Patient reported outcome measures in oral lichen planus: A comprehensive review of the literature with focus on psychometric properties and interpretability

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Abstract

Objective: To review the range of patient reported outcome measures (PROMs) used in clinical studies of patients with oral lichen planus (OLP) and to assess their psychometric properties and interpretability.

Methods: Literature searches were performed on MEDLINE, Embase and Web of Science databases (1990 - September 2016) to retrieve relevant studies related to the development, psychometric testing and/or use of PROMs assessing oral symptoms, psychosocial status, and quality of life in individuals with OLP. The identified PROMs were then categorized by concept measured and assessed for instrument characteristics and evidence for psychometric properties and interpretability.

Results: We identified a total of 41 PROMs used in clinical studies for the assessment of patient reported outcomes in patients with OLP. There were 3 PROMs of oral symptoms, 30 PROMs of psychosocial status and 8 PROMs of quality of life. Six instruments (Visual Analog Scale, Numerical Rating Scale, Change in Symptom Scale, Oral Health Impact Profile-14, Oral Health related Quality of Life-UK and Chronic Oral Mucosal Disease Questionnaire) demonstrated some evidence of psychometric properties but no evidence for interpretability of their results in the OLP population.

Conclusion: The range of PROMs used in clinical studies of patients with OLP is wide and include instruments for oral symptoms, psychosocial status and quality of life. The vast majority of these instruments have no evidence of psychometric properties and interpretability for patients with OLP. Further qualitative and validation

studies are required to investigate whether these instruments are appropriate for use in this patient population.

Introduction

Over the past few decades, there has been a substantial increase in the development, validation and application of patient reported outcome measures (PROMs) for research and/or clinical practice (1). A PROM is a standardized instrument (usually a questionnaire) for patients to directly evaluate one or more aspects of their own health (2). The aim is to quantify, evaluate and monitor the subjective perception of the impact of the disease from patient's perspective in a standardized way, and to incorporate the patient's voice regarding the perception of their health condition and related treatment into clinical practice and research (2). PROMs are required to have adequate psychometric properties as well as good evidence for interpretability for the specific patient population. From the perspective of clinical research, a vital step in the design of clinical trial is to select a PROM with appropriate psychometric properties to ensure that the instrument is suitable for its proposed application, valid (measure what it is intended to measure), reliable (produce consistent results on repeated measurement under identical conditions) and responsive (able to detect change over time) in a specific group of patients (3). Further to the psychometric properties, it is necessary that scores or outcomes generated by the PROMs are interpretable or clinically meaningful (3).

Little is known regarding the use of PROMs in patients with oral lichen planus (OLP), a common chronic inflammatory disease (4, 5) that can cause long-standing painful ulceration of the oral mucosa (6, 7) and is also known to increase the risk of oral cancer development (8). The persistent painful symptoms of OLP can have significant negative impact on daily activities (e.g. eating, swallowing, speaking) but

can also impair psychosocial functioning as well as patient's quality of life (9). Therefore medical treatment, often in the form of long-term use of topical corticosteroids or immunosuppressants, is required to reduce patient's painful symptoms (10).

Clinical scoring systems (CSS) used in OLP have been comprehensively addressed in a recent review (11). Some of these CSS demonstrated good measurement properties for use in clinical studies of patients with OLP including Escudier severity scale (ESS) (12) and Reticulation-Erythema-Ulceration (REU) scoring system (13, 14). However, very few studies focus mainly on the use and psychometric evidence of PROMs in OLP patients. Two reviews have previously investigated the use of PROMs in patients with oral mucosal diseases (15, 16), but there remains no comprehensive assessment of the instruments used specifically in studies of OLP patients. The purposes of the present study are to 1) review the range of PROMs used for the assessment of oral symptoms, psychosocial status, and quality of life in the OLP population and 2) assess their psychometric properties and interpretability.

Methods

Literature search

Search strategies for this review were designed to retrieve articles related to the use of PROMs for the assessment of oral symptoms, psychosocial status and quality of life in patients with OLP. Electronic searches of literature on the MEDLINE (through PubMed), Embase and Web of Science Citation Index were performed. The following search terms were applied for each domain of concept.

1. Oral symptoms: ‘oral lichen planus’ AND ‘pain’, ‘burning sensation’, ‘symptom*’

2. Psycho-social status: ‘oral lichen planus’ AND ‘psych*’, ‘anxiety’, ‘depress*’, ‘stress’, ‘mood’, ‘emotion*’, ‘social’

3. Quality of life: ‘oral lichen planus’ AND ‘quality of life’, ‘oral health related quality of life’

Searches in each concept were initially limited to the literature from 1990 until 2016 based on substantial rise in the development and validation of PROMs since 1990 (17). However, due to the large number of articles related to the use of PROMs assessing symptoms in OLP population, we refined the scope of time frame to a period of 10 years (2007-2016) in the search of OLP studies evaluating symptoms.

