Original Article

Role of chewing exercise on cervical hypermobility in patients with Pierre Robin Syndrome

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Objective: To determine the effects of chewing exercises in addition to routine physical therapy on cervical hypermobility in patients with Pierre Robin syndrome (PRS).

Methodology: This randomized controlled trial was conducted at Rising Sun Institute for Special Children and Children's Hospital, Lahore. Patients with PRS and Stickler syndrome of both gender and age between 4-12 years were included. Those with any other syndrome or epilepsy were excluded. A total of 10 children were randomly divided in 2 groups. Group A received routine physical therapy and chewing exercise while Group B received only routine physical therapy. Generalized hypermobility was measured by Beighton Hypermobility Scoring (BHS) system. Children having BHS of more than 5 out of 9 were considered in this study. Twelve sessions were given for consecutive 4 weeks.

Results: Cervical range of motion (ROM) in cervical side flexion values (p=0.003), flexion (p=0.006) and Extension (p=0.004) decreased within group showed significant improvement in cervical stability. While in cervical rotation, there was no significant reduction (p=0.682). Between groups, p value showed significant decrease in ROM in cervical side flexion (p=0.016) flexion (p=0.032) and extension (p=0.008), respectively and showed marked improvement in cervical stability.

Conclusion: Chewing exercise with routine physical therapy was more effective in cervical hypermobility by decreasing cervical ROM in different cervical positions for cervical stability in patients with PRS. (Rawal Med J 202;46:232-235).

Keywords: Chewing, Pierre Robin Syndrome, cervical range of motion.

INTRODUCTION

Microganthia, cleft palate and glossoptosis are the three defects that are present in Pierre Robin Syndrome (PRS). Newborns affected with this syndrome have abnormally flexible or lax (hypermobile) joints, which can make them susceptible to joint dislocation.[1] Children with hypermobility and impaired balance have need of achieving a stable neck posture.[2] Due to small lower jaw children have trouble in eating. An instability in cervical region can disturb both static and dynamic balance.[3]

Chewing is an isotonic exercise,[4] that works on mandibular muscles and help in getting good eating patterns that not only effect growth of the jaw but also integrates head and neck with upper and lower extremity.[5] Chewing can alleviate mood swings and increase cerebral blood flow.[6] Rhythmic jaw movements (chewing) is a specific training exercise of jaw, head and neck that directly strengthen jaw musculature and provide stability in head and neck.[7] Proprioceptors present in jaw and neck region tells about bolus size, texture and shape but also stabilize neck by proprioceptive mechanism.[8] Jaw opening and closing are interrelated with neck muscles so during chewing mouth opening is parallel with neck extension and closing with neck flexion.[9] A postural sway occur in anterior posterior direction when chewing induces cervical extension due to co-contraction of jaw and shoulder muscles.[10,11]

Muscle spindles present in jaw and neck region can be activated by slight changes in neck and body position. Reduction in proprioceptive ability disturb chewing capacity, teeth clenching, biting and also leads to delayed speech.[12] A linkage was found between cervical craniofacial form and masticatory muscle performance that are interrelated in somatoganthic development.[13] Different mandibular positions affects cervical stability and shows a strong relation with postural maintenance.[14]

This study is focused on role of chewing in maintaining cervical hypermobility in PRS through strengthening of cervical muscles.

METHODOLOGY

It was a randomized controlled trial carried out from April 2019 to December 2019 at Rising Sun Institute for Special Children and Children's Hospital, Lahore. Sampling technique was non-probability convenient sampling. A total of 10 patients, 5 in each group were taken randomly by lottery method. The Inclusion criteria were diagnosed patients with PRS and Stickler syndrome with age 4 to 12 years, of both genders having hypermobility score >4 with postural instability. Children with fracture, tumor, any Pathology, epilepsy and any other syndrome were excluded. The study was approved by the Universirt of Lahore and an informed consent was taken from parents of all children.

Beighton Hypermobility Scale (BHS) was used to measure the hypermobility. For measuring cervical hypermobility cervical (ROM) was measured in different positions by goniometer. Group A received routine physical therapy plus intervention therapy three days in a week that include swing activities, forward walk, sideways walk, staircase climbing and ball kicking with total treatment session of 30 minute with chewing exercise for 15 minute. Total 12 sessions were given to children 3 times per week for consecutive four weeks. Total four times readings were taken at the start of the study and after every 4^{th} sessions.

Statistical Analysis: Data were analyzed using SPSS version 23. Friedman test was applied to see the difference in outcome measures across follow up time interval within treatment groups. Mann Whitney U Test was applied to see the difference in outcome measures between groups. $p<0.05$ was considered significant.

RESULTS

Out of 10, each group had 5 patients without any drop out for analysis with age of 5-6years in Group-A and 5-7 years in Group-B. Gender ratio and participants in both groups belonged to parents having cousin marriage or non-cousin marriage (Table 1).

In Group A, the cervical side flexion ROM was significantly reduced from Baseline 80.00±23.71 to 61.00±12.4 till 12^{th} week showed significant difference within group (p=0.003). The cervical flexion ROM from Baseline 111.00±333.61 to 86.00±2.08 showed A significant reduction (p=0.006). ROM at Baseline was 92.00±20.18 that was reduced to 69.00±11.0 showed a significant reduction in cervical extension with (p=0.004). Cervical rotation at Baseline 73.00±26.36 to 73.00±19.24 showed Statistically No significant difference (p=0.682) within group (Table 2).

