



# Training Course Results of the Assessment of Modified Rodnan Skin Score in Scleroderma

## Sklerodermada Modifiye Rodnan Cilt Skoru Değerlendirilmesinin Eğitim Kursu Sonuçları

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### ABSTRACT

**Aim:** Modified Rodnan Skin Score (mRSS) is generally used to assess skin involvement in patients with scleroderma. There are conflicting data on the effectiveness of mRSS training courses in previous studies. The aim of this study to evaluate the effectiveness of a mRSS training course applied to rheumatology minor residents.

**Materials and Methods:** Ten rheumatology minor residents were included in the study. The participants were given a 1-hour theoretical training including skin involvement in scleroderma and mRSS evaluation, by three experienced rheumatology specialists. Then training continued with performing mRSS on 4 patients with scleroderma for 1 hour. Participants made scores on a paper form on 2 patients before and after the training, including 17 regions, and the total score was between 0 and 51. Inter-observer reliability for pre- and post-training was evaluated with intra-class correlation coefficient (ICC) analysis. Agreement was evaluated with Fleiss's kappa according to 12 different score regions before and after the training.

**Results:** The ICC was detected as 0.867 [95% confidence interval (CI): 0.625-1.00, p=0.05] before the training, and 0.905 (95% CI: 0.045-1.00, p=0.02) after the training. When the regions of mRSS were evaluated individually, an increase in agreement was observed in some of the scores while there was no change in one region and a decrease in agreement was observed in some.

**Conclusion:** This study has shown that mRSS is an effective scoring that can be easily conveyed with training courses.

**Keywords:** Scleroderma, skin thickening, modified Rodnan Skin Score, training

### ÖZ

**Amaç:** Sklerodermalı hastalarda deri kalınlığının değerlendirilmesi için genellikle modifiye Rodnan Cilt Skoru (mRCS) kullanılmaktadır. Literatürde mRCS eğitim kurslarının etkinliğine dair farklı veriler mevcuttur. Çalışmamızın amacı romatoloji yan dal asistanlarına uygulanan mRCS eğitim kursunun etkinliğinin değerlendirilmesidir.

**Gereç ve Yöntem:** Çalışmaya 10 romatoloji yan dal asistanı dahil edildi. Katılımcılara skleroderma konusunda deneyimli 3 romatoloji uzmanı tarafından, deri tutulumu ve mRCS değerlendirilmesini içeren 1 saatlik teorik eğitim verildi. Ardından 1 saat süreyle 4 hasta üzerinde pratik eğitim uygulandı. Katılımcılar 2 hasta üzerinde eğitim öncesi ve sonrası 17 bölgeyi içerecek ve toplam skor 0-51 aralığında olacak şekilde kağıt form üzerinde skorlama yaptılar. Daha sonra eğitim öncesi ve sonrası mRCS için gözlemciler arası güvenilirlik, sınıf içi korelasyon katsayısı (intra-class correlation, ICC) analizi ile değerlendirildi. Eğitim öncesi ve sonrası 12 ayrı Rodnan skor bölgesine göre uyumun Fleiss's kappa ile değerlendirilmesi yapıldı.

**Bulgular:** mRCS skoru için ICC değeri eğitim öncesi 0,867 [%95 güven aralığı (GA): 0,625-1,00, p=0,05], eğitim sonrası 0,905 (%95 GA: 0,045-1,00, p=0,02) olarak hesaplandı. Tek tek Rodnan skor bölgelerine bakıldığında eğitim sonrasında bir kısmında uyumda artış gözlemlendi, bir bölgede değişim olmazken, bir kısmında ise uyumda azalma tespit edildi.

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**Sonuç:** Bu çalışma göstermektedir ki, mRCS, eğitim kursları ile kolaylıkla aktarılabilen etkin bir skorlamadır.

**Anahtar Kelimeler:** Skleroderma, deri tutulumu, modifiye Rodnan Cilt Skoru, eğitim

## INTRODUCTION

Systemic sclerosis (SSc) is a chronic inflammatory connective tissue disease that is characterized by skin fibrosis and can involve many organs such as the heart, lung, kidney, and gastrointestinal system<sup>1</sup>. SSc is divided into two main categories as diffuse cutaneous SSc and limited cutaneous SSc. The diffuse cutaneous form is more associated with mortality and morbidity, and skin involvement may progress rapidly in this form of the disease<sup>2</sup>.

