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Designing and psychometric evaluation of Stretching Exercise Influencing Scale (SEIS)

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ABSTRACT

Objective The lack of reliable and valid tools for assessing the factors that influence stretching exercises (SEs) among Iranian office employees is obvious. This study aimed to design and evaluate psychometric properties of this instrument.

Design Cross-sectional study of psychometric properties.

Setting Data were gathered from May to September 2017.

Participants Participants were 420 office employees who were working in 10 health centres affiliated to the Shahid Beheshti University of Medical Sciences in Tehran, Iran.

Primary outcome measures The instrument was designed on the basis of the constructs of the health promotion model (HPM) and extant literature. Exploratory factor analysis (EFA), Cronbach's α and intraclass correlation coefficient (ICC) were employed to check the scale's psychometric properties.

Results In total, 420 questionnaires were completed. The mean age of the office employees was 37.1±8.03 years. Among the 86 items, 77 items had significant item-to-total correlations ($p<0.05$). The results showed good internal consistency and reliability for the whole questionnaire and each domain. EFA results confirmed 53.32% of the total variance of the items yielded in 11 subscales. The ICC was acceptable (0.78, 95% CI 0.70 to 0.88).

Conclusions The Stretching Exercise Influencing Scale (SEIS) can be a reliable and valid instrument for measuring the factors that influence SEs among office employees.

Trial registration IRCT20160824295512N1

Strengths and limitations of this study

- The Stretching Exercise Influencing Scale (SEIS) could be a validated and reliable instrument to determine the factors that influence stretching exercises among 420 employees who work with computers in Shahid Beheshti University of Medical Sciences, Tehran, Iran.
- In this study, the selected convenience sample from just one university may not reflect all Iranian employee population profiles, so the generalisation of the present results is limited.
- However performing additional studies with computer users from other organisations and with different population profiles, and social, educational and cultural demographics should be accomplished to confirm the results.
- It is also suggested that the SEIS should be justified to other languages and cultures so that it could be applied in other countries.

INTRODUCTION

Musculoskeletal disorders (MSDs) are often correlated with ergonomic risk factors and also socioeconomic characteristics of workers.[1] Globally, biopsychosocial factors of the workplace affect the majority of the world's population who spend most of their waking hours in their workplace.[2] One of the most important risk factors for computer users in the work sites is prolonged sitting without doing stretching exercises (SEs).[3] Work-related MSDs (WMSDs) are one of the prevalent health problems at the work sites.[4] Repetitive motions, excessive inactivity or prolonged sitting as well as psychological stresses have been associated with WMSDs among computer operators.[5] SEs can lead to permanent lengthening of ligaments and tendons[6] and it seems to have an impact on decreasing WMSDs especially among computer operators.[7 8]

In a previous study it was argued that inactivity and not doing SEs were prevalent among Iranian computer operators.[9] The health promotion model (HPM) is one of the comprehensive models that determine the influencing factors that affect health promoting behaviours especially at work sites. This model describes factors like perceived barrier/benefit to action, perceived self-efficacy, interpersonal influences, commitment to a plan of action, immediate competing demands/preferences and situational influence on health behaviour—for instance SEs—in the context of the work site.[10] However, a previous study[11] showed that other factors such as stimulus control, counterconditioning and self-regulation were influencing exercise behaviours. It has been documented

that not doing exercise among Iranian office workers was prevalent and, on the other hand, there was no valid instrument to measure real needs of Iranian computer users based on HPM constructs to assess the causes for not doing Stretching Exercise (SE). A previous study revealed that the weight of the influencing factors on stretching training can vary depending on the cultural context.[12] Therefore, developing a reliable instrument for assessing factors influencing SEs is essential to understanding and addressing the interventional programme to promote SE. In this context, the objective of this research was to develop and validate a culturally based instrument to evaluate factors influencing SE among a sample of Iranian computer users.

OBJECTIVES

The objective of this research was to develop and validate a culturally HPM-based instrument to evaluate SE influencing factors among a sample of Iranian computer users.

METHODS

This cross-sectional study was part of a PhD thesis in Tarbiat Modares University, Tehran, Iran. All the participants signed an informed written consent form to participate in this study.