In Group B, cervical side flexion ROM at Baseline was 65.00±21.79 that showed no reduction till 4^{th} and 8^{th} week while 63.00±19.23 in12th week with no significant reduction (p=0.801). Small reduction was observed in cervical flexion ROM from Baseline 80.00±10.00 to 76.00±8.94 while no significant difference was observed (p=0.112). Cervical extension ROM at Baseline was 70.00±10.00 to 70.00±10.60 showing no significant reduction (P=0.733). Cervical rotation ROM at Baseline was 87.00±14.83 to 88.00±17.89 statistically showed No significant reduction (P=0.942) (Table 3).

Table 1. Demographic data at baseline.

Variable	Group A	Group B
Age	5.60±0.54	5.40±0.89
Gender (Male/Female)	3/2	4/1
Parental Marriage Status(Cousin Marriage /non Cousin Marriage)	5/0	5/0

Table 2. Comparison for cervical rotation ROM in four different cervical positions for Group A at different time intervals.

	Baseline	4^{th} Week	8^{th} Week	12^{th} Week	p-value
Cervical side flexion	80.00 ±23.71	76.00 ±19.49	67.00 ±17.88	61.00 ±12.44	P=0.003*
Cervical flexion	111.00 ±33.61	97.00 ±26.36	92.00 ±27.74	86.00 ±24.08	P=0.006*
Cervical extension	92.00 ±20.18	86.00 ±16.73	75.00 ±13.22	69.00 ±11.40	P=0.004*
Cervical rotation	73.00 ±26.36	76.00 ±27.92	72.00 ±17.89	73.00 ±19.24	P=0.682*

Table 3. Comparison for Cervical Rotation ROM in four different cervical positions for Group A at different time intervals.

	Baseline	4^{th} Week	8^{th} Week	12^{th} Week	p-value
Cervical side flexion	65.00 ±21.79	65.00 ±21.79	65.00 ±21.79	63.00 ±19.23	P=0.801*
Cervical flexion	80.00 ±10.00	76.00 ±8.94	76.00 ±8.94	76.00 ±8.94	P=0.112*
Cervical extension	70.00 ±10.00	70.00 ±10.00	71.00 ±11.40	70.00 ±10.60	P=0.733*
Cervical rotation	87.00 ±14.83	88.00 ±15.25	88.00 ±18.24	88.00 ±17.89	P=0.942*

Table 4. Percentage reduction for cervical Range of motion (ROM) in different groups for different cervical positions.

		Group A	Group B	p-value
Cervical side flexion	1 follow up	-4.44%	0%	0.310*
	2 follow up	-18.72	0%	0.008*
	3 follow up	-29.07	-3.18	0.016*
Cervical flexion	1 follow up	-13.84%	-5.35%	0.222*
	2 follow up	-21.24%	-5.35%	0.151*
	3 follow up	-29.52%	-5.35%	0.032*
Cervical extension	1 follow up	-6.4%	0%	0.032*
	2 follow up	-22.47%	1.17%	0.008*
	3 follow up	-34.02%	-0.15%	0.008*
Cervical rotation	1 follow up	3.81%	1.05%	0.548*
	2 follow up	0%	0.33%	-
	3 follow up	0.53%	0.33%	0.421*

P value from (p=0.310) to (p=0.0160) at the end of 3rd follow up for cervical side flexion, flexion from (p=0.222) to (p=0.032) and extension from (p=0.0032) to (p=0.008) respectively showed significant reduction. For cervical rotation no significant reduction was observed from (p=0.548) to (p=0.421) (Table 4).

DISCUSSION

Our findings showed that cervical ROM decreased in cervical side flexion, flexion and extension while in cervical rotation showed no significant difference. Decrease in cervical range of motion leads to an increase in cervical stability and neck holding which is a major milestone in achieving a stable posture for rehabilitation of a child.

Zafar et al showed that kinesthetic proprioceptive involvement has a major role in maintaining cervical postural balance and can be utilized in patients having musculoskeletal and balance issues. Literature also shows that musculoskeletal disorders can affect cervico-cephalic kinesthetic ability and disturb cervical balance.[15] This study focused on healthy individual instead of individual with musculoskeletal issues so need to be studied on individual having muscoloskeletal problems in Tamporomandibular joint.[15]

Alghadir et al measured cervicocephalic kinesthetic sense and kinesthetic sensibility test was used.[16] Haggman et al[17] and Eriksson et al[18] showed that Jaw and neck muscles co-contract with each other during chewing, teeth clenching and bitting and different mandibular positions affect cervical stability show a strong relation with cervical maintenance.

Children with PRS showed that cervical ROM decreased in cervical side flexion, flexion and extension.[18] Zafar et al showed that during maximum voluntary clenching, endurance cannot be achieved.[19] Patients having temporomandibular joint disorders and other jaw abnormalities experience muscle fatigue, stress and reduced endurance in cervical and neck muscles that affect postural stability in cervical region.[19] This study had limited sample size because of rare disease.

CONCLUSION

Chewing can decrease cervical range of motion in cervical side flexion, flexion and extension and stabilize head and neck against gravity. Cervical rotation showed no significant decrease in ROM so rotation not contributes much in cervical stability as compared to cervical side flexion, flexion and extension. A decrease in cervical ROM enhances neck stability by maintaining cervical hypermobility.

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