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# Evaluation of oral manifestations and masticatory force in patients with polymyositis and dermatomyositis

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**BACKGROUND: The polymyositis (PM) and dermatomyositis (DM) complex encompasses a heterogeneous group of acquired autoimmune skeletal muscle diseases called idiopathic inflammatory myopathies (IIM). Despite their histological and immunopathological differences, the end result of the affected muscles in all of these entities is the triad of chronic inflammation, fibrosis and the loss of muscle fibres. The aim of this study was to perform a complete analysis of the orofacial abnormalities in 34 patients with PM and DM.**

**METHODS: Evaluation of subjective oral symptoms, measurement of whole resting saliva flow rate (WS) with the 'spitting method', a visual investigation of the oral soft tissue alterations, light- and electron microscopic analysis of the symptoms of capillary abnormalities or signs of focal infiltration in labial biopsy specimens were carried out. The number of decayed, missing and filled teeth (DMF-T) according to the WHO recommendations (1997), the periodontal probing depth (PPD), the plaque index (PI; Silness–Löe) and the gingival index (GI; Löe–Silness) were determined. For comparison with healthy controls the masticatory force (MF) and the force of the upper extremities' flexors were measured with a specially developed device. The SPSS version 11.0 for Windows software program, two-tailed Student's *t*-test and Mann–Whitney test were used to statistically analyse all data. Values were considered to be significant if *P* level was ≤0.05.**

**RESULTS: Nine patients complained of subjective xerostomia, 11 showed the signs of salivary hypofunction (WS ≤ 0.1 ml/min). The most prominent symptom of the oral mucosa and perioral tissues was the presence of telangiectasia, detected in seven cases. Fibrosis of the minor salivary glands was found in 12 patients, interstitial–perivascular infiltration was detected in eight cases, periductal infiltration in one case. The findings on dental and periodontal conditions indicate, that the patients with IIM diseases had significantly higher DMF-T scores (24.06 ± 7.04 vs. 19.54 ± 8.93, respectively; *P* = 0.002), they had less remaining teeth in average (15 vs. 20; *P* = 0.002), compared with the control group. Their oral hygiene was significantly worse (PI was 1.46 ± 0.75 and 0.73 ± 0.54, *P* = 0.001). GI was significantly higher in the patients (1.27 ± 0.60 and 0.66 ± 0.56, respectively, *P* = 0.0003), although we could not demonstrate any difference in the severity of the periodontal destruction between patients and controls. Masticatory force was significantly weaker in the first molar region on both sides in the patient group (309 ± 213 N and 113 ± 146 N, *P* = 0.0016 for the right side; 315 ± 239 N and 123 ± 76 N, *P* = 0.009 for the left side), but only the left hands showed to be weaker in the patient group (77 ± 27 N and 59 ± 20 N, *P* = 0.04).**

**CONCLUSION: In conclusion, the present study showed that, patients with IIM diseases have hyposalivation and mucosal alterations, mainly in the form of telangiectasia. They have increased prevalence of dental caries, which may be secondary to the hyposalivation. The masticatory and the upper extremity flexor forces indicate that the weakness of the masticatory muscles can manifest earlier than that of the arms.**

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**Keywords:** dental caries; dermatomyositis; gingivitis; hyposalivation; polymyositis; Sjögren's syndrome

## Introduction

The idiopathic inflammatory myopathies (IIM) are a heterogeneous group of systemic autoimmune diseases with the common features of chronic muscle weakness and mononuclear cell infiltrates in the muscles (1, 2). On the basis of clinical, histological and immunopathological characteristics the acquired inflammatory myopathies are subdivided into dermatomyositis (DM), polymyositis (PM) and sporadic inclusion body myositis (IBM). In DM, early activation of complement components (C5b–C9) leads to the deposition of membrane attack complex on the endomysial capillaries, resulting

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in perivascular inflammation, capillary depletion, muscle ischemia, necrosis and perifascicular atrophy (1, 2). In PM and IBM sensitized CD8+ cytotoxic T-cells invade and destroy muscle fibres that aberrantly express the class I major histocompatibility complex antigen. Despite their histological and immunopathological differences, the end result of the affected muscles in all of these entities is the triad of chronic inflammation, fibrosis and the loss of muscle fibres. The most common extramuscular manifestations are fever, weight loss, arthritis, arthralgia, subcutaneous calcification (calcinosis), cancer (cancer-associated myositis), cardiac symptoms (atrioventricular conduction defects, tachyarrhythmia and myocarditis) and pulmonary symptoms (because of the weakness of the thoracic muscles or interstitial lung disease) (3, 4). Overlap can be seen with other connective tissue diseases: DM overlapping systemic sclerosis and mixed connective tissue diseases, rarely Sjögren's syndrome; PM associated with lupus erythematosus, rheumatoid arthritis, Sjögren's syndrome, Chron's disease, vasculitis and sarcoidosis (3).

