A longitudinal study of the Swedish MD Anderson Dysphagia Inventory in patients with oral cancer

Lisa Tuomi PhD1,2 | Per Fransson PhD3 | Johan Wennerberg MD, PhD4 | Caterina Finizia MD1,2

1Department of Otorhinolaryngology, Head and Neck Surgery, Institute of Clinical Sciences, Sahlgrenska Academy, Gothenburg University, Gothenburg, Sweden
2Region Västra Götaland, Sahlgrenska University Hospital, Department of Otorhinolaryngology, Gothenburg, Sweden
3Department of Nursing, Umeå University and Cancercentrum, Norrlands University Hospital, Umeå, Sweden
4Division of Otorhinolaryngology, Head and Neck Surgery, Clinical Sciences, Lund University and University Hospital of Scania, Lund, Sweden

Correspondence
Lisa Tuomi, Department of Otorhinolaryngology, Head and Neck Surgery, Institute of Clinical Sciences, Sahlgrenska Academy, Gothenburg University, 413 45 Gothenburg, Sweden. Email: lisa.tuomi@gu.se

Funding information
Cancerfonden; the Swedish state under the agreement between the Swedish government and the county councils, the ALF-agreement

Abstract
Objective: The aim of this study was to investigate whether the Swedish MD. Anderson Dysphagia Inventory (MDADI) is able to detect changes in dysphagia symptoms over time for patients with head and neck cancer (HNC).

Methods: One hundred and forty-two patients with resectable tumors of the oral cavity were included prior to treatment. The patients filled out the MDADI, European Organization for Research and Treatment of Cancer Quality of Life questionnaire Core 30 (EORTC QLQ-C30) and the HNC module (H&N35) at baseline and at least one follow-up at 6 and/or 12 months after oncologic treatment. A control group without dysphagia (n = 115) was included.

Results: Self-perceived swallowing function decreased in all domains at 6 months, and improved between 6 and 12 months. The changes were similar to the changes of the EORTC domains, indicating a sensitivity to change. However, even if improvements were seen at 12 months, the values were still inferior compared to baseline values, and the values of a control group without dysphagia. Convergent validity was found with values of the MDADI and EORTC domains producing similar results, and moderate correlations as hypothesized. Patients with moderate-severe dysphagia according to the MDADI (<60 points) demonstrated inferior values of the EORTC domains compared to patients with scores above 60 points.

Conclusion: The Swedish MDADI was found to be sensitive to change, and showed convergent results when compared to other established instruments. The threshold value for the MDADI (<60 points) indicating moderate-severe dysphagia may be a valuable addition in the clinical use.

Level of Evidence: 1.

KEYWORDS
deglutition disorders, head and neck neoplasms, quality of life, questionnaires, validation studies
Swallowing difficulties is a common side effect following oncological treatment for head and neck cancer (HNC). Studies show that 40% of patients experience dysphagia up to 3 years following completion of treatment.\textsuperscript{1-2} Patients with tumors of the tongue have been found to have the worst functional dysphagia quality of life scores compared to other subsites of the oral cavity, while patients with tumors of the buccal mucosa demonstrate the worst overall scores using the MD. Anderson Dysphagia Inventory (MDADI).\textsuperscript{3} Swallowing problems are often associated with reduced health related quality of life (HRQL), morbidity, anxiety and depression.\textsuperscript{3,4}