Selection criteria

Articles were included in this review if they fulfilled the following criteria: publication in the English language and in a peer-reviewed journal; full text available; and reporting on the development, psychometric testing and/or application of at least one PROM for the assessment of oral symptoms, psychosocial status and quality of life in patients with OLP.

Exclusion criteria included: the use of PROMs as a screening tool rather than for study outcome measurement; the use of *ad hoc* instrument or instrument developed without psychometric testing for specific use in one study; literature reviews, editorials and letters.

Data extraction

A specific data extraction form was employed to systematically extract the data of interest from each article including study title, authors and year of publication, country, study design and type of intervention, number of participants, participant characteristics (female-to-male ratio, age, clinical type of OLP) and type of PROMs used. All identified PROMs were categorized into three groups based on the concepts they aimed to measure: oral symptoms, psychosocial status, and quality of life. Their number of items, subscales or domains, rating scales and score types and range were reviewed. In addition, all PROMs were investigated for evidence of psychometric testing as well as interpretability for the application in patients with OLP.

The assessment of psychometric testing and interpretability of identified PROMs included

1. Validity: the degree to which a PROM measures the construct(s) it purports to measure. The assessment of validity includes
    - Content validity: the extent to which the content of a PROM adequately reflects the proposed construct to be measured.
    - Construct validity: the extent to which a PROM validly measures the 'construct' or the theoretical concept that it purports to measure.
    - Criterion validity: the extent to which the scores of a PROM adequately relate to another 'criterion' measure that is considered to be a 'gold standard' in the field of study.
2. Reliability: the degree to which the measurement is free from measurement error. The assessment of reliability includes

- Test-retest reliability: the extent to which the same results are obtained on repeated measurement of the same PROM when no change in patient's status has occurred.
- Internal consistency reliability: the degree of the interrelatedness among the items.

3. Responsiveness: the ability of a PROM to detect change over time in the construct measured.
4. Interpretability: the degree to which one can assign qualitative meaning to an instrument's quantitative scores or change in scores (3).

Results

Search results

The initial literature search yielded a total of 2,942 citations. After removing duplicates and spurious references, and following a review of the titles and abstracts, 120 articles were considered to meet the inclusion criteria (Figure 1). A total of 41 PROMs were identified from these 120 publications (detailed in Table 1).

PROMs assessing oral symptoms of OLP

Three generic PROMs were identified from 81 studies: the visual analog scale (VAS), the numerical rating scale (NRS) and the change in symptoms scale (CSS). The majority of studies (75/81, 92.59%) used the VAS while the NRS and CSS were used in seven (8.64%) and two studies (2.47%) respectively. Interestingly, word descriptors for the VAS varied among studies including "pain" (used 49 times; in 65.33% of studies), "pain and/or burning sensation" (used 12 times; in 16% of

studies), discomfort, taste dysfunction, and many others (Table 2). Out of the seventy-five OLP studies using the VAS, less than 50% (33/75, 44%) provided clear and accurate information, in the relevant material and methods section, regarding the use of the instrument and the measurement of results; twenty-five articles (33.3%) reported incorrect or unclear information while seventeen articles (22.67%) did not provide any information.

PROMs assessing psychosocial status in OLP patients

A total of 30 PROMs assessing psychosocial status in OLP patients were identified from 29 studies. All of them were generic instruments (Table 3). The most commonly used instruments were the State-Trait Anxiety Inventory (STAI; 9 studies), followed by the Beck Depression Inventory (BDI; 7 studies) and the Hospital Anxiety and Depression Scale (HADS; 7 studies).

PROMs assessing the quality of life of OLP patients

A total of 8 PROMs focusing upon quality of life in patients with OLP were identified from 27 studies. Six of these PROMs were oral health-related quality of life (OH-QoL) instruments; the other two were general quality of life instruments (SF-36 and SF-12). Out of the six OH-QoL instruments, two were developed for specific group of patients: individuals with head and neck cancer (UW-QOL) and with chronic oral mucosal diseases (COMDQ). Table 4 provides characteristics of these instruments. The most frequently used quality of life PROMs in the OLP population was the Oral Health Impact Profile-14 (OHIP-14; 11 studies), followed by the Oral Health Impact Profile-49 (OHIP-49; 6 studies) and the Medical Outcome Study Short Form 36 Health Survey (SF-36; 3 studies).

Evidence for psychometric properties and interpretability of identified PROMs

With respect to PROMs of oral symptoms, we found one study assessing the psychometric properties of VAS, NRS and CSS in the OLP population (18), and no study assessing interpretability of these PROMs in this patient population was found.

