Original Article

Changes in Spinal Mobility among Patients with Axial Spondyloarthritis after Supervised Rehabilitation Programme — A randomized Controlled Trial

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Background : Axial Spondyloarthritis leads to progressive loss of spinal mobility. A study was done to assess the improvement in spinal mobility among the patients with Axial Spondylarthritis undergone Supervised Rehabilitation Programme (SRP).

Materials & Methods : A parallel concurrent randomized controlled trial was conducted after relevant approval from the Institutional Ethics Committee. 63 participants with Axial Spondyloarthritis within 18-45 years, were randomly allocated in two groups. Intervention group participants were undergone SRP for 3 months, control group participants were on multimodal home exercises. Spinal mobility was measured by Bath Ankylosing Spondylitis Metrology Index (BASMI) & Chest expansion, at baseline & 3 months. After exclusion of drop outs, each group consisted 30 participants (Male 25, Female 5). Master chart done in Microsoft office excel 7 and analyzed by SPSS version 20.

Analysis and Results : Variables were tested for normal distribution by Shapiro-wilk test. Then the appropriate test of significance used. Overall BASMI significantly improved in intervention group ($p=0.001$) compared to control group. Significant improvements were seen with intervention group in respect to Cervical Rotation (CR) score ($p=0.006$), Intermalleolar Distance (IMD) score ($p=0.004$) & Tragus to Wall (TW) score ($p<0.001$). Significant improvements in Chest expansion ($p=0.001$), Modified Schober test (MST) score ($p=0.013$) & Lateral Flexion (LF) score ($p<0.001$) were seen among intervention group, but on intergroup analysis, no significant change in Chest expansion ($p=0.126$), MST score ($p=0.100$) or LF score ($p=0.086$) recorded over control group.

Conclusion : Spinal mobility measured by BASMI in patients with Axial Spondyloarthritis, had a significant improvement after Supervised Rehabilitation Programme (SRP).

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Key words : Axial Spondyloarthritis (Ax-SpA), Supervised Rehabilitation Programme (SRP), Bath Ankylosing Spondylitis Metrology Index (BASMI), Spinal Mobility.

Axial Spondyloarthritis is a group of inflammatory rheumatological disorder which includes Ankylosing Spondylitis, Enteropathic Spodyloarthritis, Juvenile Spondyloarthritis, Reactive Arthritis, Psoriatic Arthritis etc. The inflammatory low back pain with involvement of axial skeleton especially sacroiliac joints, vertebra, costochondral joints, leads to progressive loss of spinal mobility. Disease onset is mostly in between second to fourth decade of life, most important period for initiation of Socio-economic productivity in young people. Thus, disability limitation & deformity prevention need to be addressed as early as possible. Comprehensive Rehabilitation Programme could be an accessible, affordable & effective tool for improvement in spinal mobility. A systemic review by Cochrane musculoskeletal group[1] suggested that an Individual home based or supervised exercise programme is better than no intervention and supervised group exercise is better than home exercise. The American College of Rheumatology/Spondylitis Association of America/ Spondyloarthritis Research and Treatment Network

Editor's Comment :

- Spinal stiffness is a major challenge for young patients with Axial Spondyloarthritis which hinders their Socio-economic productivity & Quality of Life, Pharmacotherapy alone can not address the Spinal mobility component which has their own adverse effects on prolong use. Supervised Rehabilitation Programme (SRP) is a cheap, affordable, accessible, acceptable comprehensive programme consisting of Institutional Supervised Multimodal exercises in groups, occupational therapy, Cognitive Behavioral therapy, lifestyle modification counseling, posture care advises etc.
- This study shows that Spinal mobility is significantly improved with participants undergoing 3 months Supervised Rehabilitation Programme over controls. Thus, SRP could be a very important management tool which drives the persons with Axial Spondyloarthritis from disability to productive life.

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Recommendations[2] also go in favor of land based supervised active exercises. Most of the studies in this context were of different duration of intervention, & lack standardized multidisciplinary rehabilitation approach. So, a study was planned with multi-disciplinary Supervised Rehabilitation Programme to assess the improvement in Spinal mobility among the patients with Axial Spondyloarthritis.