Dysphagia is often monitored through functional assessment of swallowing ability, by for example videofluoroscopy or fiberoptic endoscopic evaluation of swallowing. In addition to this, instruments to measure the degree and impact of dysphagia are useful when evaluating the treatment and rehabilitation outcome and needs. Several different instruments exist, including the Eating assessment tool-10 item version (EAT-10),\textsuperscript{5} the Sydney Swallow questionnaire (SSQ),\textsuperscript{6} the Swallowing Quality of Life questionnaire (SWAL-QOL)\textsuperscript{7} and the MDADI.\textsuperscript{8} The MDADI is advantageous as it is developed specifically to evaluate the impact of dysphagia on HRQL for HNC patients. Additionally, the instrument is relatively short, only 20 items, when compared to SWAL-QOL (44 items) or the Dysphagia Handicap Index (30 items).\textsuperscript{9} The MDADI has been translated to Swedish and validated,\textsuperscript{10} which found it to be a valid and reliable instrument. However, the Swedish version has not yet been used longitudinally, and therefore, the sensitivity to change, that is, responsiveness, has not been evaluated. The ability of an instrument to measure a change in state, responsiveness, should be included in the validation process of an instrument. An instrument should be reliable and result in similar results when a patient is stable, but it should also respond to changes in their condition, which allows for longitudinal use. Additionally, a total score below 60 points of the MDADI has been found to indicate moderate to severe dysphagia.\textsuperscript{11-13} This threshold value has not previously been used and evaluated in a Swedish population.

The aim of this study was to investigate whether the Swedish MDADI is able to detect changes in dysphagia symptoms over time for patients with HNC. Additionally, the study aimed to evaluate the suggested threshold value for the MDADI, indicating moderate to severe dysphagia (<60 points).

## 2 | MATERIALS AND METHOD

### 2.1 | Participants

Participants in the present study are part of the ARTSCAN II-study. The ARTSCAN II is a Swedish multicenter randomized controlled study aimed to compare the efficiency of preoperative accelerated radiotherapy followed by surgery with surgery followed by postoperative radiotherapy, including chemotherapy for high risk resectable tumors in the oral cavity. Preliminary data with respect to loco-regional control and survival have been presented.\textsuperscript{14} Patients with T1-T4 and/or N0-3 tumors were included. In total, 250 patients were included in the study of which six (n = 6) patients withdrew their consent leaving 244 patients eligible for the ARTSCAN II-study. In the present longitudinal study of the MDADI, only patients who had filled out the MDADI at baseline and on at least one more occasion were included. Therefore, a total of 142 patients could be included in the present study, where the remaining 108 participants were excluded due to insufficient MDADI data.

Data was collected at baseline (prior to start of oncologic treatment, that is, surgery or radiotherapy) and patients were randomized to receive either preoperative or postoperative radiotherapy. Additional follow-ups were at 6 and 12 months after randomization. Questionnaires were either given directly to the patients, in connection to the hospital visit or sent by e-mail from the study center.

A control group without dysphagia (n = 115) was included for comparison purposes. These participants were recruited when visiting the Otorhinolaryngology department at the Sahlgrenska University Hospital for reasons such as symptoms from the ears, nose, sinuses or benign skin tumors. The control group without dysphagia filled out the same instruments as the study patients but they only filled them out once.

### 2.2 | Oncologic treatment

Patients were randomized 1:1 between the two trial arms. Preoperative radiotherapy was administered as hyperfractioned radiotherapy, twice daily with 2 or 1.1 Gy per fraction, totaling 68 Gy. The surgery was preferably performed within 4-6 weeks post-radiotherapy completion. Postoperative radiotherapy was given as conventional radiotherapy once daily in doses of 2 Gy per fraction to a total of 60-66 Gy (60 Gy to histopathological low risk patients and 66 Gy + weekly Cisplatin to high risk patients). Postoperative radiotherapy was given at the latest 6 weeks after surgery.

### 2.3 | Patient demographics

All patients answered questions for example regarding age and smoking habits. Further details regarding treatment and tumor characteristics including WHO Performance status are described in Table 1.