There was no evidence of psychometric testing or interpretability on any of the PROMs relevant to the psychosocial status of OLP individuals.

Three out of eight quality of life PROMs had their psychometric properties tested including OHIP-14, OHQoL-UK and COMDQ but none of these instruments have evidence for the interpretability of their results. Table 5 summarises the psychometric testing of the reviewed PROMs.

Discussion

Oral lichen planus can give rise to longstanding painful symptoms to the oral mucosa, often leading to psychological distress and a reduction in the quality of life (19-21). Patient reported outcome measures are crucial in assessing the effect of the disease and its treatment, as perceived by the affected patients, and provide complementary information to the clinician-based clinical assessment of the condition (2). A wide range of PROMs has been used in clinical studies of OLP patients; however, there remains no comprehensive review of these instruments and, more importantly, there is no thorough critical assessment of their psychometric properties and interpretability. As a consequence little guidance is available for

clinicians as regards to which instruments have been appropriately validated and therefore could be used for treatment and research of OLP.

In the present study three PROMs (VAS, NRS and CSS) were identified that have been used to assess oral symptoms of OLP, with VAS being the most common. However there was a wide variability and lack of consistency in the type of oral symptoms measured by this instrument, as reflected by a number of different descriptors including “pain”, “pain at rest”, “discomfort”, “burning sensation” and many others (Table 2). This heterogeneity makes study comparison and data pooling difficult. We also found that the material and method sections of the reviewed studies provided the necessary information (22, 23) about the use and interpretation of the VAS only in 44% of instances. In the remaining studies information on VAS were either absent or incorrect; for example one study stated that “*patients* rated their symptoms on a scale from 0 to 10”, which appear to reflect NRS rather than VAS.

Both VAS and NRS have been validated in patients with OLP resident in the US by Chainani-Wu *et al* (2008) (18), who reported better construct validity in NRS than in VAS, as demonstrated by higher correlations with clinical manifestations. Other strengths of NRS over VAS include its simplicity of scoring, better compliance owing to its comprehensibility and ease of completion, as well as the fact that it can be used in greater variety of patients including the elderly and those with motor problems (24). Therefore, NRS may be considered a better instrument than VAS for the measurement of oral symptoms in the OLP population. We did not find any studies providing information regarding the interpretability of PROMs of oral

symptoms in the OLP population, which raises concerns regarding the clinical meaning of their results (3, 25, 26).

Our review identified a wide range of PROMs focusing on the psychosocial status of OLP patients. Studies have used instruments relevant to psychological constructs (anxiety, depression, stress, distress, coping with illness, hardiness, health locus of control, psychological symptoms and well-being, spirituality and vulnerability), as well as emotional (mood, emotion regulation, anger, loneliness) and social constructs (social support).

Anxiety and depression were the most frequently assessed psychosocial concepts in OLP population, and STAI, BDI and HADS were the most commonly used PROMs in OLP studies. All three instruments have demonstrated good psychometric properties in a general population (27-29); however, all of them lack psychometric evidence in OLP samples. Instruments focusing upon other psychosocial constructs were few (30, 31) and, again there was no evidence of their psychometric testing or interpretability in the OLP population. Overall, the present findings raise concerns as to whether these instruments are indeed relevant, comprehensive, valid and reliable for capturing the psychosocial status of individuals with OLP. Nonetheless HADS may have a potential to be a PROM of choice for use in patients with OLP as it comprises 14 simple-to-follow items with detailed, straightforward instruction (29) and can capture both anxiety and depression, whereas STAI and BDI have more questions, require more time to complete and provide information on only one psychological concept.

Assessment of quality of life in OLP individuals is important as it reflects the patient's subjective perception of the impact of a disease and related treatment on physical, psychological and social aspects of life (32, 33). A number of quality of life PROMs have been used in patients with OLP, and can be divided into instruments assessing oral health-related quality of life (OH-QoL) and those assessing general aspects of quality of life.

Our review identified six OH-QoL PROMs, but only three have had their psychometric properties tested in the OLP population: the OHIP-14, OHQOL-UK and COMDQ. OHIP-14 is the most frequently used PROMs for the assessment of quality of life in OLP literature. This was initially developed for use in older Australian adults and is a shortened version of the original OHIP-49 containing 14 items with a subset of 2 questions for each of the 7 domains of OH-QoL, which is based upon Locker's conceptual framework of oral health (34, 35). OHQOL-UK was developed upon adult UK population's perceptions of how oral health affects quality of life (36). Therefore both OHIP-14 and OHQOL-UK were developed without the input from patients with OLP and therefore may not be able to capture all relevant aspects associated with the disease and related treatment. COMDQ is an oral medicine-specific PROM developed for the assessment of quality of life in patients with chronic oral mucosal disease (37). It is the only validated PROM that was developed with input from patients with OLP. In addition, COMDQ has the highest number of validation studies of patients with OLP compared to the other OH-QoL PROMs. Regarding the measurement of general aspect of quality of life, only two PROMs have been used in studies of OLP patients including SF-36 and SF-12. Neither of them had their psychometric properties or interpretability tested in the OLP population.