For this study, first of all, a questionnaire including 86 items pertaining to the mentioned constructs of HPM—in the context of WMSDs and based on the existing evidences—was designed. The validity of the instrument was determined by a sample of 420 office employees who were working at health centres and were eligible due to the inclusion/exclusion criteria. The inclusion criteria were having no disability or illnesses to prevent SEs and signing the written consent form. So, those suffering from any defect or illness interfering with SE were excluded from the study. Both quantitative and qualitative approaches were taken for face validity of the questionnaire. In the qualitative approach, 30 office employees assessed each item of the questionnaire for 'ambiguity', 'relevancy' and 'difficulty'. In this process, three items needed to be improved.

For the quantitative approach, the same office employees were asked to determine the importance of each item through a 5-point Likert Scale. In this way the impact score for each item was calculated. As the impact score of 1.5 or above was satisfactory, all the items were approved for the instrument.

Content validity was done by both qualitative and quantitative methods. For the qualitative method an expert panel consisting of 15 specialists, including 6 health education specialists, 2 psychologists, 1 psychometric specialist, 1 physiotherapist, 1 neurological pain manager, 1 orthopaedic specialist, 1 physical medicine expert and 1 nurse with experience on pain management, checked all the survey items. These experts inserted their recommendations into the questionnaire. Moreover, they also

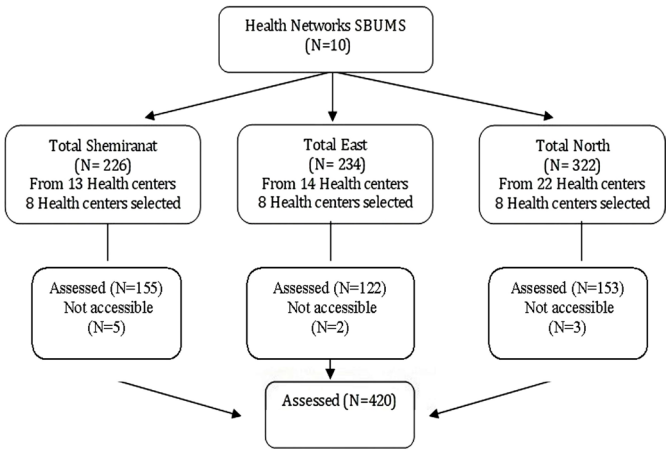

Figure 1 Flow of the procedure for sampling office employees. Shahid Beheshti University of Medical Sciences (SBUMS).

evaluated the questionnaire for 'grammar', 'wording', 'item allocation' and 'scaling' indices. This expert panel was asked to comment on item relevance, item comprehensiveness and any confusing meaning.

For quantitative content validity, the Content Validity Ratio (CVR) and Content Validity Index (CVI) were used. The necessity of an item was assessed through CVR and items with a score <0.4 were deleted according to Harrington.[13] The simplicity, relevance and clarity of the items were assessed through CVI and a value of 0.79 or above was considered satisfactory for each item.

According to a rule of five individuals for each item (86×5), a sample size of 385 computer users was estimated for exploratory factor analysis (EFA). However, for greater accuracy the sample size was increased to 420 individuals.[14] Multistage cluster sampling was applied to select the sample for psychometric evaluation of the instrument. First, from 10 health networks of Shahid Beheshti University of Medical Sciences, the North, Shemiranat and East networks were selected. Then eight health centres were selected from each health network, and 150 computer users from each health centre in the North and Shemiranat networks and 120 office employees from the health centre in the East network were randomly selected. Figure 1 shows the sampling procedure.

The primary questionnaire included 19 demographic questions and 86 questions relevant to the 11 constructs of HPM and other evidences. Each construct included five to nine questions. The construct validity of the questionnaire was examined through EFA. Principal component analysis with varimax rotation was performed to extract the underlying factors. Factor loadings ≥0.5 were considered appropriate. Eigenvalues >1 and Scree plots were used for determining the number of statements. The Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity (p<0.001) were used to assess the appropriateness of the sample size for factor analysis.