### 2.4 | M. D. Anderson Dysphagia Inventory

The M. D. Anderson Dysphagia Inventory (MDADI) evaluates the impact of dysphagia on the health-related quality of life (HRQL) of patients who have undergone treatment for HNC. It was originally designed by Chen et al, and has been found psychometrically valid and reliable.\textsuperscript{8} It has been translated into several languages, including Swedish. The Swedish MDADI was found to be valid (Cronbach's alpha 0.77-0.88) and have reliable test-retest correlations (ICC = 0.83-0.97).\textsuperscript{10}
The instrument encompasses four domains consisting of 20 items as well as total score. The Global domain illustrates how the patient is limited in their day-to-day activities due to their swallowing disorder. The Emotional domain (6 items) indicates the patient’s emotional response to the swallowing disorder. The Functional domain (5 items) measures the effect of the patient’s swallowing problem on daily activities, and the Physical domain (8 items) represents the patient’s perception of the swallowing difficulty. Each item is rated on a 5-point Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree). The Global domain is presented separately, while a sum of the other domain scores and a mean score of all other domains are calculated and converted to scores ranging from 20 (extremely low functioning) to 100 (high functioning); i.e. a higher score indicates a better HRQL. A 10-point difference in the total score between groups has been found to respond to meaningful between-group differences in swallowing function. A total score below 60 has been suggested to indicate moderate to severe dysphagia and was tested in the present prospective longitudinal study.

### 2.5 Study specific questions

Four study-specific questions regarding eating and swallowing were included, described in detail in Table 2. These items were answered, calculated and presented in the same way as the items of the MDADI. Therefore, a high value corresponds to a high (good) function.

### 2.6 The European Organization for Research and Treatment of Cancer Quality of Life questionnaires

The cancer-specific questionnaire European Organization for Research and Treatment of Cancer Quality of Life questionnaire Core 30 (EORTC QLQ-C30) consists of 30 items that describe symptoms and functional level. Additional symptoms associated specifically with HNC and its treatment is included in a complementary 35-item module, the EORTC QLQ-H&N35. Calculated domain scores range from 0 to 100. On the functioning domains and global quality of life domain, a score of 100 represents maximum functioning, whereas on the symptom domains and single items a score of 100 equates to worst possible symptoms. In this study, it was hypothesized a priori which domains of the EORTC QLQ-C30 and H&N35 would correlate to the MDADI domains. Moderate correlations between the following domains of the EORTC QLQ-C30 and H&N35 and the different MDADI domains were hypothesized: Role function, Social function, Emotional function, Global QOL, Swallowing, Social eating, Social contact and Sticky saliva. Only the hypothesized domains are included in the present study.

### 2.7 Ethical considerations

The study was conducted in accordance with the Declaration of Helsinki, and was approved by the Regional Ethical Review Board in Umeå Sweden on the eighth January 2008 (ref: 07-178M). It was then approved by the heads of participating centers. The study was announced at http://www.controlled-trials.com/ISRCTN00608410. All participants signed written informed consent before inclusion in the study.

### 2.8 Statistical analysis

Descriptive statistics are presented as means and standard deviations (SD) for continuous variables, and numbers (n) and percentages (%) for
categorical variables. For comparisons between more than two groups, the Kruskal Wallis test was used for continuous values, and the Chi-square for categorical values. For comparisons between two groups, the Mann-Whitney U test was used for comparisons of continuous variables, the Mantel Haenszel test for ordered categorical values, the Chi square for non-ordered categorical values, and the Fisher’s exact test for dichotomous variables. For within-group changes, the Wilcoxon Signed ranks test was used for pairwise comparisons over time. Comparisons between the study group and a healthy control group without dysphagia were performed for known-group validity.

Correlations of the changes between baseline and the 12-month follow-up were calculated using the Spearman correlation coefficient (\(\rho\)) to assess convergent validity. To avoid confusion, the Spearman correlation coefficient is hereafter reported as "\(r\)." \(r < .3\) was considered to be a weak correlation, \(.3-.7\) moderate correlation and \(> .7\) a strong correlation.\(^{18}\)