This review found that there are no studies reporting the interpretability of PROMs in patients with OLP. Interpretability gives meaning to the scores from these instruments in a clinical context, which facilitates better understanding of PROM results (3, 26). The numerical scores derived from PROMs should be easily translated into clinically meaningful information, relevant to patients, clinicians and researchers. An interpretability parameter such as the minimal important difference (MID), the smallest magnitude of change in PROM scores which constitutes a clinically meaningful change (26, 38), can therefore facilitate the translation of these scores. There is thus a need for further studies determining interpretability of PROMs in patients with OLP.

The treatment of OLP is not curative, rather the goal is to minimise symptoms and improving patient's quality of life. Although a wide array of topical and systemic medications are available for patients with OLP, there is currently weak evidence supporting the superiority of any of these medications over placebo (12, 39), and future large randomized placebo-controlled trials (RCTs) are needed. These RCTs will require the careful selection of validated outcome measures, both clinical measures and PROMs. Although the present study identified some promising PROMs in several patient-reported concepts with appropriate psychometric properties for use in clinical studies of patients with OLP, there is currently a lack of uniformity in the choice of outcome measures including both PROMs and clinical measures of signs and disease activity (11) across the OLP literature. Therefore there is an urgent need for a consensus on the core outcome set for clinical trials of OLP. This could enhance the quality of future clinical research, leading to more

robust evidence supporting the use of OLP medications and eventually better patient care.

Conclusions

A wide range of PROMs have been used in clinical studies of OLP patients. However, as there is little convincing evidence regarding their psychometric properties and interpretability in patients with OLP. Concerns exist about their appropriateness as well as the clinical meaningfulness of their results. Furthermore, our review showed a high heterogeneity among published studies in the use of PROMs in OLP population. There is therefore an urgent need to establish a core set of PROMs OLP to be used in clinical trials, so to allow comparison of interventions and data pooling in systematic reviews and meta-analyses.

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Conflict of Interest Statement

Dr. Wiriyakijja, Dr. Fedele, Prof. Porter, Dr. Mercadante, Dr. Ni Riordain have no conflicts of interest to disclose.

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Table 1 Types (by concepts measured), acronyms and frequency of use of PROMs in clinical studies of patients with OLP

Instrument type and name	frequency of use
PROMs assessing oral symptoms	
Symptoms	
Visual Analog Scale (VAS)	75
Numerical Rating Scale (NRS)	7
Change in Symptoms Scale (CSS)	2
PROMs assessing psychological status	
Anxiety (only)	
State-Trait Anxiety Inventory (STAI)	9
Beck Anxiety Inventory (BAI)	1
Depression (only)	
Beck Depression Inventory (BDI)	7
Centre for Epidemiologic Studies Depression Scales (CES-D)	1
Stress (only)	
Perceived Stress Questionnaire (PSQ)	2
Perceived Stress Scale (PSS)	2
Lipp's Inventory of Stress Symptoms of Adults (LISS)	1
Social Readjustment Rating Scale (SRRS)	1
Test of Recent Experience (TRE)	1
Anxiety and depression	
Hospital Anxiety and Depression Scale (HADS)	7
Anxiety, depression and stress	
Depression, Anxiety and Stress Scale (DASS-42)	3
Anxiety, depression and vulnerability	
Hassanyeh Rating of Anxiety-Depression-Vulnerability (Hassanyeh RADV)	1
Distress/psychological symptoms	
Brief Symptom Inventory (BSI)	1
General Health Questionnaire-12 (GHQ-12)	1
General Health Questionnaire-28 (GHQ-28)	1
Self Reporting Questionnaire (SRQ)	1
Symptom Checklist (SCL-90)	1
Coping	
Coping Orientation to Problems Experienced Inventory (COPE)	1
Freiburg Questionnaire on Coping with Illness-short form (FKV-LIS)	1
Ways of Coping Questionnaire (WCQ)	1
Hardiness	
Hardiness Scale	1
Health locus of control	
Health/Illness Locus of Control Questionnaire (KKG)	1
Psychological well-being	
Psychological General Well-being Index-short form (PGWBI-S)	1
Spirituality	
Systems of Belief Inventory (SBI-14-R-D)	1

Table 1 Types (by concepts measured), acronyms and frequency of use of PROMs in clinical studies of patients with OLP (cont)

