

We have been interested in substituting the scarred tissue withmaterial that would be adequate in preventing recontraction anddevelopment of contracture. For this purpose, in March, 2013 webegan to use acellular human dermis as a tissue replacement formyectomy defects. AlloDerm (LifeCell Corp, Branchburg, NJ) is decellularizedhuman dermis that is devoid of immunogenic components. Whenplaced in vivo, it biointegrates by cellular repopulation andrevascularization, and becomes vascularized and remodeled withhost tissue afterimplantation.(11)AlloDerm processing removes theepidermis and the cellular components of the dermis, leavingcollagen and elastin, which control tensile strength and elasticity,proteoglycans that induce angiogenesis, laminin that maintainsbinding with the connective tissues, and basement membrane that consists of collagen type IV.(12),(13) Acellular dermal matrix (ADM)was released commercially in 1994 for the replacement ofinadequate integumental tissue due to burn injuries.(14) Since thenits use has broadened in scope and it has been used successfully inmany clinical cases, such as breast reconstruction,(15) abdominalhernia repair, Dupuytren treatment, and facial soft tissue augmentation.Acellular dermal matrix has also been reported for the treatmentof difficult or recurrent scar contracture in the hand followingburn wounds considering the inverse relationship between theamount of dermis and scar contracture.(16)

This report describes our experience with the use ofADMfor therelease of recurred and neglected CMT patients over 8-years-ofage.During the follow-up, the outcome of the surgery was evaluatedby analyzing clinical parameters including range of neckmotion. To the best of our knowledge, no prior study addressedtreatment of CMT using ADM as a replacement tissue.

II. MATERIALS AND METHODS

This study was conducted on 52 consecutive patients over 8-yearsof-age with CMT who had undergone surgical release of the SCMbetween May 2013 and July 2015 at our institute. We followed upall the patients for more than 12 months after surgery including themedical records, clinical photographs, and radiographs. Threepatients were lost to follow-up, leaving a total of 49 patients forevaluation and analysis. Congenital muscular torticollis was diagnosedbased on the clinical detection of a mass or fibrous band withdocumentation of a deficit in passive neck rotation in associationwith ipsilateral SCM muscle shortening. There were no othercongenital deformities in enrolled patients. Indications for surgerywere a persistent deficit of either passive neck rotation or lateralflexion (>10) observed for more than 6 months, and cosmeticproblems caused by head tilt. Conventional unipolar release wasperformed in all patients, with myectomy of the sternal andclavicular head of the SCM. In recurred patients, the contracturedscar tissue was removed along with the offending portion of themuscle. Patients were assigned to the study group (ADM group) ifthey accepted the use of ADM preoperatively. Otherwise, they wereassigned to the control group (non-ADM group). Each patient orlegal guardian decided whether to use ADM after receiving anexplanation of the nature of the material and the benefit ofADM usein other fields of plastic surgery. In the ADM group, legal guardiansof the patients gave consent to proceed with implantation of ADMafter an explanation of the potential risks and complications of theprocedures, such as infection or explantation. In the control group,no additional procedure was performed.

Surgical Technique and Postoperative Care

A uniform surgical method of distal unipolar open release wasperformed by a single surgeon under general anesthesia. Theinvolved side was placed under tension by hyperextending theneck and rotating the head toward the shoulder of the unaffectedside. Horizontal skin incision was placed 1 to 2 cm above themedial third of the clavicle of the affected side.After protecting theexternal jugular vein the platysma, adjacent fascia, and other softtissues were also resected. The 2 heads of the SCM were identifiedand divided by electrocautery. Both heads of the SCM measuringabout 2 cm in thickness were resected along with contractured softtissue bulk. The remaining tight deep fascia and additional contractedbandswere released completely (Fig. 1). In theADMgroup,the defect was then covered with 1.05-mm-thick sheets of AlloDerm tailored to the exact size of the myectomy and scar removaldefect, and hydrated before placement according to the manufacturer'sinstructions. Itwas fixed in the defect by absorbable sutures.One closed suction drain was placed beneath the AlloDerm. The drains were removed postoperatively when the amount was under10 mL/day. Follow-up documentation included daily drain volume,drain removal, signs of infection and hematoma, and otherpostoperative complications.Five days postoperatively, gentle neck movement was initiatedin all patients after drain removal. Two weeks postoperatively, afterconfirming the graft was taken without complication, neck stretchingexercise including active and passive movements was started,All patients were educated about performing stretching exercisesfor at least 15 minutes, 4 to 6 times daily. A neck brace was appliedfor at least 8 hours a day for 8 weeks.