Materials and Methods

A parallel concurrent randomized controlled trial was conducted after relevant approval from the Institutional Ethics Committee at Department of Physical Medicine & Rehabilitation. Total 63 participants, (53 male, 10 female) diagnosed as Axial Spondyloarthritis by ASAS classification criteria[3], within the age group of 18-45years were included in this study. Exclusion criteria were, active non-inflammatory spinal disease, Hip & Knee deformities, postsurgical history on Axial skeleton or peripheral Joints, Hypertension, Diabetes, Psychiatric illness, Heart diseases, Equilibrium disturbances & Pregnancy. The participants were randomly allocated in two groups by using serially numbered opaque concealed envelope technique. Total 32 participants allocated in intervention group & 31 participants in control group. The participants of intervention group were undergone multidisciplinary Supervised Rehabilitation Programme (SRP) for 3 months at the Department of Physical Medicine & Rehabilitation. They also continue this rehab advices including exercises at home during rest of the days in week. Participants of control group were demonstrated conventional multimodal home exercises for a period of initial 3months (The interventions summarized in Table 1A & 1B). After that period, participants of control group were invited in Supervised Rehabilitation Programme so that they should not be deprived. All the participants did not have any history of Biologic therapy before & during study period. Short course of Non-Steroidal Anti-inflammatory drugs used not more than two times during the 3 months period of rehabilitation (as and when required).

The multimodal exercise programme was consisted of total 50 minutes aerobic, stretching & pulmonary exercises, thrice weekly for 3 months in presence of experienced physical therapists. The participants of intervention group were also advised to continue the same exercises at their home in rest of the days. Spinal mobility was measured by Bath

Table 1A — *Interventions done*

Supervised Rehabilitation Programme	Home Exercise Programme
■ Supervised Multimodal Exercises thrice weekly, ■ Aggressive Lifestyle Modification with regular supervision thrice weekly, ■ Group therapy classes thrice weekly, ■ Counselling weekly, ■ Supervised Joint protection Technique weekly, ■ Supervised Energy Conservation Technique weekly, ■ Active Environmental modification weekly, ■ Cognitive Behavioural Therapy for pain management weekly follow up session, ■ Physical modalities for Pain management as required.	■ Multimodal Exercise Programme (demonstrated monthly, ■ Lifestyle modification advises monthly, counselling monthly, ■ Environmental modification advises monthly, ■ Joint protection advises monthly, ■ Energy conservation advises monthly. ■ Physical Modalities for Pain management in Outpatient basis as required.

Table 1B — *Descriptions of the multimodal exercise program for Axial Spondyloarthritis*[4,5]

Warm-up : 10 minutes of step exercises (each motion repeated 10 times) + 5 minutes of stretching exercises.
Main period : 20 minutes of step exercises (each motion repeated 10 times).
Cool-down : 10 minutes of pulmonary exercises + 5 minutes of stretching exercises.

Step Aerobic exercises	Stretching exercises
1. March 2. Tap up-tap down 3. V step 4. Step touch 5. Turn step 6. Grapevine 7. Grapevine with knee up 8. Grapevine with leg curl **Pulmonary exercises** 1. Deep breathing, Diaphragmatic breathing, Fast breathing Exercises. 2. Resistance exercises for the inspiratory pulmonary muscles.	1. Forward and backward head stretch. 2. Sideways head stretch. 3. Chest and shoulders stretch. 4. Deltoid muscle stretch. 5. Triceps muscle stretch. 6. Overhead stretch. 7. Lateral trunk muscle stretch. 8. Arched back stretch. 9. Leg extensor and pelvic flexor stretch. 10. Spinal twist stretch. 11. Para vertebral muscle stretch. 12. Loosen-up stretch. 13. Upper back prayer. 14. Double knee-to-chest stretch.

Ankylosing Spondylitis Metrology Index (BASMI) & Chest expansion (in centimeters) independently. The components of BASMI consist of 5 measurements with their respective scores, Lateral Flexion (LF), Tragus to Wall (TW), Modified Schober Test (MST), Intermalleolar Distance (IMD) & Cervical Rotation (CR), corresponding scores are calculated from BASMI index by Standardized Bath tool[6].

The baseline data collected from drop outs (2 from intervention group & 1 from control group) were not included in analysis. Each group after exclusion of drop outs, had 30 participants (Male 25, Female 5). Adherence to the Supervised Rehabilitation Programme by participants of intervention group was 66% or more. Data were collected at the time of entering the study (baseline) & end of the study (ie, after 3 months) from both groups. Master chart done in Microsoft office excel 7 and analyzed by SPSS version 20.