Instrument type and name	frequency of use
PROMs assessing emotional impacts	
Mood	
Mood Adjective Check List (MACL)	1
Profile of Mood States Questionnaire (POMS)	1
Anger	
State-Trait Anger Expression Inventory (STAXI-2)	1
Emotion regulation	
Multidimentional Negative Emotions Self-Regulatory Efficacy Scale (MNESRES)	1
Loneliness	
UCLA Loneliness Scale	1
PROMs assessing social impacts	
Social support	
Social Support Questionnaire-short form (F-SozU-K22)	1
PROMs assessing quality of life	
Oral health related quality of life	
Oral Health Impact Profile-14 (OHIP-14)	12
Oral Health Impact Profile-49 (OHIP-49)	6
Oral Health-Related Quality of Life-UK (OHQOL-UK)	2
Oral Health Impact Profile-German version (OHIP-G)	1
Oral health related quality of life specific to chronic oral mucosal diseases	
Chronic Oral Mucosal Disease Questionnaire (COMDQ)	2
Health related quality of life specific to head and neck cancer	
University of Washington Quality of Life Questionnaire-version 4 (UWQOL V4)	1
General health related quality of life	
Medical Outcome Study Short Form 36 Health Survey (SF-36)	3
Medical Outcome Study Short Form 12 Health Survey (SF-12)	1

Table 2 Word descriptors used in VAS in the studies assessing oral symptoms of OLP

Word descriptors	frequency
pain	49
pain and/or burning sensation	12
burning sensation	5
oral symptoms	4
pain and/or discomfort	3
taste function/disorder	2
breath odor	1
discomfort	1
dry mouth	1
loss of appetite	1
oral freshness	1
pain at rest	1
pain at meal time	1
postoperative pain	1
spontaneous pain	1

Table 3 Characteristics of PROMs assessing psychosocial status in clinical studies of patients with OLP

Name	Items (N)	Concept	Subscale (N items)	Rating scale	Score types and range		
					Subscales	Total	Others
BAI	21	Anxiety	Anxiety (21)	4-point scale (0-1-2-3)		0-63	
BDI, BDI-II	21	Depression	Depression (21)	4-point scale (0-1-2-3)		0-63	
BSI	53	Psychological symptoms	Somatisation (SOM); Obsessive-compulsive behavior (O-C); Interpersonal sensitivity (I-S); Depression (DEP); Anxiety (ANX); Hostility (HOS); Phobic anxiety (PHOB); Paranoid ideation (PAR); Psychoticism (PSY)	5-point scale (0-1-2-3-4)	✓		GSI* PST* PSDI*
CES-D	20	Depression	Depressive affect (7); Positive affect (4); Somatic and retarded activity (7); Interpersonal (2)	4-point scale (0-1-2-3)		0-60	
COPE	60	Coping	Positive reinterpretation and growth (4); Mental disengagement (4); Focus on and venting of emotions (4); Use of instrumental social support (4); Active coping (4); Denial (4); Religious coping (4); Humor (4); Behavioural disengagement (4); Restraint (4); Use of emotional social support (4); Substance use (4); Acceptance (4); Suppression of competing activities (4); Planning (4)	4-point scale (0-1-2-3)	4-16		
DASS-42	42	Anxiety, depression, stress	Anxiety (14); Depression (14); Stress (14)	4-point scale (0-1-2-3)	0-42		
FKV-LIS	35	Coping	Depressive coping; Active problem-oriented coping; Distraction and self-motivation; spirituality; Minimisation and wishful thinking	5-point scale (1-2-3-4-5)	✓ (mean of all subscale items)		
F-SozU-K22	22	Social support	Emotional support; Practical support; Social integration	5-point scale (1-2-3-4-5)	✓ (mean of all subscale items)	22-110	
GHQ-12	12	Distress	Distress (12)	4-point scale (0-0-1-1 or 0-1-2-3)		0-12 0-36	
GHQ-28	28	Distress	Somatic symptoms (7); Anxiety and insomnia (7); Social dysfunction (7); Severe depression (7)	4-point scale (0-0-1-1 or 0-1-2-3)	0-7 0-21	0-28 0-84	
HADS	14	Anxiety, depression	Anxiety (HADS-A) (7); Depression (HADS-D) (7)	4-point scale (0-1-2-3)	0-21		
Hardiness Scale	45	Hardiness	Control (15); Commitment (15); Challenge (15)	4-point scale (0-1-2-3)	0-45	0-135	
Hassanyeh RADV	68	Anxiety, depression, vulnerability	Anxiety (AN) (17); Global depression (GD) (47); Vulnerability or Personality Predisposition (PD) (16)	2-point scale (0-1)	N/A		
KKG	21	Health locus of control	Internality (7); Powerful other externality (7); Chance externality (7)	6-point scale (1-2-3-4-5-6)	✓ (mean of all subscale items)		
LISS	56	Stress	Phase: Alert (Q1) (16); Resistance amd Near-exhaustion (Q2) (16); Exhaustion (Q3) (24)	2-point scale (0-1)	0-15 (Q1, 2) 0-23 (Q3)		
MACL	72	Mood	Pleasantness/unpleasantness; Activation/deactivation; Extraversion/introversion; Calmness/tension; Positive/negative social orientation; Control/lack of control	4-point scale (0-1-2-3)	N/A		