The excluded factors from the factor analysis were those that did not increase behaviour variance. Cronbach's

Table 1 Demographic test-retest sample and EFA study

Variables	Levels	Test-retest sample (n=30) N (%)	EFA sample (n=420) N (%)
Age (years)	≤25	1 (3.3)	26 (6.2)
	26–30	9 (30.0)	45 (10.7)
	31–35	11 (36.7)	106 (25.2)
	36 – 40	4 (13.3)	78 (18.6)
	41.00+	5 (16.7)	165 (39.3)
Marriage status	Single	9 (30.0)	120 (28.6)
	Married	21 (70.0)	289 (68.8)
	Others	-	11 (2.6)
Education level	Diploma and under diploma	-	-
	Associate degree and undergraduate	19 (63.3)	303 (71.11)
	Upper masters	11 (36.7)	117 (27.9)
Location of health centre	North	10 (33.3)	150 (35.7)
	East	10 (33.3)	150 (35.7)
	Shemiranat	10 (33.3)	120 (28.6)
Work experience (years)	<5	6 (20.0)	157 (37.4)
	5 – 10	9 (30.0)	69 (16.4)
	11 – 15	5 (16.7)	71 (16.9)
	16 – 20	6 (20.0)	78 (18.6)
	20.00+	4 (13.3)	45 (10.7)

EFA, exploratory factor analysis.

α coefficient values were used to assess the internal consistency of the Stretching Exercise Influencing Scale (SEIS). Intraclass correlation coefficient (ICC) was done with 30 computer users who completed the questionnaire twice at a 2-week interval. The acceptable value for ICC was considered 0.4 or above. Data analyses were undertaken using the Statistical Package for Social Sciences. The frequency/percentage and mean (SD) for analysing demographic variables were used.

PATIENT AND PUBLIC INVOLVEMENT

Patients and/or public were not involved in the designing and planning of the study.

RESULTS

In all, 420 office employees including 113 men (26.9%) and 307 women (73.1%) participated in the study. Table 1 shows the demographic characteristics of the participants. The KMO measure was 0.914, which fell in the 'very good' category. Bartlett's test of sphericity was meaningful (p<0.001) which indicates that the sample size was sufficient for EFA. Through EFA, from the primary 86 items, 9 items were not loaded on any factor and were removed. The initial analysis indicated an 11-factor structure with 77 items for the questionnaire with a total score between 77 and 293. All the remaining items were found to have significant item-to-total correlations (p<0.05). Table 2 shows the main factor analysis of the varimax rotation for the questionnaire. Table 3 shows all 11 factors and their reliability characteristics. All 11 factors had real commonalities (the subscales ranged between 0.73 and 0.89). Cronbach's α coefficient for SEIS was 0.84 with a satisfactory result.

Test-retest of the scale at a 2-week interval was done on 30 computer users. All computer users complied with that because all were working and available in the office after 2 weeks. The results of ICC indicated appropriate and acceptable stability (ICC=0.78, 95% CI 0.70 to 0.88). The SEIS showed well constructed reliability and validity.

DISCUSSION

This study developed and evaluated the psychometric properties of SEIS among a sample of Iranian computer users. The 11-factor structure of SEIS was consistent with the original constructs of HPM and other evidence-based constructs. This well-constructed 11-subscale instrument may be due to good items that were based on good literature review and good experience of researchers regarding not practising SE in workplaces in Iran. The large sample size (n=420) of this study may result in good response for the designed instrument.

Table 2 Rotated factor analysis of the Stretch Exercise Influencing Scale

		Loading factors										
Factors	**Items**	**F1**	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**F8**	**F9**	**F10**	**F11**
Perceived benefits of action	1. Feeling comfortable with stretching exercise.	0.875										
	2. When I do stretching exercise, my energy and strength will be greater.	0.901										
	3. When I do stretching exercise, my mood gets better.	0.841										
	5. When I do stretching exercise, my physical health rises.	0.825										
	7. When I do stretching exercise, I feel healthier.	0.788										
	4. When I do stretching exercise, I feel less pain.	0.724										
	6. Performing stretching exercise is fun for me.	0.802										
	8. When I do a stretching exercise, I seem to look better.	0.746										
	Core range (8–24) with higher score means better status Response options Never Sometimes Always 1 2 3											
Perceived barriers to action	9. Doing stretching exercise is time-consuming for me.		–0.755									
	10. I do not do stretching exercise because I do not have the right place for doing it.		–0.696									
	11. I do not do stretching due to my feeling of fatigue.		–0.593									
	12. I do not do stretching because I have lots of work to do.		–0.526									
	13. I do not stretch due to the lack of comfortable shoes.		–0.625									
	14. I do not stretch because I do not have sufficient skill.		–0.666									
	15. I do not do stretching exercise because I am not encouraged by my friends and colleagues.		–0.724									
	16. I am not interested in stretching.		–0.713									
	17. I often do not do stretching because of the pain I feel.		–0.729									
	Core range (9–36) with higher score showed the worse position Response options Never Sometimes Often Always 1 2 3 4											

