Mandibular Function is Severely Impaired in Systemic Sclerosis Patients

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Aims: *To evaluate the presence of temporomandibular disorders (TMD) in systemic sclerosis (SSc) patients and its possible association with the severity of skin involvement.* ***Methods:*** *The presence of TMD was evaluated in 35 SSc women and 30 age- and sex-matched healthy controls by means of the anamnestic (A_i) and clinical (D_i) Helkimo indices; the jaw mobility was further analyzed (M_I). Skin involvement was scored by the Modified Rodnan Skin Score (MRSS).* ***Results:*** *Signs and symptoms of TMD were more frequent in SSc patients than in controls, the frequency distribution of the different clinical dysfunction indices differing significantly (*P < *.001) between patients (D_i0 8.6%, D_iI 48.6%, D_iII 22.8%, and D_iIII 20%) and controls (D_i0 50%, D_iI 33.3%, and D_iII 16.7%). Cyclophosphamide for severe and rapidly progressive cutaneous fibrosis was prescribed in six out of seven patients with severe signs (D_iIII), in contrast this treatment was indicated for only two out of 25 patients with mild to moderate signs (D_iI and D_iII,* P < *.001). Impaired jaw mobility was more frequent in SSc patients than controls (*P < *.001). It was severe in 77.1% (M_III) and mild in 22.9% (M_II) of the cases, in contrast to controls (M_I0 33.4%, M_II 53.3%, and M_III 13.3%;* P < *.001). Approximately half of SSc patients with severe (M_III) but none of those with mild impairment were on cyclophosphamide treatment for severe cutaneous fibrosis (*P = *.02).* ***Conclusion:*** *Severe signs of TMD according to the anamnestic and clinical Helkimo indices were very frequent in SSc patients.* J OROFAC PAIN 2010;24:197–202

Key words: Helkimo indices and fibrosis, systemic sclerosis, temporomandibular disorders, temporomandibular joint

Systemic sclerosis (SSc) or scleroderma is a rare autoimmune connective tissue disease of unknown etiology that is characterized by cutaneous and visceral fibrosis and that is associated with a vascular involvement identified as Raynaud phenomenon.[1] Women are more often affected than men and on average patients are approximately 50 years of age at diagnosis.[2] The main clinical feature of the disease is abnormal collagen deposition with consequent thickening of the skin, frequently seen in the face, hands, and internal organs.[3] SSc is classified into diffuse and limited subtypes according to the extension of the skin involvement. In the limited subtype, skin fibrosis is restricted to distal extremities, face, and neck whereas the diffuse subtype not only has a pronounced cutaneous involvement of these areas but also involves the thorax, abdomen, and areas proximal to the elbows and knees.[4]

Among the clinical signs of SSc in the face, the lips become thinner and rigid because of the skin thickness, consequently reducing the oral aperture (microstomy); modifications also occur in facial appearance and the patient has difficulty in swallowing, speaking, and even with oral hygiene.[5] The involvement of facial tissues and jaw muscles can also cause pressure and resorption of the mandible. This finding was previously reported in nearly 10% of SSc patients and has been associated with pathological fractures, osteomyelitis, and neuropathies.[6,7]

The effective evaluation of microstomy management using exercise programs[8] and surgical correction [9,10] has been hampered in previous studies by the lack of assessment of the amount of jaw movements and temporomandibular function.[8–10] Thus, the aim of the present study was to evaluate the presence of temporomandibular disorders (TMD) in SSc patients and its possible association with the severity of skin involvement.

Materials and Methods

Thirty-five consecutive SSc women who fulfilled the American College of Rheumatology (ACR) criteria for Systemic Sclerosis[11] were evaluated during routine visits at the Outpatient SSc department of the hospital, University of São Paulo. A convenience group of 30 age- and sex-matched healthy employees of the same institution were selected as controls. Patients and controls had to have all maxillary and mandibular incisors in order to reliably measure the maximum interincisal mouth opening. The study was approved by the Local Ethical Committee and informed consent was obtained from all patients and controls.

