Validation of robust tools to measure sialorrhea in amyotrophic lateral sclerosis: a study in a large French cohort

Maya Abdelnour-Mallet[1], Sophie Tezenas du Montcel[2,3], Pamela A. Cazzolli[4], Avi Assouline[5], Christine Pointon[1], Nathalie Leveque[1,6], Henri Dominique[1], Hassan Elmazria[1], Michaela Rothmayer[1], Timothée Lenglet[1], Gaelle Bruneteau[1], Nadine Le Forestier[1], Sylvie Delanian[7], Jesus Gonzalez[8], François Salachas[1], Benjamin Rix Brooks[9], Pierre François Pradat[1,10].

[1] Département des Maladies du Système Nerveux, Groupe Hospitalier Pitié Salpêtrière, APHP, 75651 Paris Cedex 13, France. [2] Unité de Biostatistique et Information Médicale, Groupe Hospitalier Pitié Salpêtrière, AP-HP, 75651 Paris Cedex 13, France; [3] ER4 Modélisation en Recherche Clinique, Université Pierre et Marie Curie-Paris 6, Paris, F-75013, France. [4] ALS Care Project, 4450 Belden Village Street NW, Suite 704A, Canton, OH 44718, USA. [5] Service d'Oncologie Radiothérapie, Centre Clinique de la Porte de Saint Cloud, Boulogne-Billancourt, France. [6] Laboratoire de Phonétique et Phonologie, UMR 7018 CNRS-Paris3/Sorbonne Nouvelle, Paris, France.
[7] Service d'Oncologie-Radiothérapie, Hôpital Saint-Louis, APHP, Paris, France. [8] Service de Pneumologie, Groupe Hospitalier Pitié Salpêtrière, APHP, 75651 Paris Cedex 13, France. [9] Carolinas Neuromuscular/ALS-MND Center, Carolinas Medical Center - Department of Neurology, University of North Carolina School of Medicine – Charlotte Campus, 1010 Edgehill Road North, Charlotte, NC 28207-1885. [10] UMR-678, INSERM-UPMC, Groupe Hospitalier Pitié-Salpêtrière, Paris, France.

Background :

There is an unmet need for validated tools to measure sialorrhea in amyotrophic lateral sclerosis, especially to evaluate treatments. We assessed the inter/intra rate reviewer reliability of two scales: the Oral Secretion Scale (OSS), specifically developed for ALS patients, and the Sialorrhea Scoring Scale (SSS), initially developed for Parkinson disease patients.

Patients and methods :

Sialorrhea was prospectively rated in 69 ALS consecutive patients during April and May 2011 by four evaluators: two neurologists, one nurse and one speech therapist. Inter-rater reliability was evaluated by the light kappa coefficient and intra-rater reliability by the weighted kappa coefficient. We also compared patients' and caregivers' answers by Spearman correlation coefficient.

Table 1: Oral Secretion Scale (OSS) scale grades

Score	Label
0, very severe	constant drooling requiring constant lip-blotting, regular suctioning
1, severe	difficult conscious secretion swallowing, frequent drooling in any position, lip-blotting 12-30/hr, intermittent suctioning
2, moderate	conscious saliva swallow required, drooling upright leaning forward, lip-blotting 4-6/hr
3, minimal	automatic saliva swallow decreased, infrequent drooling
4, normal	normal automatic saliva swallow, no drooling

Table 2 : Sialorrhea Scoring Scale (SSS) scale grades

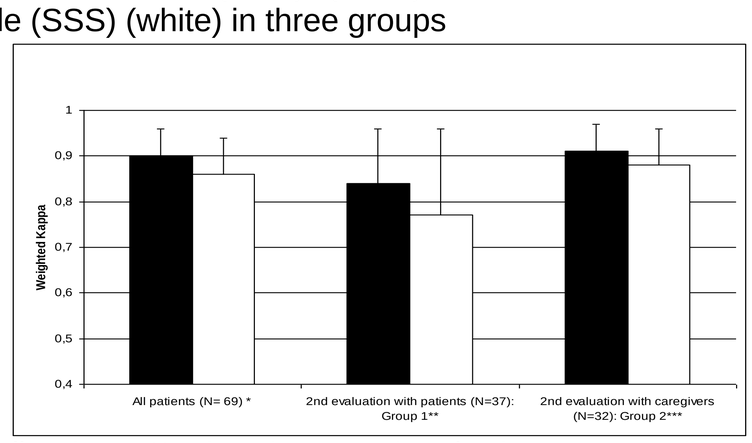
Score	Label
1	dry, never drools.
2	mild, only the lips are wet, occasionally.
3	mild, only the lips are wet, frequently.
4	moderate, wet on the lips and chin, occasionally.
5	moderate, wet on the lips and chin, frequently.
6	severe, drools to the extent that clothing becomes damp, occasionally.
7	severe, drools to the extent that clothing becomes damp, frequently.
8	profuse, clothing, hands and objects become wet, occasionally.
9	profuse, clothing, hands and objects become wet, frequently.