| TABLE 2 | Mean values (SD) for study specific items before treatment (baseline) and follow-up and P-values and effect sizes for changes at follow-up compared to baseline and previous study occasion |
|-----------------|-----------------|-----------------|-----------------|-----------------|
|                | Baseline (n = 142) | 6 months (n = 138) | 12 months (n = 121) | Control group without dysphagia (n = 115) |
| Mean (SD) min-max | Mean (SD) min-max compared to baseline | Mean (SD) min-max compared to baseline | Mean (SD) min-max compared to 6 months |
| It hurts when I eat, drink, swallow | 69.5 (31.7) 20-100 | 67.4 (30.6) 20-100 | 78.2 (27.8) 20-100 .036/.001 | 99.3 (3.6) 80-100 |
| The food gets stuck when I swallow | 89.5 (19.8) 20-100 | 71.7 (27.9) 20-100 <.001 | 78.6 (28.7) 20-100 <.001/.026 | 98.3 (8.2) 40-100 |
| I have trouble swallowing because my mouth and throat are dry | 89.9 (19.4) 20-100 | 63.0 (29.5) 20-100 <.001 | 64.8 (30.1) 20-100 <.001/ns | 99.5 (3.2) 80-100 |
| I need to rinse down what I eat to be able to swallow | 84.9 (24.7) 20-100 | 56.2 (28.8) 20-100 <.001 | 61.0 (30.1) 20-100 <.001/.008 | 98.1 (8.8) 40-100 |

Note: For the study specific items, 100 indicates the most favorable state, 20 the least favorable. P-value compared to baseline, and at 12 months also compared to 6 months. Comparison between patients and control group without dysphagia revealed \(P < .05\) in all study specific items and occasions. ns, nonsignificant.

| TABLE 3 | Data regarding weight and weight loss in all study occasions for the patients in the study group |
|-----------------|-----------------|-----------------|-----------------|-----------------|
|                | Baseline Mean (SD) min-max | 6 months Mean (SD) min-max | 12 months Mean (SD) min-max | Difference baseline-6 months Mean (SD) min-max P value | Difference baseline-12 months Mean (SD) min-max P value |
| Weight (kg)     | 78.5 (15.6) 45-132 | 71.2 (13.2) 40.7-119 | 72.4 (15.9) 42-127 | \(-6.5 (5.4) \) -21-15 <.001 | \(-7.0 (6.3) \) -26.8-7 <.001 |

A total of 142 patients and 115 healthy controls were included in the study. Patients were included if they had completed the MDADI at baseline and at least one more occasion, therefore the number of patients varies between the study occasions. Participant demographics are presented in Table 1. A larger proportion of smokers were found in the patient group (22%) compared to the control group without dysphagia (8%). Comparisons between the included (n = 142) and excluded (n = 108) patients revealed no statistically significant differences regarding age, gender, tumor localization and size, WHO performance status and smoking habits.

Comparisons between the study group and a healthy control group without dysphagia revealed \(P < .05\) in all study specific items and occasions. ns, nonsignificant.

3 | RESULTS

3.1 | Longitudinal changes

Table 4 demonstrates the results of the MDADI over time in the study group. In all domains, there were statistically significant deteriorations from baseline to 6 months. The comparison between 6 and 12 months demonstrated statistically significant improvements regarding the Functional, Physical, Global and Total domains. Compared to the control group without dysphagia, the mean values of the MDADI reported by the study participants were inferior at all study occasions. Additionally, the proportion of patients experiencing moderate-severe
dysphagia according to the MDADI threshold value (<60 points) increased significantly over time, starting at 10% at baseline and reached 27% at 6 months, which remained at 12 months.

The study specific items demonstrated statistically significant deterioration between baseline and 6 months regarding 3 of 4 items (Food gets stuck, trouble swallowing because of dry throat and need to rinse down to swallow), see Table 2. The comparison between 6 and 12 months revealed statistically significant improvements in all items except “I have trouble swallowing because of dry throat.” When comparing baseline to 12 months, statistically significant deterioration was found in all items. At all study occasions, the study group revealed values inferior to the values of the control group without dysphagia, where all differences were statistically significant. Missing data was low with only 0.5% missing items.