SSc patients were classified into a diffuse or limited subtype according to LeRoy et al.[4] Disease duration was defined as the onset of the *Raynaud* phenomenon.[1] Treatments of SSc patients were assessed during interview and by means of an extensive questionnaire. During the examination, all diffuse SSc patients were evaluated by the same rheumatologist (RBC) who used the Modified Rodnan Skin Score (MRSS). This score, that is not routinely assessed in patients with the limited subtype, grades the cutaneous involvement (0 = normal to 3 = intense thickness) at 51 sites in 17 body regions.[12] The rheumatologist was blind to the patients' scores on the Helkimo indices (see below).

Mandibular Mobility and TMD Evaluation

A standardized diagnostic protocol was applied to patients and controls by a single experienced and trained orofacial pain investigator (ELAF). It consisted of an interview followed by a systematic evaluation of cervical and facial muscles; oral structures[13–15] that were evaluated by temporomandibular lateral and posterior poles palpation with a standardized pressure. Temporomandibular joint (TMJ) dysfunction of SSc patients and controls was evaluated by the same investigator (ELAF) using the Helkimo indices.[16]

The functional degree of the masticatory system was assessed by means of the Helkimo anamnestic index (A_i 0 symptom free, A_iI mild, and A_iII severe symptoms) and the clinical dysfunction index (D_i) that is based on the evaluation of five clinical signs of dysfunction [impaired jaw mobility (M_I), impaired TMJ function, jaw muscle tenderness to palpation, TMJ tenderness to palpation, and pain on mandibular movement], and that is graded as sign free (D_i0), mild signs (D_iI), moderate signs (D_iII), and severe signs (D_iIII). The jaw mobility (M_I) was also separately evaluated in all SSc and controls by measuring with a millimeter ruler the maximum interincisal opening (without overbite), the right and left laterotrusive movements, and jaw protrusion (with overjet). Jaw mobility was rated as normal (M_I0), mildly impaired (M_II), and severely impaired (M_III): normal (M_i0) when the maximum interincisal opening was ≥ 40 mm and the maximum laterotrusive movements ≥ 7 mm, mildly impaired (M_II) when at least one of these measures was lower than the normal values, and severely impaired (M_III) when all measures were lower than the normal values. The dental occlusion index was not assessed in this study.

Orthopantomography of the Jaw

This radiograph was obtained in order to exclude structural lesions of teeth and jaw and to evaluate the teeth, mandible angle, and the TMJ. All images were analyzed by a dentist specializing in TMD who was blind to the findings of the scores on the Helkimo indices.

Table 1 Frequency Distribution of the Various D_i Indices in the SSc Patients and Healthy Controls

D_i	SSc (n = 35)	Control (n = 30)	Fisher exact test *(P)*
Normal (D_i0)	8.6%	50.0%	< .001
Mild (D_iI)	48.6%	33.3%	
Moderate (D_iII)	22.8%	16.7%	
Severe (D_iIII)	20.0%	0.0	

Table 2 Frequency Distribution of the Various Jaw Mobility (M_I) Scores in the SSc Patients and Healthy Controls

M_I	SSc (n = 35)	Control (n = 30)	Chi-square test *(P)*
Normal (M_I0)	0.0	33.4%	< .001
Mild (M_II)	22.9%	53.3%	
Severe (M_III)	77.1%	13.3%	

Statistical Analysis

Data are expressed as mean ± standard deviation (SD) or percentage. The percentage distribution of the different Helkimo indices in both groups was compared by chi-square test or Fisher exact test (categorical data with frequency < 5%). The mouth-opening parameters were analyzed by Student *t* test (parametrical data) or Mann-Whitney test (nonparametrical data). Correlations were analyzed by Spearman correlation index. *P* value less than .05 was considered significant.

Results

The mean age of the 35 SSc female patients was similar to that of the 30 control group subjects (41.8 ± 11.6 versus 39.2 ± 9.2 years, *P* = .32). This was the case also for the percentage of subjects belonging to the Caucasian race (80% versus 90%, *P* = .32). The mean SSc disease duration was 10.08 ± 8.97 years, and 21 patients were classified as diffuse and 14 patients as limited subtype. Twenty-three SSc patients were treated with cyclophosphamide, 8 for severe rapidly progressive cutaneous fibrosis, and 15 for pulmonary involvement; 12 never used this drug.