It has been shown that the increase in skin thickness in patients with diffuse cutaneous SSc, reflecting the severity of the disease, is associated with the involvement of internal organs and increased mortality. In this respect, skin score measurement is important<sup>3</sup>. In addition, improvement in skin score is associated with better clinical outcomes<sup>2</sup>. One of the best ways to identify high-risk patients for clinical trials is to measure the severity and extent of skin involvement<sup>4</sup>.

Modified Rodnan Skin Score (mRSS), which is a measure of skin involvement, is used as a primary outcome measure in multicenter clinical studies because its feasibility, reliability and validity have been demonstrated<sup>5</sup>.

While creating the scoring, the skin thickness of the distal forearm in patients with SSc was first scored by skin palpation (using a scale of 0-4) and this value was compared with the weight of the skin punch biopsy taken from the same site. A good correlation has been demonstrated between the degree of clinical palpation and the weight of the biopsy specimen<sup>6</sup>. Subsequently, the clinical palpation score method was used to estimate skin thickness at 26 skin sites, and the first full description of this methodology was published in 1982 by Clements et al.<sup>3</sup> in a controlled study of D-penicillin in SSc. A few years later, this scoring was modified using a 0-3 scale across 17 body regions. Nine of the skin regions [neck (1), shoulders (2), breasts (2), back (1), waist (1), toes (2)] were excluded from the calculation due to high inter-observer variation. One of the first applications of mRSS was a randomized clinical trial comparing high dose versus low dose D-penicillin in the early stages of diffuse cutaneous SSc<sup>7</sup>. Although there are scoring systems developed by other researchers, it has been agreed over time that mRSS is the gold standard for measuring skin thickness in SSc<sup>8</sup>.

Modified RSS stands out with its easy applicability. The aim of this study is to evaluate the effectiveness of a practically applied mRSS course given to rheumatology minor residents by means of pre-training and post-training scorings.

## MATERIALS AND METHODS

### Selection and Definition of Cases

Ten rheumatology minor assistants studying at different universities were included in the study. Minor residents had not previously attended a course on mRSS. The participants were given theoretical training on skin involvement and mRSS evaluation, which lasted for 1 hour, by 3 rheumatology specialists experienced in SSc. Then, practical training was applied on 4 patients for 1 hour. Participants scored on a paper form before and after the training, including 17 regions on 2 patients and the total score between 0 and 51 (Figure 1). The forms of the participants were collected and evaluated.

The study were approved by the Dokuz Eylül University of Ethics Committee (protocol number: E-36862155, date: 14.09.2021).

### Technical Information

#### Modified Rodnan Skin Score Calculation

In the calculation of mRSS, which is applied based on the literature, a total value is obtained by squeezing the skin between the fingers in 17 different parts of the body (face, chest, abdomen, as well as right/left fingers, hands, forearms, arms, thighs, legs, feet) and scoring the skin thickness between 0 and 3 (0=normal, 1=mild thickness, 2=moderate thickness, 3=severe thickness) (total score 0-51). Finally, three more anatomical regions (neck, upper back and lower back) were included in the scoring system<sup>5,9</sup>.

How to apply the skin thickness measurement during the training was also explained on the patient. For this measurement, the skin should be slightly rounded or pinched using the index finger and thumb, or as a second method, the fold formed on the skin by the laterals of both thumbs should be examined. During measurement, it is important to understand the relative distribution of subcutaneous adipose tissue and underlying musculoskeletal structures in different anatomical regions.

- a. mRSS=0: normal skin,
- b. mRSS=1: thickened skin,
- c. mRSS=2: thickened and unable to pinch skin,
- d. mRSS=3: thickened and unable to move skin<sup>10</sup>.

### Statistical Analysis

Inter-observer reliability for pre- and post-training mRSS was evaluated with intraclass correlation (ICC) analysis using the Statistical Package for the Social Sciences 15 software. Compliance was evaluated with the Fleiss's kappa according to 12 different Rodnan score regions before and after the training.

### RESULTS

The ICC value for the total Rodnan score was 0.867 before training [95% confidence interval (CI): 0.625-1.00; p=0.05] and 0.905 (95% CI: 0.045-1.00, p=0.02) after training. When the mRSS score regions were examined separately, an increase in compliance was observed in some of them after the training. There was no change in one of the score regions, while a decrease in compliance was detected in some (Table 1).