Reviewing the literature, only few authors have mentioned oral manifestations of IIM. Mucous membrane involvement is reported in 10–20% of the cases (5). Mucosal oedema, and erythema, manifesting in telangiectasia are the most common oral alterations (6–8). Marginal oedematous gingivitis is believed to be a special sign of the capillary changes in PM and DM (7), and furthermore, gingival telangiectasia was found to be analogous to nail fold telangiectasia, which is a prominent alteration of DM (8). Calcification is also a typical manifestation of the skin and the mucosa in DM (9) but an unusual form, as a corollary sign of the generalized calcinosis, may result in the obliteration of the pulp chamber of the teeth (9). Whitish reticulated patches on the tongue, lichen-like lesions were also described, although authors declared that those are not specific characteristics of myositis (6, 7). Dysphagia, affects 15–50% of the patients with IIM diseases (6, 10, 11), which is attributed to the oesophagus dysmotility (because of the weakness of the striated muscles), and to the inflammatory macroglossia (10). These quite few reviews are limited only to the mucosal symptoms (5, 7, 9), or case reports (10) about very few, mainly paediatric, DM patients (6, 8). There are no studies, which have systematically evaluated the oral health status of these patients; neither dental nor periodontal considerations have been available. We have not found data about the saliva flow rate, and the masticatory force, which would be important from different aspects of oral health (chewing efficacy, hyposalivation).

Based on the previous descriptions, it is supposed, that oral mucosal signs could be the intraoral manifestations of the autoimmune inflammatory process of IIM. It is likely that patients with these diseases might have several other oral signs and symptoms, including increased caries prevalence and periodontal involvement, because of the feasible hyposalivation and the masticatory weakness.

Principal objective of this study therefore was to perform a complete analysis of the orofacial abnormalities in PM and DM, and to clarify the oral consequences of the systemic clinical and immunological alterations of IIM.

## Materials and methods

This paper is based on a study of 34 patients with PM or DM, encountered at the Division of Immunology, 3rd Department of Medicine, Medical and Health Science Center, University of Debrecen, Hungary. Patients underwent a general medical and an immunological examination, supplemented with electrocardiography, echocardiography, chest radiography, manual muscle test, electromyography and muscular biopsy. All of them fulfilled the diagnostic criteria for PM or DM, according to the Bohan and Peter system (1977) (11, 12). The mean length of the disease was 60 ± 6 months at the time of the investigation. The clinical and laboratory data of patients were evaluated according to a standard protocol (Table 1). The orofacial condition of 35 age- and sex-matched healthy controls was also examined (Table 2). They were the outpatients of the Teaching Hospital, Dental Faculty, University of Debrecen. Distribution of persons coming from the rural and urban areas of the north-eastern part of Hungary, was similar in the two groups. The design of this study was set up according to the Regulations of the Hungarian Ministry of Health 'regarding the human studies 23/2002.' ('Magyar Közlöny no. 2002/61').

*Immunological and laboratory tests*

The presence of autoantibodies was detected by the ELISA (Abstart II-HYCORE, Garden Grove, CA, USA) technique. The preparation of Sjögren's syndrome-A (SS-A) and Sjögren's syndrome-B (SS-B)

**Table 1** Clinical and immunological profile of 34 patients with polymyositis and dermatomyositis

| | |
|---|---|
| Age (mean ± SD, years) | 42 ± 11 |
| No. of patients (M:F ratio) | 34 (0.48:1) |
| Dermatomyositis (M:F ratio) | 5 (0.66:1) |
| Polymyositis (M:F ratio) | 29 (0.45/1) |
| EMG positivity | 34 |
| Arrhythmia and/or cardiac failure | 4 |
| Interstitial lung disease | 2 |
| Gastrointestinal symptoms | 3 |
| Endocrine involvement | 1 |
| Anti-SS-A positivity | 3 |
| Anti-SS-B positivity | 3 |
| Anti-SS-A and anti-SS-B positivity | 2 |
| Anti-Jo1 positivity | 0 |
| Anti-RNP positivity | 5 |
| Raised CK-level | 34 |
| Anti-ENA positivity | 6 |
| Anti-DNA positivity | 5 |
| Anti-SM positivity | 5 |
| sc-170 | 0 |
| Non-destructive arthritis or arthralgia | 8 |
| Manual muscle test positivity | 34 |
| Muscle biopsy positivity | 34 |
| Smokers | 3 |