### 3.2 MDADI compared to EORTC

Figure 1 demonstrates the changes of the MDADI in comparison to the domains Swallowing and Social eating of the EORTC QLQ H&N35. The changes of the MDADI domains follow the same pattern as the changes of the EORTC; that is, deterioration from baseline to 6 months, with improvement to 12 months, however, still inferior to values of healthy controls and still worse than pretreatment values.

The correlations of change between baseline and 12 months are found in Table 5. The strongest correlation coefficients were found between the MDADI domains and Swallowing and Social eating domains of the EORTC QLQ H&N35, with moderate correlations found between the MDADI domains and Swallowing ($r = -0.505$ to $-0.677$), moderate to strong correlations were found to the Social eating domain ($r = -0.595$ to $-0.768$). Somewhat weaker, but still moderate, correlations were found between all domains of the MDADI to several of the EORTC QLQ C30 and H&N35 domains (Social contact, sticky saliva, Role function, Emotional function, Social function and Global QOL).

### 3.3 MDADI threshold compared to selected domains of the EORTC

Table 6 demonstrates the HRQL values of the EORTC when the MDADI threshold value was applied, that is, the patients were divided at each study occasion according to their respective score of the MDADI total; above or below 60 points, at all study occasions. There were statistically significant differences between the patients with

### Table 4 MDADI scores before treatment (baseline) and follow-up (6 and 12 months) and a control group without dysphagia. Comparisons of changes within and between groups

|                          | Baseline (n = 142) Mean (SD) min-max | 6 months (n = 138) Mean (SD) min-max P value compared to baseline | 12 months (n = 121) Mean (SD) min-max P value compared to baseline/6 months | Control group without dysphagia (n = 115) |
|--------------------------|--------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------------------|------------------------------------------|
| MDADI emotional          | 86.6 (15.7) 33-100                   | 75.9 (20.5) 23-100 <.001                                    | 78.4 (21.5) 30-100 <.001/ns                                              | 96.6 (6.2) 67-100                       |
| MDADI functional         | 86.1 (16.4) 32-100                   | 70.7 (17.8) 20-100 <.001                                    | 75.9 (23.6) 24-100 <.001/.003                                             | 96.2 (6.8) 76-100                       |
| MDADI physical           | 81.7 (19.0) 33-100                   | 68.1 (17.6) 23-100 <.001                                    | 73.8 (19.3) 28-100 <.001/.001                                             | 98.9 (4.6) 55-100                       |
| MDADI global             | 75.1 (29.5) 20-100                   | 61.2 (29.4) 20-100 <.001                                    | 73.8 (29.2) 20-100 Ns/.001                                               | 99.0 (4.5) 80-100                       |
| MDADI total*             | 84.3 (16.2) 38-100                   | 71.1 (17.6) 28-100 <.001                                    | 75.6 (19.7) 29-100 <.001/.003                                             | 97.5 (4.4) 64-100                       |
| n (%) below threshold (60 points) indicating moderate/severe dysphagia | 15 (10.6%)                             | 38 (27.5%) <.001                                            | 32 (26.7%) Ns/.001                                                        | 0 (0%)                                  |

Note: For MDADI domains 100 indicates the most favorable state, 20 the least favorable. P-value compared to baseline, and at 12 months also compared to 6 months. ns, nonsignificant. Comparison between patients and control group without dysphagia revealed $P < .005$ in all domains of the MDADI and occasions.

*The total MDADI total score includes 19 items, omitting the global item.
moderate-severe dysphagia (<60 points) and no/mild dysphagia (≥60 points) in all selected domains of the EORTC, where the patients with moderate-severe dysphagia experienced inferior HRQL throughout. Dry mouth however, did not reveal statistically significant differences at baseline and 12 months when comparing patients with moderate/severe dysphagia to patients with no/mild dysphagia.