Method of Assessment

Passive range of motion (PROM) of the neck was assessed forrotation and lateral flexion immediately after general endotrachealanesthesia was administered preoperatively. Each measurement wasperformed with the arthrodial protractor, with the patient in thesupine position with both shoulders stabilized, and the head andneck supported so that the neck was free to rotate and bend laterally.The extent of PROM was recorded when the examiner felt limitationof movement (Fig. 2). The difference between the affected andnormal sides was recorded as the rotational or flexional deficit. Thismethod can provide accurate measurement of subtle difference inSCM contraction. Passive range of motion was similarly evaluatedpreoperatively and at the 12-month follow-up. In addition, head tilt,cosmetic and functional satisfaction, lateral formation, and surgicalscar were evaluated at a 1-year follow-up visit. The overall outcomewas evaluated using a modification of a previously detailed scoringsystem (Table 1).17 In the authors' view, assessment of craniofacialasymmetry was irrelevant at this age, despite SCM release, becausethe growth potential is decreased and since postoperative correctionof craniofacial asymmetry cannot be expected. Scar evaluation wasperformed quantitatively. Two surgeons who were not involved with the study evaluated and graded the scar outcome of the neck incisionat the 1-year follow-up using the Vancouver scar scale (VSS), whichincludes pigmentation (0, normal; 1, hypopigmented; 2, mixedpigmentation; 3, hyperpigmented), vascularity (0, normal; 1, pink;2, red; 3, purple), pliability (0, normal; 1, supple; 2, yielding; 3,firm; 4, banding; 5, contracture), and height (0, flat; 1–2 mm; 2, 2–5 mm; 3, >5 mm). The score for each parameter was scoredseparately, and then all 4 parameters were summed.

Statistical Analyses

The value of outcome was checked for normality distributionwith the Shapiro–Wilk test or, when necessary, Kolmogorov–Smirnov test with Lilliefors correction. Collected data are comparedbetween the 2 groups. x2 test or Fisher exact tests were used toexamine differences in categorical characteristics between the 2groups. Two-sample t test or Wilcoxon rank sum test was used toexamine differences in continuous characteristics. To reduce potentialselection biases arising from nonrandom allocation of observationalstudies, the inverse probability of treatment weighting viapropensity score was used.18 The propensity score was generatedfrom logistic regression model based on covariates including age,sex, location, recurrence, preoperative rotation deficit, and preoperativeflexion deficit. To examine the association between the useof ADM and the surgical outcomes, we performed multivariatelogistic regression and linear regression, after adjusting for age, sex,and several confounders, and also weighted model via propensityscore was used. R language software Version 3.2.1 (R Foundationfor Statistical Computing, Vienna, Austria) was used for allanalyses. Data are presented as the mean value and standarddeviation. A P value <0.05 was considered statistically significant.

III. RESULT

The mean age at presentation was 15.0 years (range, 8–41 years).The right side was involved in 24 patients and the left side in 25patients. The primary objective for surgery was cosmesis in 28 patients and functional deficit in 21 patients. Fifteen had previousoperation for SCM release. The mean number of the previousoperations for the recurred patients was 1.4 (range, 2–4). Eighteenpatients (36.7%) had computed tomography -confirmed plagiocephalyat presentation and 29 (59.2%) had facial asymmetry onphysical examination and computed tomography.
The mean follow-up period was 18.8 months (range, 13–32months). The mean period of postoperative physical therapy was4.8 months. No patient required further operation for recurrenceduring the follow-up. No major complications were noted duringthe follow-up in both groups, including wound infection, hematoma,and spinal accessory nerve injury. One patient of suspiciousor subclinical infection was noted in an ADM-implanted patient,presenting serous drainages of 3 times the average amount and drainremoval at postoperative day 5. No signs of systemic infection orreoperation were seen.
The mean age at operation differed between the groups, being18.7 years (range, 8–36 years) in the ADM group and 14.3 years(range, 8–41 years) in the non-ADM group, without significance(Table 2). Male-dominance was significant in the ADM group,compared with the non-ADM group. There were more patients ofrecurred torticollis and more previous surgeries in the ADM groupwith statistical significance. In patients of ADM implantation, theaverage size of implanted ADM was 7.24 cm2 (range, 3–12 cm2).Preoperative deficit of neck rotation and lateral flexion in the ADMgroup averaged 15.38 and 28.98 respectively. No statistical differencewas shown in relation to baseline deficit of neck motionbetween the 2 groups. To simulate randomized distribution betweenthe groups, an inverse probability of treatment weighting using thepropensity score was introduced. After propensity weighting, thebalance between the 2 groups improved.
In both groups, the mean deficit of rotation and lateral flexionwere improved significantly by 1-year follow-up (Figs. 3 and 4). Inall patients, the limitation of cervical rotation improved by anaverage 13.2 from 18.6 preoperatively to 5.3 postoperatively,with the limitation of lateral flexion improving by an average 24.5from 31.5 preoperatively to 7.0 postoperatively. The