Table 3 Characteristics of PROMs assessing psychosocial status in clinical studies of patients with OLP

Name	Items (N)	Concept	Subscale (N items)	Rating scale	Score types and range		
					Subscales	Total	Others
MNESRES	15	Emotion regulation	Perceived self-efficacy in dealing with negative emotions: Anger/irritation (3); Despondency/sadness (3); Fear (3); Shame/embarrassment (3); Guilt (3)	5-point scale (1-2-3-4-5)	3-15		
PGWBI-S	6	Psychological well-being	Anxiety (1); Vitality (2); Depressed mood (1); Self-control (1); Positive well-being (1)	6-point scale (0-1-2-3-4-5)	✓	0-30	
POMS	65	Mood	Tension (T) (9); Depression (D) (15); Anger (A) (12); Fatigue (F) (7); Confusion (C) (7); Vigour (V) (8)	5-point scale (0-1-2-3-4)	✓		TMD*
PSQ	20	Stress	Worries (5); Tension (5); Joy (5); Demands (5)	4-point scale (1-2-3-4)		20-80	
PSS	10	Stress	Perceived stress (10)	5-point scale (0-1-2-3-4)		0-40	
SBI-15-R-D	15	Spirituality	Belief and practice (10); Social support (5)	4-point scale (0-1-2-3)		0-45	
SCL-90	90	Psychological symptoms	Somatisation (SOM); Obsessive-compulsive behavior (O-C); Interpersonal sensitivity (I-S); Depression (DEP); Anxiety (ANX); Hostility (HOS); Phobic anxiety (PHOB); Paranoid ideation (PAR); Psychoticism (PSY)	5-point scale (0-1-2-3-4)	✓		GSI* PST* PSDI*
SRQ-20	20	Psychological symptoms	Mental health (20)	2-point scale (0-1)		0-20	
SRRS	43	Stress	Stressful life events (43)	2-point scale (0-life change units)		✓ (total life change units)	No of events
STAI	40	Anxiety	State anxiety (STAI-S) (20); Trait anxiety (STAI-T) (20)	4-point scale (1-2-3-4)	20-80		
STAXI-2	57	Anger	State anger (S-Anger) (15) (Feeling angry, S-Ang/F; Feel like expressing anger verbally, S-Ang/V; Feel like expressing anger physically, S-Ang/P); Trait anger (T-Anger) (10) (Angry temperament, T-Ang/T; Angry reaction, T-Ang/R); Anger expression-out (AX/Out) (8); Anger expression-in (AX/In) (8); Anger control-out (AX/Con-Out) (8); Anger control-in (AX/Con-In) (8); Anger expression index (AX index) (32)	4-point scale (1-2-3-4)	✓		AX index* (0-96)
TRE	42	Stress	Vital events (42)	2-point scale (0-life change units)		0-600	
UCLA Loneliness Scale	20	Loneliness	Loneliness (20)	4-point scale (1-2-3-4)		20-80	
WCQ	66	Coping	Confrontive coping (6); Distancing (6); Self-controlling (7); Seeking social support (6); Accepting responsibility (4); Escape-Avoidance (8); Planful problem solving (6); Positive reappraisal (7)	4-point scale (0-1-2-3)	✓		

**Abbreviation: AX index* = AX/Out + AX/In – (AX/Con-Out + AX/Con-In) + 48; GSI = Global Severity Index (mean of all subscale scores); PST = Positive Symptom Total (number of items with score > 0); PSDI = Positive Symptom Distress Index (the sum of all item values divided by PST); TMD = Total Mood Disturbance ([Tension + Depression + Anger + Fatigue + Confusion] - Vigour)

Table 4 Characteristics of PROMs assessing quality of life in clinical studies of patients with OLP