EMG, electromyographic; ENA, extractable nuclear antigen; RNP, ribonucleoprotein.

**Table 2** Glandular functions and clinical symptoms in patients with polymyositis and dermatomyositis compared with the controls

| | *Patients (n = 34)* | *Controls (n = 35)* |
|---|---|---|
| Age at time of referral (years) | 42 ± 11 | 41 ± 15 |
| Male:Female ratio | 0.48:1 | 0.59:1 |
| Whole resting saliva flow rate (WS; ml/min) | 0.18 ± 0.11[a] | 0.33 ± 0.21[a] |
| Salivary hypofunction (WS ≤ 0.1 ml/min) | 11 | – |
| Subjective xerostomia | 9 | – |
| Swollen parotid gland | 1 | – |
| Histological alteration of the lower labial salivary glands | 14 | – |
| Positive focus score (no. of foci ≥ 1) | 1 | – |
| Dysphagia | 10 | – |

Data signed by the same superscript letters (a) are significant at $P \leq 0.05$, the actual $P$-value was 0.003.

antigens and the ELISA technique for detecting anti-SS-A and anti-SS-B antibodies in the serum was performed according to the method of Lieu et al. (13).

*Evaluation of subjective symptoms*
The presence or absence of subjective symptoms, especially xerostomia and dysphagia was assessed by a questionnaire similar to the one employed in the development of the revised European Classification Criteria for Sjögren's syndrome (2002) (14, 15).

*Investigation of oral mucosal alterations*
A visual examination was performed to detect any oral soft tissue alterations (16, 17).

*Exocrine function test*
Signs of possible salivary hypofunction were evaluated. Whole resting saliva flow rate (WS) was determined according to Sreebny (1992) (18); a secretion rate of less than 0.1 ml/min was considered as a sign of salivary hypofunction (18).

*Histological investigations in the lower lip*
All the patients had a biopsy taken of the lower labial salivary glands. Light microscopic findings were evaluated for signs of focus score after the method of Daniels (1984) (19). Fibrosis, perivascular or interstitial infiltration was determined.

Electron microscopic investigations were performed to evaluate the capillary changes. Tissue samples from the lower labial salivary glands were fixed in 3% glutaraldehyde (v/v), postfixed in 1% osmium tetroxide (w/v) and embedded in Araldite (Durcupan ACM, Fluka Chemie AG, Switzerland). Semifine sections were cut in a Reichert ultramicrotome (Vienna, Austria) (OMU2). Fine sections were stained with uranyl acetate and viewed in Tesla BS500 Electron microscope (Brno, Czech Republic).

*Dental and periodontal examinations*
The number of the decayed, missing and filled teeth (DMF-T) was determined with the use of a standard dental mirror and probe and supplemented with full-mouth radiographs (20).

The periodontal condition of teeth was evaluated by determining the periodontal probing depth (PPD) with a calibrated periodontal probe [William's periodontal probe (Astir Intermedica, Kensington, London)]. In addition, the plaque index (PI; Löe–Silness, 1963) and gingivitis index (GI; Silness–Löe, 1964) were determined (21–23).

Full-mouth intraoral and panoramic radiographs were taken of each patient by the same technician with the use of constant exposure and positioning.

*Temporomandibular joint status*
The characteristics of the involvement of the temporomandibular joints were evaluated by physical examination. Pain, tenderness, clicking and deviations of the mandible during opening of the mouth were considered as signs of the temporomandibular joint involvement. With respect to the possible restriction of mouth opening, we measured the interincisal distance between the incisal edges of the upper and lower first incisors at maximal opening of the patient's mouth. The interincisal distance less than 40 mm was regarded as abnormally low.

