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OUTCOMES OF COSTOCHONDRAL GRAFTING IN THE MANAGEMENT OF UNILATERAL PEDIATRIC TEMPOROMANDIBULAR JOINT ANKYLOSIS AT TERTIARY CARE HOSPITAL: A CROSS-SECTIONAL STUDY

Original Research

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ABSTRACT

Objective: To assess the outcomes of costochondral grafting in managing unilateral temporomandibular joint (TMJ) ankylosis among pediatric patients at a tertiary care hospital.

Methodology: Conducted as a cross-sectional investigation the research took place at the Department of Oral and Maxillofacial Surgery Mardan Medical Complex from 25-08-2024 to 25-05-2025. A total of 126 children aged 4 to 12 years were recruited using non-probability convenient sampling with inclusion limited to those with unilateral TMJ ankylosis and exclusion of Swahney Type 2 cases previously operated patients non-traumatic etiologies or those with growth abnormalities. Each child underwent a detailed history review and clinical examination with ankylosis type confirmed via CT scan. Surgery involved removal of the ankylotic mass and reconstruction with a costochondral graft from the sixth or seventh rib. Outcomes maximum interincisal opening (MIO) reankylosis and graft resorption were evaluated clinically and radiographically at one three and six months. post-surgery.

Results: Findings revealed an average participant age of 8.44 years (±2.557) with 55.6% male (70 children) and 44.4% female (56 children). Normal MIO (30–35 mm) was achieved by 67.5% (85 children) while 32.5% (41 children) fell below this range. Reankylosis occurred in 11.1% (14 children) and graft resorption affected 19.0% (24 children) with 88.9% and 81.0% remaining free of these complications respectively.

Conclusion: The study concludes that costochondral grafting proved largely effective though reankylosis and resorption posed challenges in a minority. These insights suggest refining surgical techniques and enhancing follow-up care to optimize results.

Keywords: Costochondral grafting pediatric TMJ ankylosis maximum interincisal opening reankylosis graft resorption unilateral ankylosis.

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INTRODUCTION

Temporomandibular joint ankylosis (TMJA) occurs due to the fibrous and bony fusion that connects the condylar head with the glenoid fossa, presenting an important problem for patients as well as a complex challenge for surgeons. This condition is characterized by limited movement of the jaw, leading to problems with chewing, difficulties in speech, facial inconsistencies, compromised airway function, as well as psychosocial issues, particularly in younger populations. Trauma as well as infection are the primary reasons; however, TMJA may also arise after TMJ surgery and in the context of systemic diseases that include rheumatoid arthritis.[1-3]

In pediatric populations, TMJA substantially contributes to facial asymmetry as well as retrognathia. Significant facial asymmetry along with restricted mouth opening result in multiple functional challenges, including difficulties with chewing and sustaining oral hygiene. These issues can contribute to additional complications and ultimately lead to psychosocial impairments.[4-6] Severe Class II malocclusion characterized by posterior crossbite as well as anterior open bite can manifest in instances of TMJA. In bilateral cases, their appearance resembles that of a bird's face due to reduced chin growth. On the other hand, unilateral cases exhibit facial asymmetry, with the chin deviating regarding the affected side.[7]

The management of pediatric TMJA presents a complex and challenging clinical scenario. The primary goal in managing pediatric patients is to restore mandibular function, prevent or fix facial deformities, and avoid re-ankylosis.[6] There are several treatment options for managing TMJA, including gap arthroplasty, interpositional arthroplasty, and total joint reconstruction using autogenous grafts. [6] Gap arthroplasty necessitates a gap of 10-20mm, which usually leads to mouth deviation. [7] Interpositional arthroplasty necessitates a relatively smaller gap.[7] A study indicates that 80% of cases attained normal growth, with a mean maximal interincisal opening of 35mm, while reankylosis occurred in 20% of cases. [7]

This study aims to assess the outcomes, including maximum interincisal opening, reankylosis, and graft resorption, of Costochondral grafts in a pediatric population with unilateral TMJ ankylosis. Both clinical and radiographic evaluations will be conducted, as this type of study has not been previously undertaken at our center. The findings of my research will contribute to the current body of knowledge and establish local evidence. The findings of this study will be utilized by policy makers, planners, health managers, hospital administrators, practitioners, and surgeons. This study's findings aim to enhance awareness among healthcare professionals and the general public about the issue, while also contributing to the development of new protocols for managing TMJ ankylosis in the local pediatric population.

METHODOLOGY:

The study was conducted within the Department of Oral and Maxillofacial Surgery at Mardan Medical Complex spanning from 25-08-2024 to 25-05-2025. A cross-sectional design was employed to explore the outcomes of costochondral grafting in pediatric patients with unilateral temporomandibular joint ankylosis. The sample consisted of 126 children a size determined by assuming 9% of reankylosis[10] which allowed estimation of the true population proportion with a 7% margin of error at a 95% confidence level.