results werestatistically significant on paired samples t test ($P<0.05$).

The deficit of lateral flexion at 12-month follow-up was significantlylower in the ADM group compared with the non-ADMgroup ($P=0.042$; Table 3). However, postoperative rotation deficitwas not different significantly between the groups. The incisionalscar was satisfactory in both groups. The 2-cm neck scar, camouflagedin a skin crease, seemed acceptable to all patients. Thepostoperative scar of neck incision was assessed using VSS at 12-month follow-up. The mean VSS scores of the ADM group weresignificantly lower than that of the non-ADM group (1.80 versus2.44; $P<0.05$). However, the range of VSS scores in both groupswas 1 to 4 and the difference was minimal, hence it was concluded that scar outcome was acceptable in both groups. Average drainvolume showed no statistical difference between the 2 groups.Average duration of drain indwelling was higher in the ADMgroup, with statistical difference (2.86 and 2.29 days in theADM and non-ADM groups, respectively).

Results of logistic regression analysis showed that preoperativedeficit of neck motion was a significant predictor forpostoperative deficit of less than 10 (Table 4). Acellulardermal matrix implantation was also found to be associatedwith being belong to the group of postoperative deficits withless than 10 ($P=0.047$). Patients with a history of surgicalrelease were associated with VSS score of over 3, in bothunweighted and weighted models (Table 5). Acellular dermalmatrix was not a significant predictor for drain indwellingperiod of over 2 days in the logistic regression model. In linearregression analysis of overall score and total drainage volume,use of ADM was significantly associated with higher overallscore of the assessment chart (Table 6). Age negatively affectedthe total amount of drain discharge in both unweighted andweighted models. The patients with history of surgical releasewere significantly more likely to have larger volume of totaldrainage in weighted model.

IV. DISCUSSION

It remains controversial whether surgical treatment of CMT isbeneficial in neglected adult patient, for the effectiveness of surgeryis more or less noncontributory and the irreversibility of craniofacialasymmetry. However, craniofacial asymmetry is still ongoing inneglectedCMT.(19) With respect to the treatment in neglected patients,many reports support the notion for surgical intervention.(9),(20)–(22) Judging by the effectiveness of surgery and the ongoing nature ofplagiocephaly, surgical intervention is needed to prevent progressionof craniofacial asymmetry in adults with neglected CMT.

The histological picture of muscular torticollis is similar to thatof scar contracture, typified by interstitial fibrosis and hyperplasialeading to tissue contraction. Compared with primary infantileCMT, the extent of surgery is extensive due to long-standingadjacent tissue contracture in adult neglected patients; the situationis much the same in recurred patients. The therapeutic strategies forrecurred and neglected CMT should be differentiated from the primary patients. Most primary CMT presents at an early age andrelease of the SCM alone is sufficient to achieve a stable long-termoutcome. Because complete release of contracture by simple SCMtenotomy or SCM resection alone is difficult to achieve in neglectedor recurred patients, we propose a different technique. As in the release of scar contracture in other areas of the body, completeresection of contractured scar tissue along with the causativeportion of SCM is performed first. The resultant tissue deficit isto be restored because the size of the deficit is much larger than thatof infantile patients. The soft tissue defect tends to contract duringhealing, which favors recurrent torticollis. As the amount of thedermal component contributes to the prevention of contractures inburn surgery,(23) we sought to fill the defect with a dermal substitute.