Continued

Table 2 Continued

Factors	Items	Loading factors										
		F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11
Perceived self-efficacy	18. I have the ability to perform stretching exercises.				0.542							
	19. When I have other things to do, I can do stretching exercise.				0.713							
	20. When I am alone, I can do stretching exercises.				0.672							
	22. When I am sad and upset, I can do stretching exercise.				0.674							
	24. I am sure I can do stretching, even if I'm bored.				0.643							
	23. I do not try to learn tension strength to prevent physical injury.				0.660							
	21. In every situation, I am confident of doing stretching exercise.				0.734							
	Score range (7–28) with higher score means better status Response options Never Sometimes Often Always 1 2 3 4											
Activity-related effect	25. It makes sense to me to make a stretching motion.				0.775							
	27. I hate stretching.				0.560							
	26. I do not feel good about stretching.				0.516							
	30. When I do a stretching exercise, I feel joy.				0.562							
	27. Performing stretching is my favourite pastime.				0.658							
	28. Performing stretching exercise helps me get away from despair and disappointment.				0.543							
	29. Performing stretching exercise leads to a decrease in my anxiety and anger.				0.643							
	Score range (7–21) with higher score means better status Response options Never Sometimes Always 1 2 3											

Continued

Table 2 Continued

Factors	Items	Loading factors F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11
Interpersonal influences	32. Which of the following people expect you to do stretching during work with a computer? My family members expect me to do stretching during work with a computer. 1 - None at all 2 - Much 3 -Too much 4- Too much 5-No difference					0.701						
	33. My closest friends expect me to do stretching during work with a computer. 1 - None at all 2 - Much 3 -Too much 4- Too much 5-No difference					0.757						
	34. Two and three family members who spend most of their time with them, expect me to do stretching during work with a computer. 1 - None at all 2 - Much 3 -Too much 4- Too much 5-No difference					0.657						
	35. One of my administrative colleagues closer to him, expect me to do stretching during work with a computer. 1 - None at all 2 - Much 3 -Too much 4- Too much 5-No difference					0.675						
	36. My doctor, expects me to do stretching during work with a computer. 1 - None at all 2 - Much 3 -Too much 4- Too much 5-No difference					0.629						
	Score range (5–25) with higher score means better status Response options 1 - None at all 2 - Much 3 -Too much 4- Too much 5-No difference											

Continued

Table 2 Continued

Factors	Items	Loading factors F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11
Commitment to plan of action	37. I consider certain times in a weekly timetable for stretching.						0.782					
	38. In a comfortable place, I do stretching exercises.						0.832					
	39. I reward myself for doing stretching exercise.						0.520					
	40. I sometimes change the stretching strategy to prevent tiredness and duplication.						0.671					
	41. I try to gradually change the amount and intensity of stretching.						0.656					
	42. I try to get acquainted with my acquaintances and friends about how I do tension strength.						0.757					
	43. I enable the software to perform stretching on my computer, which reminds me to do stretching.						0.657					
	44. I encourage my friends to do stretching.						0.782					
	Score range (8–32) with higher score means better status Response options Never Sometimes Often Always 1 2 3 4											
Immediate competing demands and preferences	45. (A) I enjoy doing stretching exercise. (B) I enjoy using the computer.							0.572				
	46. (A) I enjoy doing stretching exercise. (B) I enjoy sitting and relaxing between work.							0.536				
	47. (A) I like to stretch with my friend. (B) I would like to sit down and speak with my friends or colleagues.							0.677				
	48. (A) When I feel pain; I do the recommended tension strength to reduce it. (B) When I have pain, though I get annoyed, I continue working on the computer.							0.567				
	49. (A) I prefer tension movements. (B) I prefer to sit and eat.							0.741				
	50. (A) I can deal with anxiety by doing stretching and without taking medication. (B) I fight with medication.							0.524				
	51. I prefer… stretching. ► Alone ► With a person ► In a small group (less than six people) ► In a large group (six or more)							0.557				
	Score range (7–16) with higher score means better status Response options Agree Disagree 1 2											