4 | DISCUSSION

This study aimed to evaluate the longitudinal changes of dysphagia-related HRQL of patients with oral carcinoma up to 1 year following oncologic treatment, and to evaluate if the Swedish MDADI was responsive to dysphagia-related HRQL over time. Results showed that the Swedish MDADI achieved statistically significant changes over time, with deteriorations in all domains at 6 months, with improvements at the 12-month follow-up. However, the values at 12 months were still inferior compared to the baseline values and when compared to the values of the control group without dysphagia. Additionally, at all study occasions, the difference between the patients and the control group without dysphagia exceeded the suggested threshold (10 points) indicating a clinically important difference. These results are in line with other studies of patients with HNC, where patients with oral and oropharyngeal tumors demonstrated similar values of the MDADI and with a similar pattern of change over time. Additionally, the a priori hypothesized correlations of changes over time of the MDADI domains to selected domains of the EORTC QLQ C30 and H&N35 were confirmed, where moderate correlations were found as expected, and with the strongest correlations to Social eating and Swallowing. This indicates convergent validity,

| TABLE 5 | Spearman correlation coefficients of the changes between baseline and the 12 months follow-up in the MDADI domains and the selected domains of the EORTC QLQ C30 and H&N35. |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EORTC QLQ H&N35 | EORTC QLQ C30 |
| Swallowing | Social eating | Social contact | Sticky saliva | Role function | Emotional function | Social function | Global QOL |
| MDADI emotional | −.505** | −.595** | −.562** | −.365** | .330** | .352** | .421** | .439** |
| MDADI functional | −.569** | −.643** | −.559** | −.383** | .418** | .331** | .465** | .449** |
| MDADI physical | −.693** | −.773** | −.412** | −.490** | .591** | .407** | .506** | .582** |
| MDADI global | −.515** | −.728** | −.483** | −.397** | .509** | .370** | .460** | .447** |
| MDADI total | −.677** | −.768** | −.544** | −.464** | .512** | .404** | .530** | .555** |

Note: <0.3 was considered to be a weak correlation, 0.3–0.7 moderate correlation, and >0.7 a strong correlation. **Correlation is significant at the .01 level.
and that the Swedish MDADI is sensitive to changes of dysphagia-related HRQL over time.

The threshold value of the MDADI, (<60 points) indicating moderate-severe dysphagia demonstrated that a small proportion of the patients experienced dysphagia at baseline and almost 30% experienced dysphagia at 6 and 12 months. This is a higher prevalence of patients with moderate-severe dysphagia compared to the study by Grant et al who developed the threshold value, where 16% of patients experienced dysphagia at 6 and 12 months. This is a higher prevalence of the patients experienced dysphagia at baseline and almost 30% experienced dysphagia among patients treated for oral tumors. Additionally, missing items were low—at only 0.5%.

4.1 | Limitations

This study may be limited by the excluded 108 patients who only completed the MDADI at baseline. However, comparisons of tumor characteristics and other baseline data between included and excluded patients revealed no statistically significant differences. An additional possible limitation may be the fact that not all participants responded to the MDADI at all study occasions. However, as this is the only study using the Swedish MDADI in a longitudinal setting, it still adds important aspects regarding the longitudinal mapping of dysphagia among patients treated for oral tumors. Additionally, missing items were low—at only 0.5%.

5 | CONCLUSION

The Swedish MDADI has been investigated in a large longitudinal study of patients with oral cancer and the instrument was found to be lower in patients with moderate to severe dysphagia compared to patients without dysphagia. This further strengthens the use of this threshold value in clinical praxis.