Numerous factors could contribute to favorable outcomes;according to the present study, the defect caused by myectomyand scar resection was filled with ADM in patients with recurred orneglected congenital muscular torticollis. The long-term result wassuperior to the conventional method. The graft was well taken onthe defect and seemed to prevent further contracture. Althoughsome degree of resorption of ADM during the postoperative periodis anticipated, it is crucial that the defect be completely filled withthe graft without residual dead space during operation, which seemsto facilitate graft take without complication. The authors proposethat this technical tip may also secure a reliable outcome.

We inserted a closed suction drain beneath the ADM layer withthe aim of decreasing the infection rate. Most patients of infection inADM-based breast reconstruction found upon surgical explorationhave at least a subclinical degree of seroma in the sub-ADMpocket.(24) Thus, we presume that the placement of a drain coulddecrease seroma formation and subsequent infection rate. The deadspace is much larger in secondary and neglected patients comparedwith primary patients, emphasizing the importance of drain placement.Along with soft postoperative compression dressings, conservativedrain removal threshold <10mL in 24 hours can yieldboth reduced dead space and seroma. When the volume of drainagewas small enough that we could remove the drain on day 2 postoperatively,vigorous neck stretching exercise including active andpassive movements was started 2 weeks postoperatively.

Plastic surgeons are familiar with the use of ADM in many otherfields of reconstructive surgery. Acellular dermal matrix is commonlyused for implant-based breast reconstruction, and recentreports of patients undergoing revisional breast reconstruction usingADM indicate that long-term results are good, with a low rate ofcomplication and few revisionary surgeries needed during follow-upperiods of up to 5 years.(25) Acellular dermal matrix exhibits a modestdegree of stretching during tissue expander/implant breast reconstruction. (15) Instead of full-thickness skin grafting in burn contracturerelease of the hand,ADMcan be effectively usedwith split-thicknessskin.(16) The dermal component seems to resist the tissue contracture.

The present study demonstrates the value of using ADM as softtissue reconstructive material to obtain a better long-term functionalresult in the treatment of recurred or neglected CMT. Limitationsinclude the small number of patients and the absence of randomization.Although the ADMgroup was not chosen randomly, it is clearthat long-term result of release with ADM is effective. The surgicaloption may be of greatest benefit in patients in whom more than 2operationswere done previously. Given the fact that no more surgicalstep was necessary in the patients of multiple previous operations, thelack of random distribution may have been somewhat offset.

V. CONCLUSION

In patients with recurred or neglected CMT, use of dermal substituteto fill the defect caused by torticollis release is effective in preventingrecurrence and achieving a satisfactory range of motion ofthe neck. Surgical sectioning of the SCM and ADM graft should beconsidered in recurred CMT, even in adults with neglected CMT.The surgery restores the range of neck motion and resolves the headtilt, and so can improve the quality of life.

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FIGURE 1. (A) After monopolar release of right sternocleidomastoid muscleheads, tight deep fascia and additional contracted bands remained. (B) Defectafter myectomy and complete soft tissue release. (C) The defect was covered by1~4 cm tailored acellular dermal matrix. Closed suction drain was placedbeneath the acellular dermal matrix. (D) The contractured soft tissue wascompletely released by excising a 4-cm-wide fibrous band.

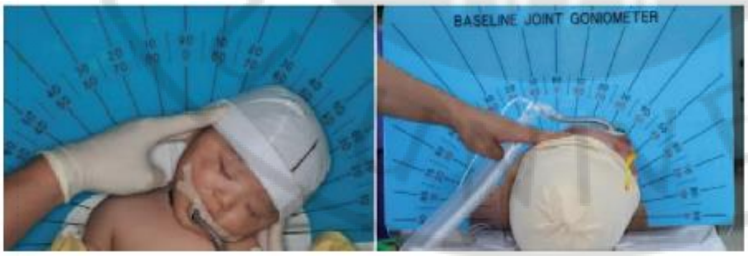

FIGURE 2. Measurement of passive range of neck motion with arthrodialprotractor. The neck was free to rotate and bend laterally under generalanesthesia. When the examiner felt limitation of movement, the passive range ofmotion was recorded

TABLE 1. Scoring System of Surgical Outcomes at 12-Month Follow-Up

Assessed Outcomes	Excellent (3 Points)	Good (2 Points)	Fair (1 Point)	Poor (0 Point)
Rotational deficit	<6	6–10	11–15	>15
Lateral flexion deficit	<6	6–10	11–15	>15
VSS score	<3	3–4	5–6	>6
Residual band	No	Lateral	Lateral, clavicular	Lateral, clavicular, sternal
Patient satisfaction (cosmetic and functional)	Excellent	Good	Fair	Poor
Head tilt	No	Mild	Moderate	Severe

VSS, Vancouver scar scale.
Modified from Cheng and Tang;[17] overall scores range from 0 to 21 points.