Anamnestic Index (A_i)

According to this index, 22 (62.8%) of the SSc patients had severe symptoms (A_iII), 6 (17.2%) mild symptoms (A_iI), and 7 (20%) were symptom-free (A_i0). In contrast, only 4 (13.4%) of the healthy subjects had severe, 11 (36.6%) mild symptoms, and 15 (50%) were symptom-free. The difference in the percentage distribution of the different anamnestic indexes of the two groups was statistically significant (*P* < .001).

Dysfunction Index (D_i)

Seven (20%) patients in the SSc group but none in the control group had severe signs (D_iIII) (*P* < .001) (Table 1). In addition, a significant difference in the total D_i score was observed in SSc patients compared to the control group (5.6 ± 4.76 versus 1.43 ± 2.28; *P* < .001). Nine of the 21 patients with diffuse SSc had moderate to severe signs (D_iII and D_iIII), with a trend for higher mean skin score of the face (MRSS) compared to the 12 patients with mild signs (D_iII) (1.77 ± 0.66 versus 1.16 ± 0.74; *P* = .06, respectively). Also, a trend for positive correlation was found between skin score of the face (MRSS) and the total D_i score (r = 0.37, r^2 = 0.14; *P* = .09). However, the D_i score explained only to 14% the variation in skin score of the face.

Jaw Mobility (M_I) Score

None of the SSc patients had a normal jaw mobility (M_I0) compared to 33.4% of the controls and the majority of SSc patients (77.1%) had a severe jaw mobility impairment (M_III), whereas this was the case for only four controls (13.3%) (Table 2). The percentage distributions of the different M_I scores were significantly different between the two groups (*P* < .001). The total M_I score was significantly higher in the SSc patients than in the controls (7.62 ± 3.78 versus 2.26 ± 2.55; *P* < .001).

Evaluation of the 21 patients with diffuse SSc revealed that the mean skin score of the face (MRSS) of the patients with severe jaw mobility impairment (M_III) was comparable to that of patients with mild (M_II) impairment (1.5 ± 0.7 versus 1.12 ± 1.03; *P* = .53, respectively). No correlation was observed between skin score of the face and the total M_I score (r = 0.25, *P* = .27).

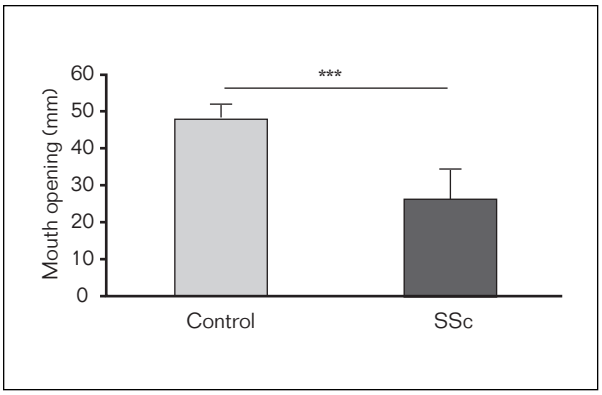

Fig 1 Maximum interincisal mouth opening (mm) in the SSc patients and healthy controls (values: mean ± SD). ***$P < .001$.

Maximum Mouth Opening and MRSS

Only two (8.6%) of the SSc patients had a maximum opening ≥ 40 mm compared to 93.3% of controls ($P < .001$). The mean mouth opening was 25.9 ± 8.2 mm for the SSc patients and 42.8 ± 4.3 mm for the controls ($P < .001$) (Fig 1). In the 21 patients with diffuse SSc, the mean skin score of the face (MRSS) was negatively correlated to the maximum interincisal mouth opening ($r = –0.41$, $r^2 = 0.17$; $P = .06$). However, only 17% of the variance in the skin score of the face could be explained by the amount of maximum opening.