Continued

Table 2 Continued

Factors	Items	Loading factors F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11
Situational influences	69. I try to understand the right ways of doing stretching.								0.524			
	70. At work, there are good conditions for stretching.								0.639			
	71. If my work environment is busy and unplanned, I can keep stretching.								0.542			
	72. I can stretch easily on my working desk.								0.656			
	73. At work, there are cheat codes for stretching.								0.567			
	74. At work, I support stretching during rest periods and interruptions.								0.600			
	75. Before making tension strokes, while working on my computer I make sure that the software is attractive and an automatic reminder of tension strength.								0.548			
	76. In order to save time, I sit at the desk and think of stretching at training sessions.								0.571			
	77. On my computer, there is a guide for using the autotensioning software.								0.570			
	Score range (9–36) with higher score means better status Response options Never Sometimes Often Always 1 2 3 4											
Self-regulation	62. I perform stretching to achieve a specific goal.									0.524		
	63. When I consider a particular goal for stretching, my motivation rises for doing it.									0.543		
	64. I try my best to make tension stretches as difficult as possible.									0.541		
	65. I rate my progress in case of proper stretching.									0.540		
	66. I try to check the tension strength.									0.551		
	67. Proper tension movements are important in my plans.									0.567		
	68. I have sufficient stretching during the day.									.591		
	Score range (7–35) with higher score means better status Response options 1-Never 2-Rarely 3-Sometimes 4-Often 5-Always											

Continued

Table 2 Continued

Factors	Items	Loading factors F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11
Counterconditioning	52. Instead of sitting at the computer desk and waiting for tea, I prefer to go and make tea myself.										0.660	
	53. Instead of sitting at the computer desk in my break time, I do stretching exercises.										541	
	54. If I do not know the skill of doing stretching, I prefer to learn and do it instead of giving up.										0.749	
	55. When I do not have tension strength, I can do stretching exercises.										0.620	
	56. When I feel tired, depressed or anxious, instead of thinking, I do stretching. A-It's never so. B-Sometimes, this is true. C-It's always the case.										0.849	
	Score range (5–15) with higher score means better status Response options Never Sometimes Always 1 2 3											
Stimulus control	57. I think about the right position before doing stretching at work.											0.692
	58. I spend my rest time doing stretching exercises at workplace.											0.580
	59. I work with colleagues to do the right things and do tricks on my computer software.											0.586
	60. I try to get out of my environment in any possible way. Means or factors that cause dormancy in me.											0.561
	61. I often plan to do the right tension while working with a computer.											0.619
	Score range (5–25) with higher score means better status Response options 1-Never 2-Rarely 3-Sometimes 4-Often 5-Always											
Total	**Cumulative variance (%)**		**53.32**									
	Cronbach's α coefficient of the EEPQ		**0.84**									
	Cronbach's α ICC (95% CI)		**0.78**									

ICC, intraclass correlation coefficient.

Table 3 Specifications of the developed Pender's model, changing the Stretching Exercise Influencing Scale in Iranian office employees (n=420)