FIGURE 3. Preoperative (upper row) and 3-month follow-up (lower row)photographs of a 12-year-old boy with left-side torticollis. The patient hadreceived 2 previous operations. Acellular dermal matrix graft was performed. Hehad 258 of deficit of rotation and lateral flexion preoperatively (B, C) andachieved a full range of motion postoperatively (E, F). Postoperative neutralposition (D) was improved from preoperative neutral position (A).

FIGURE 4. Preoperative (upper row) and 20-month follow-up (lower row)photographs of a 19-year-old male patient with neglected right-sidetorticollis. Acellular dermal matrix graft was performed. He had 108 of deficit ofrotation and 308 of lateral flexion preoperatively (B, C) and achieved a full rangeof motion postoperatively (E, F). Postoperative neutral position (D) wasimproved from preoperative neutral position (A).

TABLE 2. Demographic and Clinical Characteristics of Acellular Dermal Matrix Group and Non-Acellular Dermal Matrix Group

Characteristics	ADM Group (n ¼ 18)	Non-ADM Group (n ¼ 31)	P Value	P Value[z] (Weighted)
Age, mean SD (years)	18.7 8.7	14.3 7.8	0.064	0.804
Gender, male/female (%)	77.8/22.2	38.7/61.3	0.019[y]	0.351
Side, right/left (%)	50/50	51.6/48.4	>0.999[y]	0.915
History of physiotherapy, n (%)	8 (44.4)	14 (45.2)	0.754	0.864
Recurred patients, n (%)	12 (66.7)	3 (9.7)	<0.001[y]	0.247
Number of prior operation, mean SD	0.9 0.9	0.1 0.3	<0.001	NA
Preoperative rotation deficit, mean SD (8)	15.3 6.5	19.5 12.0	0.290	0.384
Preoperative flexion deficit, mean SD (8)	28.9 13.2	31.8 12.7	0.652	0.632
Follow-up duration, mean SD (months)	16.2 7.2	20.3 8.2	0.063	0.316

ADM, acellular dermal matrix; SD, standard deviation.
Two-sample t test or Wilcoxon rank sum test.
[y]x^2test or Fisher exact test.
[z]Weighting by propensity score.

TABLE 3. Comparison of Surgical Outcomes for Passive Range of Motion Deficit, Scoring System, and Drainage Between the Groups

Characteristics	ADM Group (n ¼ 18)	Non-ADM Group (n ¼ 31)	P Value
Postoperative PROM deficit			
Rotational deficit, mean SD (8)	5.56 5.11	6.616.24	0.792
Lateral flexion deficit, mean SD (8)	4.17 4.29	8.556.85	0.042
Assessment			
VSS score, mean SD	1.80 0.86	2.440.75	0.016
Overall score, mean SD	17.5 1.3	15.52.0	0.002
Closed suction drainage			
Total drainage, mean SD (mL)	47.6 43.6	23.217.0	0.053
Drain removal, mean SD (days)	2.86 0.83	2.290.54	0.010

ADM, acellular dermal matrix; PROM, passive range of motion; SD, standard deviation; VSS, Vancouver scar scale.
Two-sample t test or Wilcoxon rank sum test.

TABLE 4. Results of Multivariate Logistic Regression Models Predicting Rotation Deficit and Flexion Deficit of Less Than 108 at 12-Month Follow-Up

	Rotation Deficit (<108)			Flexion Deficit (<108)		
Predictors	OR (95% CI)	P Value	P Value (Weighted)	OR (95% CI)	P Value	P Value (Weighted)
Age	1.03 (0.96–1.11)	0.429	0.196	1.01 (0.94–1.08)	0.857	0.904
Sex (female)	0.95 (0.86–1.03)	0.209	0.063	1.82 (0.59–5.81)	0.305	0.487
Preop. rotation deficit	0.89 (0.81–0.96)	0.010	0.030	1.00 (0.94–1.05)	0.847	0.711
Preop. flexion deficit	0.99 (0.95–1.04)	0.785	0.834	0.90 (0.81–0.99)	0.043	0.047
Side (right)	1.50 (0.19–4.72)	0.477	0.206	1.52 (0.49–4.78)	0.470	0.225
Recurrence	0.88 (0.25–2.97)	0.830	0.831	0.47 (0.13–1.59)	0.228	0.602
Physiotherapy history	0.95 (0.8–1.03)	0.209	0.051	3.38 (0.71–16.07)	0.132	0.175
ADM graft	0.45 (0.11–1.64)	0.230	0.230	5.46 (1.59–20.00)	0.010	0.100

ADM, acellular dermal matrix.