Eligible participants were pediatric patients aged 4 to 12 years presenting with unilateral TMJ ankylosis regardless of gender who met specific inclusion criteria while those with Swahney Type 2 ankylosis prior surgical interventions non-traumatic etiologies or other growth abnormalities were excluded. Patients who satisfied these criteria and sought care at the oral and maxillofacial surgery unit were enrolled after the study received ethical clearance from the hospital's Maxillofacial Surgery Department ethical committee. Following informed consent from their guardian a comprehensive history was taken and a thorough clinical examination was performed under the direct oversight of a supervisor. The type of ankylosis was evaluated both clinically and radiographically with final diagnoses confirmed via CT scans. Surgical intervention involved excision of the ankylotic mass followed by joint reconstruction using a costochondral graft harvested from the patient's sixth or seventh rib. Outcome measures including maximum interincisal opening reankylosis and graft resorption were assessed through clinical and radiographic evaluations at follow-up visits scheduled for the first third and sixth months post-surgery. All relevant data encompassing demographic details such as age and gender as well as the study's primary outcomes were meticulously recorded on a pre-designed proforma.

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Data analysis was carried out using IBM SPSS version 24. For numerical variables like age and maximum interincisal opening means and standard deviations were computed though medians and interquartile ranges were calculated if the data deviated from normality as assessed by the Shapiro-Wilk test. Categorical variables including reankylosis and graft resorption were summarized using frequencies and percentages and these outcomes were further stratified by age and gender for deeper analysis. Statistical significance was tested using either the chi-square test or Fisher's exact test depending on the data's characteristics with a p-value of 0.05 or less deemed significant. The results were then presented in the form of tables and charts to facilitate interpretation and dissemination.

RESULTS:

The study gathered data from 126 children aged between 4 and 12 years with an average age of 8.44 ±2.557 years. When looking at how these participants were distributed across age groups 48.4% fell into the 4 to 8 years bracket while 51.6% were in the 9 to 12 years range showing a fairly even split with a slight tilt toward the older group (Figure 1). In terms of gender 70 participants were male making up 55.6% of the sample and 56 were female comprising 44.4% indicating a moderate male predominance (Figure 2).

Regarding the type of ankylosis observed the majority of cases were classified as Type 3 with 67.5% falling into this category. This was followed by Type 2 seen in 24.6% patients. Type 1 was less common affecting 4.8% while Type 4 was the rarest present in 3.2% patients. When considering the side of ankylosis the right side was more frequently involved with 63.5% patients compared to the left side which occurred in 36.5% (Table 1).

Turning to the outcomes of costochondral grafting the maximum interincisal opening defined as achieving a range of 30 to 35 millimeters was successfully attained in 67.5% of the sample while 32.5% did not reach this threshold suggesting that a substantial majority experienced favorable mouth-opening results six months after surgery. Reankylosis assessed clinically and radiographically at the six-month mark occurred in 11.1% patients leaving 88.9% free from this complication indicating a relatively low recurrence rate. Graft resorption another key outcome evaluated at six months was observed in 19.0% patients while 81.0% showed no signs of resorption reflecting a generally stable graft integration in most cases (Table 2).

Upon stratification of the outcomes with age, side of ankylosis, type of ankylosis and gender did not yield any notable association ($P > 0.05$) (Table 3 to 6).

Figure 1 Age groups (Years)

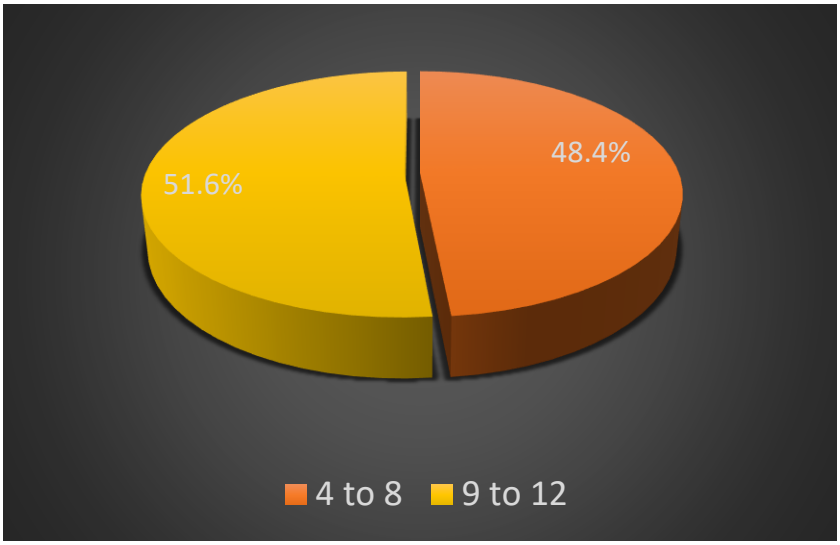

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Figure 2 Gender distribution