Patient's Age, Disease Subtype, Disease Duration, and Degree of Dysfunction

No significant difference was observed between diffuse and limited subtypes regarding the A_i ($P = .19$), D_i (5.04 ± 5.16 versus 4.92 ± 4.19; $P = .48$, respectively), and the M_I (8.42 ± 3.98 versus 6.42 ± 3.22; $P = .11$, respectively) scores. This was the case also when the various indices were compared among SSc patients older than 40 years with those younger than 40 years (A_i, $P = .71$; D_i, $P = .83$; and M_I, $P = .68$) or between patients with a disease duration of ≥ 5 years with those with a duration of < 5 years (A_i, $P = .65$; D_i, $P = .43$; and M_I, $P = .89$).

Cyclophosphamide Therapy

Patients with severe clinical dysfunction were treated with a more aggressive therapy since 86% of SSc patients with severe signs (D_iIII) were treated with cyclophosphamide prescribed for severe cutaneous involvement. In contrast, only 8% of patients with mild to moderate signs (D_iI and D_iII) were treated with cyclophosphamide specifically for severe cutaneous fibrosis ($P < .001$). Moreover, the total D_i score was significantly higher in SSc patients on cyclophosphamide treatment for the cutaneous fibrosis (n = 8) compared to patients without any immunosuppressive drug (n = 6) (11.25 ± 4.83 versus 3.16 ± 2.51, $P = .001$; respectively). Likewise, SSc patients on cyclophosphamide treatment for cutaneous fibrosis had a higher D_i score compared to SSc patients on cyclophosphamide for pulmonary involvement (n = 15) (11.25 ± 4.83 versus 4.53 ± 3.59, $P = .006$; respectively). Finally, eight out of 17 (47%) patients with a severe M_I index were treated with cyclophosphamide that is indicated for severe cutaneous involvement, contrasting with no indication of this treatment among the eight patients with mild M_I ($P = .02$).

Orthopantomogram Evaluation

The orthopantomograms of 27 SSc patients were analyzed and only four (19%) were considered normal. Three (14.2%) showed a mild mandibular resorption, six (28.6%) a mild resorption of the condyles, and eight (38%) an enlargement of the periodontal space. No patient had severe resorption of the mandible or condyles.

Discussion

This study has shown that SSc patients have a severe restriction of mandibular function which seems to be associated with the loss of skin elasticity due to collagen deposition. Demographic features such as age and gender cannot account for the functional restriction as shown by the comparisons of SSc patients with a group of control subjects matched for age and gender. To the authors' knowledge, this is the first study using Helkimo indices[16–18] to specifically address the prevalence of mandibular system dysfunction in a scleroderma population and not only the MRSS that grades only the cutaneous involvement.[12] Previous studies have reported pseudoankylosis, malocclusion, and mandibular resorption in SSc patients.[6,7,19,20] These complications were observed in the minority of our patients.

In other rheumatological diseases, such as rheumatoid arthritis and psoriatic arthritis,[21,22] the dysfunction of the masticatory system is caused by

joint inflammation. In the case of SSc patients the dysfunction is, however, likely due to the increased skin thickness and decreased skin elasticity as a consequence of collagen deposition that lead to jaw movements restriction. First, the cutaneous indication for cyclophosphamide was mainly limited to patients with severe dysfunction and none of the patients had normal TMJ mobility. Second, SSc patients treated with cyclophosphamide had a more severe D_i score, and cyclophosphamide is indicated in cases of severe cutaneous involvement. Third, there was a negative correlation between the maximum interincisal mouth opening and the MRSS of the face.

The significant decrease in mouth opening is the major problem in scleroderma patients when they have to undergo dental therapy. Although cases have been described in the literature that could be treated prosthetically in spite of microstomy,[23–26] surgery may be necessary in extreme cases.[9,10]

Two studies have recommended mouth-stretching exercises in order to reduce and/or to decrease the risk of mouth-opening limitation.[8,27] The findings of this study suggest that facial skin fibrosis should be treated in order to decrease the degree of mouth-opening reduction. In this regard, dermatological treatments such as photodynamic therapy, phototherapy with ultraviolet long-wavelength light or photo chemotherapy have shown promising results in the treatment of patients with localized SSc,[28–33] although these therapies have not yet been proven effective.

In conclusion, SSc patients often show signs of TMD, especially a reduced maximum mouth opening, that are likely related to the increased skin rigidity due to collagen deposition.

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