Name	Items (N)	Concept	Subscale (N items)	Rating scale	Score types and range		
					Subscales	Total	Others
COMDQ	26	OH-QOL specific to COMD	Pain & function limitation (PF) (9); Medication & treatment (MT) (6); Social & emotional (SE) (7); Patient support (PS) (4)	5-point scale (0-1-2-3-4)	0-36 for PF 0-24 for MT 0-28 for SE 0-16 for PS	0-104	
OHIP-14	14	OH-QOL	Functional limitation (FL) (2); Physical pain (PhyP) (2); Psychological discomfort (PsyD) (2); Physical disability (PhyDis) (2); Psychological disability (PsyDis) (2); Social disability (SDis) (2); Handicap (H) (2)	5-point scale (0-1-2-3-4)		0-56 (Severity)	Extent*
OHIP-49	49	OH-QOL	Functional limitation (FL) (9); Physical pain (PhyP) (9); Psychological discomfort (PsyD) (5); Physical disability (PhyDis) (9); Psychological disability (PsyDis) (6); Social disability (SDis) (5); Handicap (H) (6)	5-point scale (0-1-2-3-4)	0-36 for FL, PhyP, PhyDis 0-24 for PsyDis, H 0-20 for PsyD, SDis	0-196	
OHIP-G	53	OH-QOL	Functional limitation (FL) (9); Physical pain (PhyP) (9); Psychological discomfort (PsyD) (5); Physical disability (PhyDis) (9); Psychological disability (PsyDis) (6); Social disability (SDis) (5); Handicap (H) (6); Additional German Items (AGI) (4)	5-point scale (0-1-2-3-4)	0-36 for FL, PhyP, PhyDis 0-24 for PsyDis, H 0-20 for PsyD, Sdis 0-16 for AGI	0-212	
OHQOL-UK	16	OH-QOL	Physical effects/impacts (Phy-E/I) (6); Social effects/impacts (S-E/I) (5); Psychological effects/impacts (Psy-E/I) (5)	5-point scale (1-2-3-4-5 for effects and 0-1-2-3-4 for impacts)	6-54 for Phy-E/I 5-45 for S-E/I, Psy-E/I	16-144	
SF-12	12	GH-QOL	Physical functioning (PF) (2); Role physical (RP) (2); Bodily pain (BP) (1); General health (GH) (1); Vitality (VT) (1); Social functioning (SF) (1); Role emotional (RE) (2); Mental health (MH) (2)	2- to 6-point scale			PCS-12 MCS-12
SF-36	36	GH-QOL	Physical functioning (PF) (10); Role physical (RP) (4); Bodily pain (BP) (2); General health (GH) (5); Vitality (VT) (5); Social functioning (SF) (2); Role emotional (RE) (3); Mental health (MH) (5); Health transition (HT) (1)	2- to 6-point scale	0-100 (transformed from raw score)	0-100 (transformed from raw score)	PCS* MCS*
UWQOL-V4	16	H-QofL specific to H&N cancer	Domain: Pain (1); Appearance(1); Activity (1); Recreation (1); Swallowing (1); Chewing (1); Speech (1); Shoulder (1); Taste (1); Saliva (1); Mood (1); Anxiety (1) Importance rating (1) Global score: HRQofL compared to mouth before had cancer (1); HRQofL during the past 7 days (1); Overall QofL during the past 7 days (1)	3- to 6-point scale	0-100		Physical subscale score* Social-Emotional subscale score*

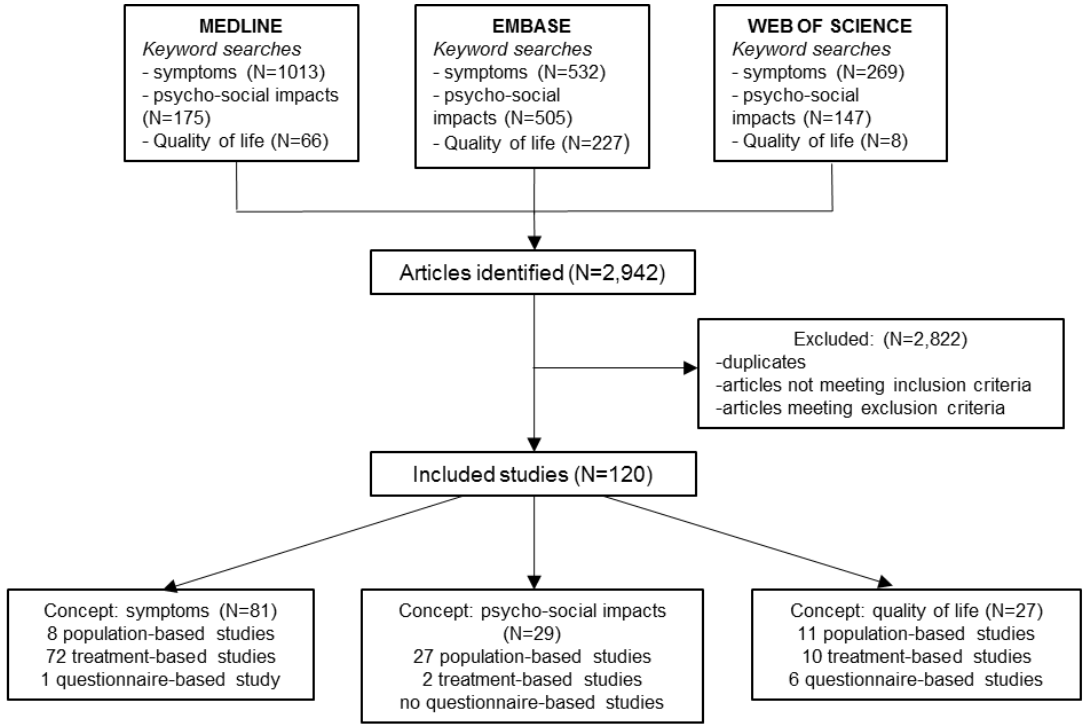
*Note: Extent = N of items reported fairly often (3)/very often (4); GH-QOL = general health related quality of life; H-QOL = health related quality of life; OH-QOL = oral health related quality of life; PCS = Physical Component Summary; MSC = Mental Component Summary; Physical subscale score = Chewing+Swallowing+ Speech+Taste+Saliva+Appearance; Social-Emotional subscale score = Anxiety+Mood+Pain+Activity+Recreation+Shoulder function)