Concepts	N of items	Mean (SD)	R Eigenvalues	Explained variance (%)	Cronbach's α coefficient	ICC (95% CI)
Perceived benefits of action	8	17.90 (5.05)	3.423	6.227	0.89	0.84
Perceived barriers to action	9	20.31 (6.031)	6.79	7.523	0.86	0.79
Perceived self-efficacy	7	17.15 (3.71)	0.557	7.583	0.89	0.88
Activity-related effect	7	16.27 (2.45)	1.311	4.371	0.87	0.85
Interpersonal influences	5	11.55 (4.64)	1.504	3.354	0.82	0.71
Commitment to a plan of action	8	16.82 (4.28)	1.61	7.771	0.85	0.74
Immediate competing demands and preferences	7	11.70 (2.80)	1.813	3.656	0.74	0.71
Situational influences	9	14.21 (4.59)	1.963	4.086	0.79	0.71
Self-regulation	7	19.71 (4.98)	1.013	2.432	0.89	0.87
Counterconditioning	5	12.41 (2.53)	1.908	3.126	0.84	0.74
Stimulus control	5	11.99 (2.80)	4.632	3.193	0.73	0.7
Total	77	14.30 (3.7)	-	53.32	0.84	0.78

ICC, intraclass correlation coefficient.

The internal consistencies of SEIS' subscales were also similar to those demonstrated by other studies.[9 15 16] Furthermore, in this study, explanatory factor analysis showed that the factors of perceived barriers to action, perceived self-efficacy and commitment to plan of action had satisfactory loading and contributed to doing SE. These findings are in the line with that of another study which found that commitments to other preferences prevent individuals from doing exercises in the workplaces, while perceived adherence to plan caused home exercise motivation.[17] Another study revealed that commitment to plan of action is a key concept of HPM that could influence behaviour.[10] These evidences support the results of the present study with regards to the validity of SEIS. However, the current study relies on the fact that self-regulation, counterconditioning and stimulus control construct were satisfactorily loaded in the instrument which influences preferences. These findings are in line with other evidences that argue with the positive impacts of these factors on the construct of preferences.[18]

In SEIS, there was a positive relationship between perceived benefit and doing SE that is supported by the results from other studies.[18–20] Moreover, in the present study, perceived barrier and self-efficacy levels were found to be effective for SE. This result is consistent with the confirmatory factor analysis of HPM in Robbins' study in which social support structures, perceived barriers and self-efficacy were fit and significantly correlated with physical activity.[21] It is well known that the perceived barriers to action could demotivate individuals' behaviour, so it is most important. Similar to the present study, a previous study stated that self-efficacy in physical activity could overcome external and internal barriers.[22] Sharma, in his study, reported that physical activity interventions need to be built on promoting self-efficacy.[23]

Previous evidence reported the satisfactory validity and reliability for self-efficacy in the exercise scale among older adults.[24] In our study, the instrument jointly accounted for 53.32% of the total variance for doing SE, which is well above the earlier studies assessing the model without the three constructs. Furthermore, it was determined that the structure of the instrument consisting of 11 factors and 77 questions explained desirable variance for doing SE. Zheng's and Newman's studies showed 57% and 71% of the variance in adherence to exercise, respectively, both of which are higher rates compared with our study.[10 13] While our analysis suggested that the SE scale showed good reliability and strong internal consistency, Rivière's study[25] showed poor-to-good reliability, credibility and concurrent validity.

This study designed and validated an SEIS among Iranian office employees. According to the findings, satisfactory psychometric properties for the instrument were achieved. This achievement regarding good factor recovery may be due to adequate sample size (420 individuals) in this study, although the limitation of small sample size has been mentioned in other study.[26]

WMSDs of different employees were not specifically the same[27]. WMSDs are a multidisciplinary problem and biopsychosocial demographic characteristics may affect it.[28 29]Moreover, no analysis was done to realise the differences between the subgroups in terms of marital status and educational level. In spite of these differences, a questionnaire with a good recovery factor could be obtained because of the general similarities between the reasons for not doing SE at the work site.

The results of this study are not representative of the general population due to sampling from only one university and also because the majority of the participants was aged ≥41 years. However, despite these probable limitations, the designed scale could determine the factors that may have an impact on doing SE among the target group.

CONCLUSION

The designed scale in the present study could determine the factors which may have an impact on doing SE among a sample of Iranian computer users. Therefore, this study could be a foundation for further investigations for confirming this instrument as a culturally appropriate tool for assessing factors that may influence SE behaviour.

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Contributors MHD conducted the study and had full access to all of the data for analysis. Also, he confirmed the eligibility of the office workers for the study. He was also involved in drafting the article. SST and AK supervised the whole study and approved the final version of the manuscript.

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Competing interests None declared.

Patient consent for publication Obtained.

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