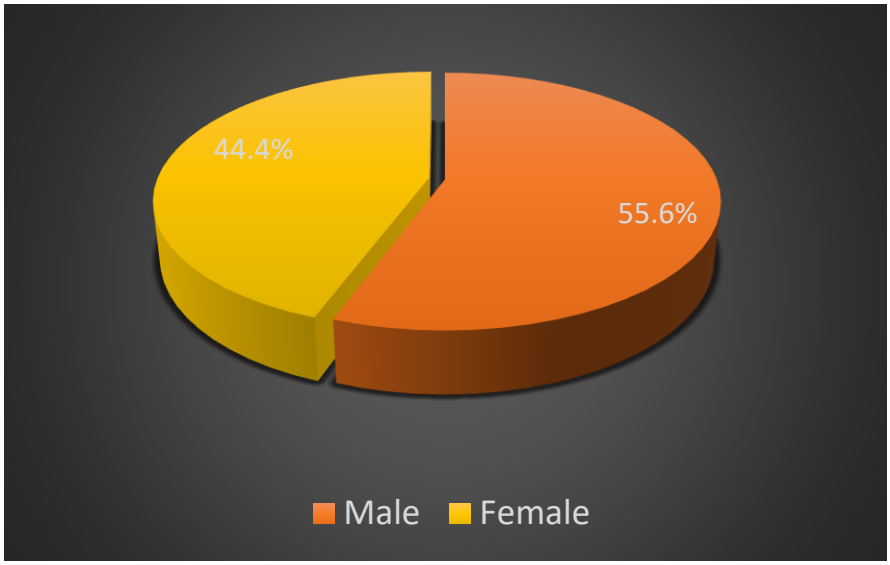

Table 1: Clinical characteristics

Clinical characteristics		N	%
Type of ankylosis	Type1	6	4.8%
	Type 2	31	24.6%
	Type3	85	67.5%
	Type 4	4	3.2%
Side of ankylosis	Right	80	63.5%
	Left	46	36.5%

Table 2: Outcomes

Outcomes		N	%
Maximum interincisal opening (30 to 35 mm)	Yes	85	67.5%
	No	41	32.5%
Reankylosis	Yes	14	11.1%
	No	112	88.9%
Graft resorption	Yes	24	19.0%

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	No	102	81.0%

Table 3: Association of outcomes with age

		Age groups (Years)				P value
		4 to 8		9 to 12		
		n	%	n	%	
Maximum interincisal opening (30 to 35 mm)	Yes	44	51.8%	41	48.2%	0.27
	No	17	41.5%	24	58.5%	
Reankylosis	Yes	4	28.6%	10	71.4%	0.11
	No	57	50.9%	55	49.1%	
Graft resorption	Yes	14	58.3%	10	41.7%	0.28
	No	47	46.1%	55	53.9%	

Table 4: Association of outcomes with gender

		Gender				P value
		Male		Female		
		n	%	n	%	
Maximum interincisal opening (30 to 35 mm)	Yes	49	57.6%	36	42.4%	0.49
	No	21	51.2%	20	48.8%	
Reankylosis	Yes	7	50.0%	7	50.0%	0.65
	No	63	56.2%	49	43.8%	
Graft resorption	Yes	14	58.3%	10	41.7%	0.76
	No	56	54.9%	46	45.1%	

Table 5: Association of outcomes with Type of ankylosis

		Type of ankylosis								P value
		Type1		Type 2		Type3		Type 4		
		n	%	n	%	n	%	n	%	
Maximum interincisal opening (30 to 35 mm)	Yes	2	2.4%	22	25.9%	58	68.2%	3	3.5%	0.32
	No	4	9.8%	9	22.0%	27	65.9%	1	2.4%	
Reankylosis	Yes	1	7.1%	5	35.7%	8	57.1%	0	0.0%	0.63
	No	5	4.5%	26	23.2%	77	68.8%	4	3.6%	
Graft resorption	Yes	2	8.3%	7	29.2%	14	58.3%	1	4.2%	0.68

	No	4	3.9%	24	23.5%	71	69.6%	3	2.9%

Table 6: Association of outcomes with Type of ankylosis

		Side of ankylosis				P value
		Right		Left		
		n	%	n	%	
Maximum interincisal opening (30 to 35 mm)	Yes	54	63.5%	31	36.5%	0.99
	No	26	63.4%	15	36.6%	
Reankylosis	Yes	7	50.0%	7	50.0%	0.26
	No	73	65.2%	39	34.8%	
Graft resorption	Yes	16	66.7%	8	33.3%	0.72
	No	64	62.7%	38	37.3%	

DISCUSSION:

Our results suggest that costochondral grafts are an effective treatment option providing functional benefits in terms of mouth opening and facial symmetry though complications such as reankylosis graft resorption and overgrowth remain concerns as seen in other studies.