Results :

Intra-rater reliability:

Intra-rater reliability was analysed in the 69 patients by the speech therapist. For the second evaluation, conducted by phone, the OSS and the SSS were scored among the patients (n=37) or among the caregivers when patients were unable to speak (n=32). OSS agreement was better but not statistically significant than the SSS agreement (figure 1). Percentage of agreement within one point of difference was minimum 81% for OSS and SSS in the 3 groups (all patients, when the second evaluation was according to the patient answers, and to the caregiver's answers).

Figure 1: Intra-rater reliability indicators for Oral Secretions Scale (OSS) (black) and Sialorrhea Scoring Scale (SSS) (white) in three groups

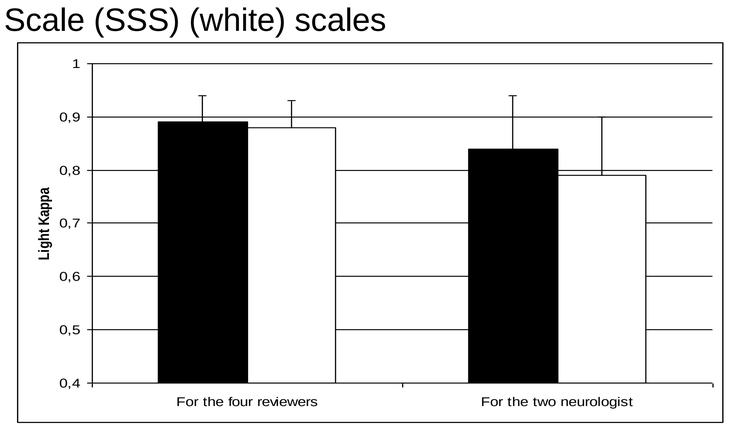


*: all patients, **: when the second evaluation was according to the patient answers, ***: when the second evaluation was according to the caregiver's answers.

Inter-rater agreement:

Inter-rater reliability was studied in 66 patients evaluated at least by two of the four reviewers Light kappas were similar for both scales (0.89 for the OSS, 0.88 for the SSS). However only 47% of all the 4 reviewers gave exactly the same scoring using the SSS and 70% gave a score with less than one point of difference between then while they were 66% and 91% respectively for the OSS. Forty-five patients were evaluated by two neurologists. The reliability was slightly better, but not statistically different, for the OSS (0.84) than for the SSS (0.79).

Figure 2: Inter-rater agreement indicators for Oral Secretions Scale (OSS) (black) and Sialorrhea Scoring Scale (SSS) (white) scales



Concurrent validity between scales:

For 53 patients, ALSFRS was measured in addition to the OSS and SSS. ALSFRS bulbar score correlated with both the OSS ($r = 0.803$, $p<0.0001$) and the SSS ($r = -0.797$, $p<0.0001$). The salivation items in bulbar ALSFRS was also correlated with both scales (OSS: $r=0.931$ $p<0.0001$, and SSS: $r = -0.909$ $p<0.0001$). In addition, SSS and OSS were highly correlated ($r = -0.935$ $p<0.0001$).

Discussion and conclusion :

Our results showed **that the two scales SSS and OSS present a very good inter and intra-rater reliability.** From a practical point of view, the two questionnaires are rapid to administer and do not exceed 5 minutes. **SSS** directly measures saliva leaking with a wide range of severity from mild to profuse **and showed a higher responsiveness compared to OSS.**

The OSS has the particularity to consider saliva swallowing besides excess saliva evaluation. The need of conscious saliva swallowing may be associated with an increased risk of saliva aspiration, and therefore of pneumonia and obstruction.

Given the very good agreement between patients' and caregivers' answers in the intra-rater test, **we can practically assess saliva retention, using one either of the two scales OSS or SSS, by phone and /or by contacting the caregiver** especially when the patient is dysarthric or in advanced stage of his disease.

In conclusion, **we validated two scales OSS and SSS as tools to measure sialorrhea in ALS patients.** We therefore suggest that these scales are useful tools to monitor hyper sialorrhea in clinical practice and are suitable end points in clinical trials aiming to treat hyper salivation in ALS. **SSS may be more sensitive to evaluate treatments in patients with severe hypersialorrhea.**