### DISCUSSION

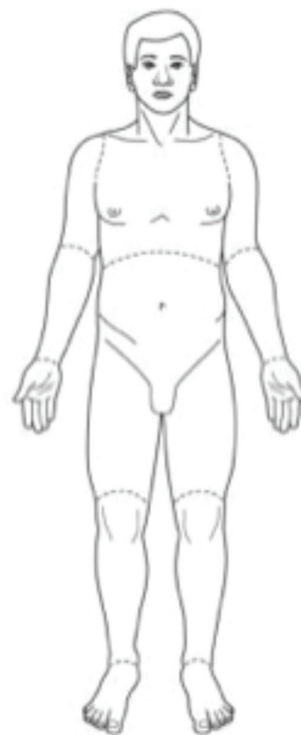
In this study, it was determined that the intra-class correlation coefficient increased after the training in the pre- and post-training evaluation of a theoretical and practical mRSS course given to rheumatology minor residents. In addition to theoretical information, it is seen that a training with this

method, which includes evaluating on patients, enables mRSS to be taught in a short time to residents who are receiving rheumatology minor education.

There are different mechanical devices such as durometer, t ultrasonography, elastometer, caliper, and tonometer that have been fully or partially validated to measure skin thickness<sup>11-13</sup>. However, mRSS is considered the most appropriate technique for assessing skin thickness. Various studies have shown that mRSS assessment is easily applicable and reliable, repeatable, accurate, and sensitive to change<sup>5,9,12,14,15</sup>. Evaluation of mRSS requires experience and careful learning<sup>15</sup>. The intra-observer correlation coefficient (ICC) may be low if scoring is done by inexperienced rheumatologists<sup>16</sup>.

The European Scleroderma Trials and Research Group (EUSTAR) conducted a study to standardize the mRSS measurement. In the study, which aimed to develop an effective methodology for teaching mRSS, it was stated that the coefficient of variation and ICC improved significantly in the repeated course, although the results of the first course were not satisfactory. In the aforementioned study, while the ICC increased from 0.496 to 0.722 to the "good" level, the coefficient of variation decreased from 54% to 32%. These results were comparable to the two previous studies [18.3% standard deviation (SD) 4.6

	Right				Left			
	0	1	2	3	0	1	2	3
Fingers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hands	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Forearms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Arms (above the elbows)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Face					0	1	2	3
Anterior chest					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Abdomen					0	1	2	3
Thighs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Legs (below the knees)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Feet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Column total								
Total								



0=Normal, 1=Mild thickening, 2=Moderate thickening, 3=Severe thickening

Figure 1. mRSS document used at the bedside in the study

mRSS: Modified Rodnan Skin Score

and 17.7% (SD 4.6), respectively]<sup>15,17</sup>. With this study, it has been confirmed that mRSS is a suitable tool for measuring skin score, and it has been shown that it is possible to teach skin score measurement technique to many rheumatologists in a short time.

In a previous study, the interobserver variation of mRSS was reported to be approximately 50%<sup>5</sup>. The outcome of this course is also similar after repeated training. The initially good ICC did not increase among experienced rheumatologists, but increased from 0.50 to 0.72 in less experienced rheumatologists. This highlights the importance of the second training course for less experienced rheumatologists. It is encouraging that the intra-observer variability is around 20%. Although it had a low ICC value, it was observed that the second repeated teaching course was generally satisfactory and this was in line with previous experience<sup>14</sup>. For example, in the first EUSTAR/EULAR course, 100 young rheumatologists were trained and the intra-patient SD values were determined at a relatively good level (5,4)<sup>5</sup>. Most participants had low ICC results. Inter-observer variability after a single training still persisted despite experienced experts educating students, but after repeated training, inter-observer variability was significantly reduced. After the completion of the course, the intra-patient SD for interobserver variability was detected to be 5.5. A good ICC value was also obtained in the mixed patient population. Consequently, given the significant observer variability, it has been suggested that teaching courses be repeated at least twice for inexperienced rheumatologists<sup>16</sup>.

There is also a study in the literature showing that good results of repetitive training courses can be stabilized. In this study, it was observed that the good initial ICC results obtained in two courses held 7 months apart continued to be similar. Therefore, the investigators suggested that training with 2 different subgroups of patients with a large number of diffuse-limited cutaneous SSc patients contributes to obtaining good results and a repeat course may not be necessary. However, it was stated that if there were significantly different scores between the trainer and the participant, a second training would be necessary. Higher coefficients of variation were obtained in patients with limited cutaneous SSc than in the diffuse cutaneous SSc subgroup<sup>18</sup>.