Table 5 Summary of psychometric properties of identified PROMs in clinical studies of patients with OLP

Authors	PROMs	Questionnaire language/country	Main Methods of Evaluation	No of patients	Major reported outcomes
Hegarty et al, 2002 (40)	OHIP-14	English/UK	Convergent validity (correlation with VAS for pain), Discriminant validity between patients with symptomatic and asymptomatic lesions, Internal consistency	48	Correlation with VAS for pain: r = 0.44, p < 0.01; Significant difference in OHIP-14 scores between patients with symptomatic and asymptomatic lesions; Cronbach's α = 0.90
	OHQOL-UK	English/UK	Convergent validity (correlation with VAS for pain), Discriminant validity between patients with symptomatic and asymptomatic lesions, Internal consistency	48	Correlation with VAS for pain: r = 0.43, p < 0.01; Significant difference in OHIP-14 scores between patients with symptomatic and asymptomatic lesions; Cronbach's α = 0.93
McGrath et al, 2003 (33)	OHIP-14	English/UK	Responsiveness to change	48	Significant postintervention change in OHIP scores (P = 0.036)
	OHQOL-UK	English/UK	Responsiveness to change	48	Significant postintervention change in OHIP scores (P = 0.003)
Chainani-Wu et al, 2008 (18)	VAS for symptoms	English/USA	Concurrent validity (correlation with other PROMs measuring symptoms), Construct validity (with clinical sign scores)	33	Strong correlation between VAS and NRS scores (r > 0.9, P < 0.001) at each visit; Good correlation between difference in VAS scores from previous visit and CSS; mild to moderate correlation with MOMI scores
	NRS for symptoms	English/USA	Concurrent validity (correlation with other PROMs measuring symptoms), Construct validity (with clinical sign scores)	33	Strong correlation between VAS and NRS scores (r > 0.9, P < 0.001) at each visit; Good correlation between difference in VAS scores from previous visit and CSS; mild to moderate correlation with MOMI scores (stronger than VAS for symptoms)
	CSS	English/USA	Concurrent validity (correlation with other PROMs measuring symptoms), Construct validity (with clinical sign scores)	33	Good correlation between CSS scores and difference in VAS/NRS from previous visit; Low to high correlation with change in MOMI scores
Ni Riordain and McCreary, 2011 (41)	COMDQ	English/Ireland	Convergent validity (correlation with VAS for pain and OHIP-14), Discriminant validity between patients with and without COMD, Internal consistency	109	Good convergent validity with VAS for pain (r = 0.883) and OHIP-14 (r = 0.819); Significant difference in COMDQ scores between patients with and without COMD; Cronbach's α = 0.929
Ni Riordain and McCreary, 2012 (42)	COMDQ	English/Ireland	Test-retest reliability, Responsiveness to change	76	Good test-retest reliability (ICC = 0.81); COMDQ is responsive to changes in the patient's overall conditions
Li and He, 2013 (43)	COMDQ	Chinese/China	Structural validity; Internal consistency; Test-retest reliability	72	EFA extracted four factors (consistent with original english version) and all items demonstrated adequate factor loadings; Cronbach's α = 0.894; ICC of total COMDQ scores = 0.83
Ni Riordain et al, 2016 (44)	COMDQ	English/UK	Convergent validity (correlation with VAS and OHIP-14), Internal consistency	100	Moderate to good convergent validity with VAS and OHIP-14; Cronbach's α = 0.93

Abbreviation: COMD = chronic oral mucosal disease; EFA = exploratory factor analysis; ICC = intraclass correlation coefficient; MOMI = Modified Oral Mucositis Index

Figure 1. Flow chart showing database search results and number and types of included studies



Note: questionnaire-based study related to the development and/or psychometric testing of PROMs in OLP population