TABLE 5. Results of Multivariate Logistic Regression Analysis of Vancouver Scar Scale Score (>3) and Day of Drain Removal (>2 Days)

	VSS Score (>3)			Day of Drain Removal (>2 Days)		
Predictors	OR (95% CI)	P Value	P Value (Weighted)	OR (95% CI)	P Value	P Value (Weighted)
Age	0.91 (0.82–0.99)	0.053	0.097	1.13 (1.02–1.27)	0.028	0.138
Sex (female)	2.09 (0.64–7.16)	0.228	0.423	0.38 (0.11–1.19)	0.102	0.788
Recurrence	5.26 (1.77–33.33)	0.050	0.015	2.75 (0.80–10.06)	0.112	0.272
Physiotherapy history	0.99 (0.93–1.08)	0.975	0.346	0.97 (0.91–1.01)	0.187	0.208
ADM graft	0.85 (0.16–4.34)	0.840	0.583	1.46 (0.31–6.35)	0.617	0.565

ADM, acellular dermal matrix; VSS, Vancouver scar scale.

TABLE 6. Results of Linear Logistic Regression Analysis of Overall Score and Total Drainage

	Overall Score			Total Drainage		
Predictors	Coefficient (95% CI)	P Value	P Value (Weighted)	Coefficient (95% CI)	P Value	P Value (Weighted)
Age	0.05 (0.02–0.12)	0.177	0.297	0.05 (0.02–0.09)	0.009	0.028
Sex (female)	1.13 (2.27–0.02)	0.053	0.986	0.11 (0.60–0.82)	0.763	0.189
Recurrence	1.21 (0.03–2.45)	0.056	0.452	0.74 (0.01–1.47)	0.051	0.028
Physiotherapy history	0.04 (1.11–0.04)	0.320	0.150	0.03 (0.70–0.02)	0.258	0.070
ADM graft	2.11 (1.05–3.18)	<0.001	<0.001	0.05 (0.77–0.66)	0.877	0.168

- 국문요약 -

Use of Acellular Dermal Matrix in Treatment of Congenital Muscular Torticollis in Patients Over 8-Years-of-Age

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일정 시기 이후까지 치료받지 않은 근성 사경환자들은 흉쇄유돌근의 구축 및 주변 조직과의 유착이 심하기 때문에 영유아기의 수술 받는 근성 사경 환자들과는 구별되어야 한다. 본 연구에서는 무세포성 진피 기질 (ADM)이 재발하거나 영유아기에 치료받지 않은채로 남겨진 환자들의 수술에 어떠한 유용성이 있는지 밝힌다.

31명의 고식적인 수술 방법을 이용한 환자들과 18명의 ADM을 사용한 환자들로 총 41명의 환자들이 연구대상이 되었고 각각 수술 전 후의 목관절의 정상측과환측의 운동가능 범위의 차이와, 수술 후 미용및 기능적인 만족도등을 조사 하였다. 또한 선형회귀 분석을 이용하여 ADM과 수술 후 예후의 전반적인 점수의 상관 관계에 대하여 규명하였다.

평균 18.8개월의 추적관찰 기간동안 재발로 인한 추가 수술이 필요한 환자는 없었으며 ADM을 사용한 환자들에게서 목의 움직임이 ADM을 사용하지 않은 환자들에 비해서 호전되는정도가 컸다. 또한 목 운동 및 미용, 기능적인 만족도 까지 같이 평가한 점수에서도 ADM을 사용한 환자들이 더 높은 점수를 받았다.

따라서 8세 이상의 재발하거나 치료받지 않았던 근성사경 환자들의 수술에 있어서 고식적인 사경의 흉쇄유돌근의 절제를 통한 이완술 이외에도 추가로 ADM 이식을 하는 것이 환자의 기능 및 미용적인 측면에서 도움이 될 수 있는 것으로 보여진다.

Key words :Acellular dermal matrix, congenital musculartorticollis, neglected torticollis, recurred torticollis