*Measurement of the masticatory force*
The masticatory force (maximum biting force) (24) was measured by a hand-held occlusal force meter, developed in the Department of Prosthodontics Semmelweis University, Budapest, Hungary, according to Prágai (1977) (25) and Voelker and Sonnenburg (1984) (26). The device is constructed from two parts: the metal gauge and the display. The working endpiece of the gauge is formed to be suitable for measurements at the front and at the molar regions as well. This part is covered with self curing acrylic resin in order to prevent reflectory decreasing of the masticatory force experienced on metal sensation. The opposing endpiece contains a resistor, which is sensitive to the deformation of the gauge. The sensed deformation is then transformed into an electronic impulse with the help of a transducer (resistor bridges); the result is visible on the display. Maximum biting forces during maximal voluntary clenching were recorded bilaterally in the first molar regions and at the incisal area, and for comparison we also measured the force of the hand gripping bilaterally. All the measurements were carried out three times with 3-min intervals and then mean values were subject to analysis.

*Statistical methods*
For the statistical analysis the SPSS version 11.0 for Windows software program (SPSS, Inc., Chicago, IL, USA) was used. Paired Student's $t$-test for analysing WS, DMF-T, GI, PI, PPD, masticatory force, hand gripping on the left side, incisal masticatory force; while Mann–Whitney test were employed for the testing the right hand force. A $P$ level of less than 0.05 was considered statistically significant.

## Results

*Immunological and laboratory findings*

Abnormal immunologic findings were observed in 15 patients (Table 1). Six of them demonstrated the presence of extractable nuclear antigen (anti-ENA) antibodies in their serum; three, had anti-SSA and three, had abnormally high anti-SS-B levels, two, showed both anti-SS-A and anti-SS-B positivity. Anti-(native) DNA antibodies in five; anti $U_1$ ribonucleoprotein (RNP) positivity in five; anti-Smith (SM) antibodies in five of the patients could be detected. None of the patients showed anti-Jo1 antibody or sc-170 positivity in their serum.

*Subjective symptoms*

Nine of the patients complained of xerostomia (Table 2) and 10 of dysphagia. None of the controls complained of those symptoms.

*Oral mucosal alterations*

Telangiectasia of the oral mucosa was observed in seven cases (20%; five was seen on the lower lip, one on the perioral skin and one on the palatal mucosa). Denture stomatitis and angular cheilitis were found in four–four cases.

*Glandular function*

Glandular function can be seen in Table 2. The mean flow rate of WS of the patient group was 0.18 ± 0.11 ml/min. This was significantly lower ($P = 0.002$) than that of the control group (0.33 ± 0.21 ml/min). Eleven of the 34 patients had flow rates of WS of less than 0.1 ml/min; none of the controls demonstrated such low rates. One patient demonstrated parotid swelling. As a sum four patients fulfilled the revised Diagnostic Criteria for Sjögren's syndrome (2002) (15).

*Histological findings in the lower labial salivary glands*

Fourteen of the biopsy specimens showed histological alterations. The most characteristic alteration, interstitial lymphocytic infiltration, was observed in 12 cases among those eight was perivascular. Six patients demonstrated periductal lymphocytic infiltration but only one of them showed positive focus score (characteristic of the Sjögren's syndrome). Fibrosis was seen in 12 cases (periductal in four, interstitial in eight cases). Acinar atrophy could be detected in one case.

Ultrastructural investigation characteristically revealed thickening of the vascular basal membrane with a lamellar arrangement (Fig. 1). Capillary endothelial cell hypertrophy was visible in some cases. The ductal epithelial cells were completely or partially lacking their villi (Fig. 2). Interepithelial canaliculi were slightly distended and their villi were fragmented and desquamated.

*Dental and periodontal condition*

DMF-T value was significantly higher ($P = 0.05$) in the patient group (mean ± SD was 24.06 ± 7.04) than among the controls (mean ± SD was 19.54 ± 8.93) (Table 3) and showed to be higher in patients with anti-SS-A and anti-SS-B antibody positivity ($P = 0.02$). In accord with this observation, the control subjects retained more teeth than the patients (20 vs. 15, $P = 0.05$). Seven patients and eight controls wore complete dentures at least in one jaw. Four patients and four controls were completely edentulous.

Table 3 shows the values of PI, GI and PPD in the patients and in healthy controls. Both PI and GI were significantly higher ($P = 0.00004$ and $P = 0.00003$, respectively) in the patients; no differences were observed in the periodontal status of the two groups.