Analysis and Results

Variables were tested for normal distribution by Shapiro-wilk test. Then the appropriate test of significance used. Discrete variables were analyzed by Chi Square tests. Continuous variables were analyzed by appropriate paired/unpaired T-test (for normally distributed variables) and non-parametric Mann-Whitney U test (for skewed distributed variables). Where p value <0.05 is taken as statistically significant change.

Baseline characteristics in both groups were similar. There was no significant difference in baseline distribution of BASMI & Chest expansion measurements between participants of both groups (vide Table 2).

After 3 months rehabilitation, data from study variables in both groups analyzed. The result of the postintervention outcome analysis is shown in Table 3.

Improvement in spinal mobility was interpreted as decrease in BASMI score & increase in chest expansion. Overall BASMI significantly improved in intervention group (p=0.001) compared to control group at the end of the study. Significant improvements were seen with intervention group over control group in respect to CR score (p=0.006), IMD score (p=0.004) & TW score (p<0.001).

There was significant improvement seen in MST score (p=0.013) & LF score (p<0.001) among intervention group at end of the study, but on intergroup analysis, no significant change in MST score (p=0.100) or LF score (p=0.086) with intervention group over control group.

After 3 months of Supervised Rehabilitation, significant improvement (p=0.001) in Chest expansion was seen among intervention group from baseline measurement. Upon intergroup analysis, there was no significant improvement (p=0.126) in chest expansion established with intervention group compared over control group.

All the spinal mobility components tested in this study showed that participants of intervention group had significant improvement at the end of the study from baseline. Whereas, no significant improvement in any component of Spinal mobility from baseline was noted with control group.

Intergroup analysis showed that Spinal mobility measured by BASMI improved significantly (p=0.001) with Supervised Rehabilitation Programme, where CR score, IMD score & TW score were the main contributor to improvement in spinal mobility, but no significant improvement was noticed at MST score & Lateral Flexion score.

Table 2 — *Comparison in Baseline characteristics between two groups*

Parameters	Intervention group (n=30)(Mean±SD)	Control group (n=30)(Mean±SD)	p value
Age (years)	29.7±7.15	28.34±6.99	0.457*
Completed years of Education (years)	10.17±4.51	9.5±4.11	0.50†
Body Mass Index (BMI) (Kg/m^2)	23.51±3.31	23.35±3.52	0.929†
Duration of low back pain (months)	39.33±30.32	39.13±35.76	0.761†
BASMI	3.45±1.36	3.07±1.33	0.074†
LF Score	4.67±2.62	3.90±2.09	0.302
TW Score	2.2±0.96	2.1±0.89	0.652
MST Score	5.07±2.43	4.57±2.16	0.455
IMD Score	2.33±1.61	2.03±1.47	0.333
CR Score	2.97±1.63	2.73±2.02	0.141
Chest Expansion (cm)	3.96±1.41	4.34±1.60	0.44

*Two tailed unpaired t-test. †Mann- Whitney U tests. BASMI=Bath Ankylosing Spondylitis Metrology Index, LF=Lateral Flexion, TW=Tragus to Wall, MST=Modified Schober Test, IMD=Intermalleolar Distance, CR=Cervical Rotation, SD=Standard Deviation.

Discussion

Spinal mobility was measured by Bath Ankylosing Spondylitis Metrology Index (BASMI) & Chest expansion (in centimeters) independently.

After, end of the 3 month Supervised Rehabilitation, intergroup analysis showed that intervention group had significant improvement in BASMI compared to control group, whereas no significant improvement in BASMI in control group. When analyzed separately for each component of BASMI, intervention group had significant improvement

Table 3 — *Effects of Supervised Rehabilitation Programme in mobility parameters*

Variables	Intervention Group (n=30)			Control Group (n=30)			Differences between outcome in two groups
	Baseline (Mean±SD)	3months (Mean±SD)	p-value	Baseline (Mean±SD)	3months (Mean±SD)	p-value	p-value
BASMI	3.45±1.36	1.87±1.00	<0.001	3.07±1.33	2.68±1.12	0.127	0.001
LF Score	4.67±2.62	2.1±1.90	<0.001	3.90±2.09	2.9±1.79	0.070	0.086
TW Score	2.2±0.96	1.43±0.68	<0.001	2.1±0.89	2±0.70	0.711	<0.001
MST Score	5.07±2.43	3.43±2.03	0.013	4.57±2.16	4.33±2.04	0.704	0.100
IMD Score	2.33±1.61	0.88±1.05	<0.001	2.03±1.47	1.80±1.40	0.434	0.004
CR Score	2.97±1.63	1.53±1.31	<0.001	2.73±2.02	2.37±1.52	0.699	0.006
Chest Expansion (cm)	3.96±1.41	5.33±1.39	0.001	4.34±1.60	4.73±1.37	0.275	0.126