**TABLE 6** Results of selected domains of the EORTC QLQ-C30 and H&N35 for patients divided below or above threshold value of the MDADI total at all study occasions

| EORTC QLQ-C30 | Baseline | 6 months | 12 months |
|---------------|----------|----------|----------|
|               | (n = 142) | (n = 138) | (n = 120) |
| Role function  | 26.7 (27.3) | 76.1 (33.8) | 69.2 (35.5) | 53.8 (37.4) | <.001 | 58.3 (32.0) | <.001 |
| Emotional function | 48.9 (33.2) | 72.6 (22.7) | 80.9 (21.0) | 59.6 (25.9) | <.001 | 85.5 (20.4) | <.001 |
| Social function | 53.3 (24.6) | 83.2 (24.6) | 76.4 (25.5) | 58.3 (32.0) | <.001 | 53.8 (25.5) | <.001 |
| Global QOL | 40.0 (19.2) | 65.9 (25.7) | 66.5 (22.0) | 48.4 (22.1) | <.001 | 73.6 (22.3) | <.001 |

**EORTC QLQ-H&N35**

| Swallowing | Social eating | Social contact | Sticky saliva |
|------------|--------------|---------------|--------------|
| 51.7 (23.0) | 58.9 (23.9) | 30.2 (18.0) | 42.2 (38.8) |
| 8-100 | 25-100 | 7-67 | 0-100 |
| 11.7 (18.5) | 14.6 (18.1) | 4.7 (10.0) | 18.3 (26.2) |
| 0-92 | 0-83 | 0-53 | 0-100 |
| <.001 | <.001 | <.001 | <.001 |

Note: For EORTC QLQ-C30 domains a higher value corresponds to a higher, that is, better function. For EORTC QLQ-H&N35 domains a higher value corresponds to a higher symptom burden, that is, worse. Baseline = before oncologic treatment. MDADI total values below 60 points correspond to moderate/severe dysphagia.
sensitive to change and shows convergent results when compared to other established HRQL instruments. Additionally, using the previously suggested cut-off value for MDADI, patients with moderate to severe dysphagia were found to experience worse HRQL, which indicates that the threshold value can be used to identify patients in need of further intervention such as swallowing rehabilitation.

ACKNOWLEDGMENT
This study was funded by Swedish Cancer Society and by grants from the Swedish state under the agreement between the Swedish government and the county councils, the ALF-agreement.

CONFLICT OF INTEREST
None to declare.