Regarding Maximum Interincisal Opening (MIO) we found that 67.5% of the patients achieved an MIO between 30 and 35 millimeters which is considered a satisfactory result. This outcome aligns with the findings of Sharma et al. and Medra et al. both of which reported similar improvements in MIO following costochondral grafting.[9] [10] In the study by Medra (2005) 58% of patients had a satisfactory MIO greater than 25 mm and our study's results show a comparable improvement demonstrating the potential of costochondral grafts to restore functional mouth opening in pediatric TMJ ankylosis patients.[10]

These findings also correlate well with studies by Choi et al. and Balaji et al. which discuss the use of costochondral grafts in reconstructive surgeries.[11] [12] Choi et al noted improvements in mouth opening but highlighted that surgical technique and graft placement played significant roles in the outcomes.[11] In our study the consistent improvements in MIO suggest that the surgical approach used along with proper post-operative care and physiotherapy may have contributed positively to the functional outcomes.

In terms of reankylosis our study observed a rate of 11.1% which though low is still an important outcome to consider. Reankylosis is a known complication following TMJ reconstruction often caused by incomplete graft integration insufficient post-surgical rehabilitation or inadequate graft fixation. This rate is consistent with other studies such as Medra et al. who reported reankylosis in 9% of cases following costochondral grafting.[10] In our study the relatively higher incidence of reankylosis may be attributed to lapses in post-operative physiotherapy and follow-up. These factors underscore the importance of a comprehensive rehabilitation protocol as highlighted by other studies where reankylosis was more common when post-operative care was not rigorously followed.

Regarding graft resorption our study found that 19% of patients exhibited some degree of resorption which is comparable to the findings in other reports. Medra et al. found that 25% of grafts showed resorption suggesting that graft resorption is a common complication after costochondral grafting.[10] However 81% of grafts in our study were stable and no major complications arose from the resorption seen in the 19% of cases. This is a positive outcome suggesting that while graft resorption is a potential issue it does not necessarily compromise the overall success of the surgery. Our findings reflect that while resorption is a concern the overall stability of the grafts in the majority of cases is a positive outcome.

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The issue of graft overgrowth is another challenge associated with costochondral grafts especially in pediatric patients. Our study did not specifically report cases of overgrowth but literature on the subject such as the work of Balaji et al. suggests that overgrowth of the graft is a significant complication in some patients. Balaji's study reported that 4 out of 14 patients showed overgrowth of the costochondral graft which led to the need for corrective surgeries such as condylar shaving. This unpredictability in the growth of the graft is a known concern and can lead to facial asymmetry occlusal discrepancies and the need for further surgical intervention. Our findings support the notion that while graft growth can be unpredictable the management of these complications with timely interventions can yield favorable outcomes.[12]

In our study age gender and the side of ankylosis did not show note worthy associations with the outcomes which mirrors the results of other studies where demographic factors did not significantly influence the functional or aesthetic results. This suggests that while patient demographics may play a role in the treatment plan they are not the primary determinants of the surgical success. The surgical technique graft choice and post-operative rehabilitation appear to have a more substantial impact on the outcomes.[11-19]

Overall our study suggests that costochondral grafts provide promising functional results in pediatric TMJ ankylosis with significant improvements in MIO and facial symmetry. However complications such as reankylosis graft resorption and overgrowth remain challenges that need to be carefully managed through meticulous surgical technique comprehensive post-operative care and long-term monitoring. These findings are consistent with other studies and add valuable insights into the clinical application of costochondral grafts in TMJ ankylosis treatment.

CONCLUSION:

We conclude that that 67.5% of children achieved a normal maximum interincisal opening while 11.1% experienced reankylosis and 19.0% faced graft resorption indicating a generally effective approach with some challenges. To enhance outcomes I recommend refining surgical techniques to minimize reankylosis and improving postoperative monitoring to detect graft resorption early. These steps could boost success rates and inform tailored care protocols for this young population.

AUTHOR CONTRIBUTION

Author	Contribution
Saman Bibi*	Data Entry, Data Collection, Data Analysis, Manuscript Writing, and Manuscript Revision
Sartaj Khan	Critical Input, Study Design Conception, Final Approval of Draft

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