As data were not distributed normally, they were analyzed by non-parametric Mann- Whitney U test. SD=Standard deviation. BASMI=Bath Ankylosing Spondylitis Metrology Index, LF=Lateral Flexion, TW=Tragus to Wall, MST=Modified Schober Test, IMD=Intermalleolar Distance, CR=Cervical Rotation.

over control group in Tragus to Wall Distance (TWD) Score, Intermalleolar Distance (IMD) Score & Cervical Rotation (CR) Score. Significant improvement was seen in Lateral Flexion (LF) Score & Modified Schober Test (MST) Score with intervention group by intragroup analysis, but intervention group had no significant improvement in intergroup analysis over control group.

There was significant improvement in Chest expansion in intervention group by intragroup analysis, whereas intergroup analysis failed to show any significant improvement over control group.

Similar duration studies show variable outcomes. Meryem Özbaþ Günay, *et al*[7] reported significant improvement in spinal mobility measured by BASMI within the study group after a 3 months Rehabilitation Programme consisting of breathing & posture exercises, where no significant improvement registered with only posture exercise & conventional exercise group. Ince G, Sarpel T, *et al*[5] reported a significant improvement in Schober test, Chest expansion. occiput to wall distance and chin to Chest distance. Study by Fernandez-de-Las-Penas *C, et al*[8] reported that significant improvement in all the clinical measures of BASMI in global posture re-education group, where in conventional exercise group, improvement in Tragus to Wall Distance & Lumber Lateral Flexion were statistically significant, although the rest of the components also improved but failed to reach a significant level. Whereas, Silje Halvorsen Sveaas, *et al*[9], showed no significant improvement in BASMI after 12 weeks rehabilitation with exercise group. Analay Y, *et al*[10], reported significant difference in Schober test.

Few short-term studies also showed satisfactory improvements. Yndis A. Staalesen Strumse, *et al*[11] reported significant improvement in spinal mobility components (they use modified Scober test, lateral Flexion & Chest expansion) from baseline in both exercise groups, where chest expansion improved significantly in Mediterranean group compared to others. Significant improvement reported in both groups in respect to modified Schober test & Lateral Flexion, where improvement was significantly higher in Mediterranean group. Siv Grødal Eppeland, *et al*[12] showed that there was a significant improvement in BASMI with their study population after a 2-week in-patient rehabilitation programme. whereas S Berea, C Ancuþa, *et al*[13] showed that axial mobility improved in supervised Pilate group & conventional exercise groups in 10 days, but it had no statistically significant difference, as assessed by Modified Schober test & Index-ground distance & Chest expansion.

Different Supervised Rehabilitation Programmes showed improvement in Spinal mobility, though some studies not reported any significant improvement in Lateral Flexion, Modified Schober test & Chest expansion measurements.

Most of the studies where Supervised Rehabilitation Programme, continued for 12weeks or more, showed significant improvement in BASMI.

Supervised Rehabilitation Programme, is beneficial for improving spinal mobility due to certain factors like, strict maintenance of durations of multimodal exercises, supervised Step aerobic exercises, stretching & endurance exercises, posture care supervisions, peer group effects in group exercise, adequate & appropriate pain control measures including cognitive behavioral therapy, regular counselling & doubt clearing sessions as well as personalized optimization.

From the above references, it was evident that the outcomes in this study were comparable with previous similar studies & it showed a significant improvement in spinal mobility within the patients of Axial Spondylarthritis with this structured 3 month Supervised Rehabilitation Programme.

Conclusion

Spinal mobility measured by Bath Ankylosing Spondylitis Metrology Index (BASMI) had a significant improvement with Supervised Rehabilitation Programme in patients with Axial Spodyloarthritis, whereas Modified Schober test, Lateral Flexion & Chest expansion separately not significantly improved.

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