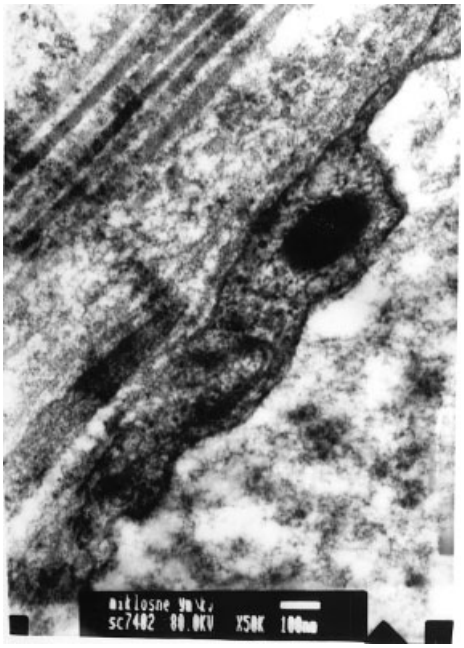


**Figure 1** Electronmicroscopic findings in patient with polymyositis. Arteriola endothel: lamellated thickened basal membrane.

**Table 3** Decayed, missing and filled teeth (DMF-T) number, gingival and periodontal condition of patients with polymyositis and dermatomyositis compared with the controls

| | *Patients (n = 34)* | *Controls (n = 35)* |
|---|---|---|
| DMF-T | 24.06 ± 7.40[a] | 20.02 ± 9.01[a] |
| Average number of remaining teeth | 15[a] | 20[a] |
| Complete denture wearers (on at least one jaw) | 7 | 7 |
| Removable partial denture wearers | 4 | 5 |
| Involvement of temporomandibular joint | 9 | 1 |
| Periodontal probing depth (mm) | 1.85 ± 0.84* | 2.10 ± 0.80* |
| Plaque index | 1.46 ± 0.75*[b] | 0.60 ± 0.48*[b] |
| Gingival index | 1.27 ± 0.60*[c] | 0.53 ± 0.51*[c] |

Data signed by the same superscript letters (a, b, c) are significant at $P \leq 0.05$, the actual $P$ values were: a, $P = 0.05$; b, $P < 0.00004$; c, $P < 0.00003$.
*30 patients, 31 controls (complete denture wearers on both jaws were excluded).

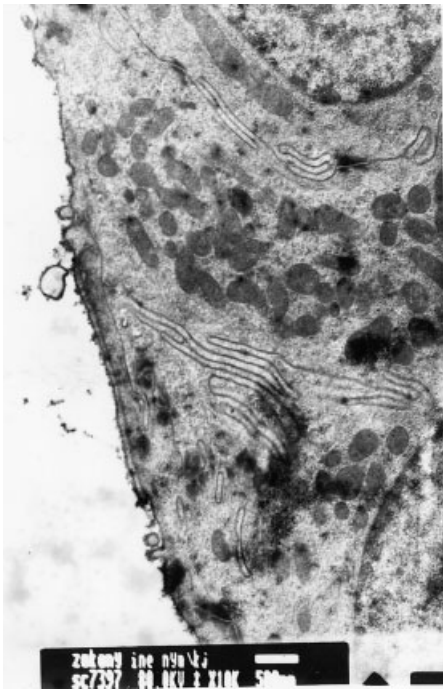

**Figure 2** Electronmicroscopic findings in patient with polymyositis. Ductal epithelial cell: missing villi.

*Temporomandibular joint*

The temporomandibular joint (TMJ) showed alteration in nine cases of the patients while only one control was complaining of that. Five patients demonstrated mandibular deviation and one had crepitation and clicking during opening of the mouth, five of them, complained about sensitivity of the lateral pterygoid muscle at palpation. None of the patients showed an interincisal distance smaller than 40 mm.

*Masticatory and hand force*

The mean maximal biting force in the first molar's region of the control subjects was 2.6–3 times greater than that of observed among the patients (actual *P*-values: left side: $P = 0.009$; right side: $P = 0.016$). No differences were noted between the groups for the masticatory forces in the anterior part of the jaws (Table 4). The mean 'hand force' was also greater in the controls. This was significant for the left hand ($P = 0.03$) (Table 4), but not for the right hand.