ORCID
Lisa Tuomi https://orcid.org/0000-0003-2081-3589

BIBLIOGRAPHY
1. Francis D et al. Dysphagia, stricture, and pneumonia in head and neck cancer patients: does treatment modality matter? Ann Otol Rhinol Laryngol. 2010;119:391-397.
2. Mortensen HR, Jensen K, Aksøe K, Behrens M, Grau C. Late dysphagia after IMRT for head and neck cancer and correlation with dose-volume parameters. Radiat Oncol. 2013;10(7):288-294.
3. Chen SC, Huang BS, Hung TM, et al. Swallowing ability and its impact on dysphagia-specific health-related QOL in oral cavity cancer patients post-treatment. Eur J Oncol Nurs. 2018;36:89-94.
4. Daugaard R, Kjaer T, Johansen C, et al. Association between late effects assessed by physicians and quality of life reported by head-and-neck cancer survivors. Acta Oncol. 2017;56(2):342-347.
5. Belafsky PC, Mouadeb DA, Rees CJ, et al. Validity and reliability of the eating assessment tool (EAT-10). Ann Otol Rhinol Laryngol. 2008;117(12):919-924.
6. Dwivedi RC, Rose SS, Roe JW, et al. Validation of the Sydney Swallow Questionnaire (SSQ) in a cohort of head and neck cancer patients. Oral Oncol. 2010;46(4):e10-e14.
7. McHorney CA, Robbins JA, Lomax K, et al. The SWAL-QOL and SWAL-CARE outcomes tool for oropharyngeal dysphagia in adults: III. Documentation of reliability and validity. Dysphagia. 2002;17(2):97-114.
8. Chen AY, Frankowski R, Bishop-Leone J, et al. The development and validation of a dysphagia-specific quality-of-life questionnaire for patients with head and neck cancer: the M. D. Anderson dysphagia inventory. Arch Otolaryngol Head Neck Surg. 2001;127(7):870-876.
9. Silbergleit AK, Schultz L, Jacobson BH, Beardsley T, Johnson AF. The dysphagia handicap index: development and validation. Dysphagia. 2012;27(1):46-52.
10. Carlsson S et al. Validation of the Swedish M. D. Anderson dysphagia inventory (MDADI) in patients with head and neck cancer and neurologic swallowing disturbances. Dysphagia. 2012;27:361-369.
11. Grant C. Single-item discrimination of quality-of-life-altering dysphagia among 714 long-term oropharyngeal cancer survivors: comparison of patient-reported outcome measures of swallowing. Cancer. 2019;125(10):1654-1664.
12. Goeppert RP, Lewin JS, Barrow MP, et al. Long-term, prospective performance of the MD Anderson dysphagia inventory in “low-intermediate risk” oropharyngeal carcinoma after intensity modulated radiation therapy. Int J Radiat Oncol Biol Phys. 2017;97(4):700-708.
13. Chen PH, Golub JS, Hapner ER, Johns MM III. Prevalence of perceived dysphagia and quality-of-life impairment in a geriatric population. Dysphagia. 2009;24(1):1-6.
14. Carwig K, Zackrisson B, Nilsson P, et al. Preoperative vs postoperative radiotherapy in treatment of oral cavity cancer—the ARTSCAN 2 study. Radiother Oncol. 2019;132:6-7.
15. Hutcheson KA, Barrow MP, Liseck A, Barringer DA, Gries K, Lewin JS. What is a clinically relevant difference in MDADI scores between groups of head and neck cancer patients? Laryngoscope. 2016;126(5):1108-1113.
16. Aaronson NK, Ahmedzai S, Bergman B, et al. The European Organization for Research and Treatment of Cancer QLQ-C30: a quality-of-life instrument for use in international clinical trials in oncology. J Natl Cancer Inst. 1993;85(5):365-376.
17. Bjordal K, Ahlner-Elmqvist M, Tolleson E, et al. Development of a European Organization for Research and Treatment of Cancer (EORTC) questionnaire module to be used in quality of life assessments in head and neck cancer patients. EORTC Quality of Life Study Group. Acta Oncol. 1994;33(8):879-885.
18. Hinkle DEJS, Wiersma W. Applied Statistics for the Behavioural Sciences. 5th ed. Boston: Houghton Mifflin; 2002.
19. Goeppert RP, Lewin JS, Barrow MP, et al. Predicting two-year longitudinal MD Anderson dysphagia inventory outcomes after intensity modulated radiotherapy for locoregionally advanced oropharyngeal carcinoma. Laryngoscope. 2017;127(4):842-848.
20. Khan MK, Patterson J, Owen S, et al. Comparing the performance status scale and MD Anderson dysphagia inventory as swallowing outcome measures in head and neck cancer patients: a prospective cohort study. Clin Otolaryngol. 2015;40(4):321-326.
21. Grant SR, Hutcheson KA, Ye R, et al. Prospective longitudinal patient-reported outcomes of swallowing following intensity modulated proton therapy for oropharyngeal cancer. Radiother Oncol. 2020;148:133-139.
22. Dwivedi RC, Chisholm EJ, Khan AS, et al. An exploratory study of the influence of clinico-demographic variables on swallowing and swallowing-related quality of life in a cohort of oral and oropharyngeal cancer patients treated with primary surgery. Eur Arch Otorhinolaryngol. 2012;269(4):1233-1239.
23. Dzboa A, Aalto D, Papadopoulos-Nydam G, et al. Functional and quality of life outcomes after partial glossectomy: a multi-institutional longitudinal study of the head and neck research network. J Otolaryngol – Head Neck Surg = Le Journal d’oto-Rhino-Laryngologie et de Chirurgie Cervico-Faciale. 2017;46(1):56-56.

How to cite this article: Tuomi L, Fransson P, Wennerberg J, Finizia C. A longitudinal study of the Swedish MD Anderson Dysphagia Inventory in patients with oral cancer. Laryngoscope Investigative Otolaryngology. 2020;5:1125–1132. https://doi.org/10.1002/lio2.490