Although it is accepted that the modified RSS tends to worsen in early disease and improve in late disease, the time when the peak value is reached has not been clearly determined. In early diffuse cutaneous SSc, rapid and severe skin thickness increase often develops 1-3 years after the onset of the disease. In the late stage, softening is observed as a result of the decrease in the extent and severity of induration of the skin<sup>19,20</sup>. One of the main goals of modified RSS teaching is to distinguish between the active period with skin thickening and the chronic period with skin atrophy.

### Study Limitations

As a limitation of the study, our training was not repeated after a certain period of time, as suggested in previous studies, but was applied in a single step. For the optimization of the results,

**Table 1. mRSS results by score regions before and after training**

Region	Before training		After training	
	Fleiss's Kappa (95% CI)	Compliance, %	Fleiss's Kappa (95% CI)	Compliance, %
Right finger	0.38 (0.003, 0.73)	<b>53.3</b>	0.60 (-0.18, 1.00)	<b>70.0</b>
Left finger	0.42 (0.16, 0.68)	56.6	0.29 (0.29, 0.29)	46.6
Right hand	0.02 (0.02, 0.02)	<b>26.6</b>	0.11 (-0.06, 0.29)	<b>33.3</b>
Left hand	0.16 (-0.11, 0.42)	<b>36.6</b>	0.16 (-0.11, 0.42)	<b>36.6</b>
Right forearm	0.29 (0.29, 0.29)	46.6	0.02 (0.02, 0.02)	26.6
Left forearm	0.29 (0.29, 0.29)	46.6	0.02 (0.02, 0.02)	26.6
Right upper arm	0.11 (-0.06, 0.29)	33.3	-0.22 (-0.11, 0.06)	23.3
Left upper arm	0.24 (0.16, 0.33)	43.3	0.02 (0.02, 0.02)	26.6
Face	0.24 (0.16, 0.33)	43.3	0.02 (0.02, 0.02)	26.6
Chest	0.24 (0.16, 0.33)	43.3	0.16 (-0.11, 0.42)	36.6
Abdomen	0.16 (-0.11, 0.42)	36.6	0.11 (-0.06, 0.29)	33.3
Right upper leg	0.02 (0.02, 0.02)	<b>26.6</b>	0.29 (0.29, 0.29)	<b>46.6</b>
Left upper leg	0.02 (0.02, 0.02)	<b>26.6</b>	0.20 (-0.50, 0.90)	<b>40.0</b>
Right lower leg	0.38 (0.003, 0.73)	53.3	0.24 (0.16, 0.33)	43.3
Left lower leg	0.29 (0.29, 0.29)	46.6	0.20 (-0.50, 0.90)	40.0
Right foot	0.11 (-0.06, 0.29)	<b>33.3</b>	0.38 (0.003, 0.73)	<b>53.3</b>
Left foot	0.29 (0.29, 0.29)	<b>46.6</b>	0.42 (0.16, 0.68)	<b>56.6</b>

mRSS: Modified Rodnan Skin Score, CI: Confidence interval

it may be appropriate to increase the number of trainees and patients and the duration of the course in future studies.

## CONCLUSION

This study shows that the training of a relatively inexperienced group by rheumatologists specialized in mRSS can be done effectively and simply. Considering that skin involvement of scleroderma is a good indicator of the course of the disease, it seems that a scoring such as mRSS has a place not only for use in studies but also for patient follow-up. For this reason, it seems appropriate to make it a part of the education through practically applied courses during rheumatology minor education.

## Ethics

**Ethics Committee Approval:** The study were approved by the Dokuz Eylül University of Ethics Committee (protocol number: E-36862155, date: 14.09.2021).

**Informed Consent:** Consent form was filled out by all participants.

**Peer-review:** Externally peer-reviewed.

## Authorship Contributions

Concept: G.C., F.Ö., S.S.K., A.A., M.B., Design: G.C., F.Ö., D.S., A.A., M.B., Data Collection or Processing: G.C., A.K.A., S.B.K., G.K., Analysis or Interpretation: G.C., A.K.A., D.S., Literature Search: G.C., S.B.K., Writing: G.C., G.K.

**Conflict of Interest:** No conflict of interest was declared by the authors.

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