**Table 4** Results of measuring the masticatory force at the incisal, left molar and right molar regions and the force of the upper extremities

| | *Patients* | *Controls* |
|---|---|---|
| Left hand ± SD (N) | 59.1 ± 20.6[a] | 77.1 ± 27.9[a] |
| Right hand ± SD (N) | 67.5 ± 18.1 | 83.5 ± 31.6 |
| Left molar region ± SD (N) | 123.3 ± 76.0[b] | 315.1 ± 239.6[b] |
| Right molar region ± SD (N) | 113.5 ± 146.6[c] | 309.7 ± 213.5[c] |
| Front region ± SD (N) | 86.6 ± 75.9 | 107.7 ± 68.7 |

Data signed by the same superscript letters (a, b, c) are significant at $P \leq 0.05$, the actual '*P*' values were a: $P = 0.04$; b: $P = 0.009$; c: $P = 0.016$.

To avoid the problem of removable denture wearers, groups were divided into removable denture wearers and non-denture wearers, because the masticatory forces were significantly higher in the non-denture wearers ($P < 0.0001$). There was no difference between the controls and the patients in the denture-wearing group (right molar: 141 ± 132 N and 97 ± 61 N; left molar: 121 ± 136 N and 62 ± 26 N; front: 54 ± 40 N and 37 ± 17 N, respectively). Patients in the non-denture wearer group showed to be significantly weaker in the molar, not on the front regions (right molar: 337 ± 156 N and 167 ± 123 N, $P = 0.007$; left molar: 355 ± 157 N and 153 ± 75 N, $P = 0.0001$; front: 134 ± 62 N $P = 0.09$ and 111 ± 82 N $P = 0.08$, respectively).

All of the patients demonstrated abnormal electromyographic (EMG) changes, and manual muscle test positivity (Table 1) which are diagnostic signs of the IIM disease.

## Discussion

In the present study a complete evaluation of the oral symptoms in polymyositis and dermatomyositis was performed. The most prominent symptom of the oral mucosa and perioral tissues was the presence of telangiectasia, which was detected in seven cases (20%). It is believed to be an integral part of IIM and as an analogous symptom of the nailfold telangiectasia. These are most probably dilated capillary loops. Gingival telangiectasia is mentioned in the literature as a symptom of childhood dermatomyositis (8) and adult dermatomyositis (5, 6). According to the results of this examination telangiectasia was detected on the lower lip and on the palate, both in PM and DM. The present and previous studies thus indicate that the most frequent mucosal signs of IIM diseases are telangiectasia and erythematous lesions which may be in connection with the capillary alterations (5).

Calcinosis and overall mucosal oedema have been reported as manifestations of myositis (9, 10), however, none of these changes were found in the present study.

The findings on dental and periodontal conditions indicate that the patients have a significantly higher prevalence of dental caries, dental plaque accumulation and gingival inflammation (PI and GI), and therefore a higher risk for early tooth loss. Oral infections are common in IIM diseases, that is indicated by the frequent number of denture stomatitis and angular cheilitis, which are most likely the signs of oral candidiasis. The main reason for these symptoms may be the hyposalivation as it can be seen in other autoimmune diseases (27–29).

Increased gingival indices without severe periodontal disease should be considered as an unusual sign of IIM, which is probably caused by the oedema and erythema secondary to the changes of the gingival capillaries. It must be noted however that the plaque index was significantly higher in the patient group, although it did not cause consequent periodontal disease. To evaluate

the real reason of this finding, future investigations are necessary.

The alterations in ductal epithelial cells of the minor labial salivary glands are either secondary to ischemia related to vascular changes or represent cell mediated epithelial damage because of the high rate periductal and interstitial lymphocytic infiltration noticed in these cases. Changes of the vascular basal membrane and the endothel have been found in other autoimmune diseases associated with secondary Sjögren's syndrome as well (28) which is a common overlap disease in IIM (3) (11% of the patients in this case).

According to the data masticatory muscles showed to be significantly weaker in the patient group, while the hands of the patients were almost as strong as those of the controls. Possibly the weakening of the masticatory muscles can manifest earlier than that of the arms, but further investigations are needed to prove this hypothesis.

In conclusion, the present study showed that, patients with IIM diseases have hyposalivation and mucosal alterations, mainly in the form of telangiectasia. They have increased prevalence of dental caries, which may be secondary to the hyposalivation.

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