



Published in final edited form as:

J Evid Based Dent Pract. 2019 March ; 19(1): 53–70. doi:10.1016/j.jebdp.2018.10.005.

Patient-Reported Outcome Measures for Adult Dental Patients: A Systematic Review

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Abstract

Objectives—Patient-reported outcomes (PROs) are used beside disease-oriented outcomes (e.g., number of teeth, clinical attachment level) to better capture diseases' or interventions' impacts. To assess PROs for dental patients (dPROs), dental patient-reported outcome measures (dPROMs) are applied. The aim of this systematic review was to identify generic dPROMs for adult patients and their dPROs.

Methods—This systematic review searched the MEDLINE, Embase, and PsycINFO databases along with hand searching, through December 2017, to identify English-language, multi-item dPROMs that are oral health-generic, i.e., they are applicable to a broad range of adult patients.

Results—We identified 20 questionnaires, which contained 36 unique dPROs. They were measured by 53 dPROMs. dPRO names (N=36) suggested they could be grouped into four dPRO categories: *Oral Function* (N=11), *Orofacial Pain* (N=7), *Orofacial Appearance* (N=3), and

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Declarations of interest:

None.

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Psychosocial Impact (N=14) and an additional dPRO that represented perceived oral health in general. Only eight questionnaires had a specific recall or reference period. dPROM's score dimensionality was only investigated in 13 of the 20 questionnaires.

Conclusions—The identified 36 dPROs represent the major aspects of an adult dental patient's oral health experience; however, four major dPRO groupings, i.e., *Oral Function*, *Orofacial Pain*, *Orofacial Appearance*, and *Psychosocial Impact*, summarize how patients are impacted. If multi-item, oral health-generic dPROMs are to be used to measure patients' suffering, the 53 dPROMs represent current available tools. Limitations of the majority of these dPROMs include incomplete knowledge about their dimensionality, which affects their validity, and an unspecified recall period, which reduces their clinical applicability.

Graphical Abstract



Keywords

Oral health; Quality of life; Questionnaire; Patient-reported outcome; Patient-reported outcome measure; Dimensionality

Introduction

Researchers and oral health professionals increasingly use patient-oriented or patient-reported outcomes (PROs)¹ beside disease-oriented outcomes (e.g., number of teeth, clinical attachment level) to better capture diseases and interventions' impact on the patient. A PRO is defined as "any report of the status of a patient's health condition that comes directly from the patient, without interpretation of the patient's response by a clinician or anyone else."² Most PROs assess (i) status of the patient's health condition, (ii) health behaviors, or (iii) experience with health care, with the first category being the largest group because they are often used to study treatment effects. To assess a PRO, a patient-reported outcome measure (PROM) is used. The most widely used PROMs have multiple questions, i.e. items, to capture the target attribute. Dental PROMs (dPROMs) assess different outcomes in comparison to PROMs in other medical fields. These outcomes are called dental PROs (dPROs).³ *Orofacial Appearance* of dental patient is an example of dPRO. Several dPROMs exist and they differ according to which aspect of the dental patient's oral health experience they measure and how they measure it. Moreover, different dPROMs for adults and children exist. For example, the Oral Health Impact Profile⁴ or the Geriatric Oral Health Assessment

Index⁵ are oral health-related quality of life instruments for adults and the Child Perception Questionnaire⁶ assesses the same construct in children ages 11–14 years.

For the researcher or the oral health professional interested in measuring dPROs by utilizing dPROMs, few review articles are already available.^{7,8} Such reviews have limitations when not performed systematically. Therefore, the set of dPROs identified by the systematic review should contain all relevant dPROs. This would improve our foundational oral health knowledge since assessment of the patient's suffering and the intervention to reduce/eliminate or, ideally, to prevent it are the primary reasons for the existence of dental health professionals. Moreover, a systematic review could also reveal how researchers approached the challenging task to capture patients' oral health suffering. For example, valuable insight into practical dPRO measurement would be achieved by knowing whether oral health impacts can be captured by simple "yes-no" patient answers, or whether they need to be measured with more complex, gradual response options.

The aim of this systematic review was to identify generic dPROMs for adult patients and their dPROs.

Methods

This review aimed to identify all dPROMs for adult patients with the following characteristics:

1. Multi-item measures applicable to individual patients were included but without considering patients' symptoms.
2. Tools for individual patients were included and, therefore, PROMs for accountable health care entities (i.e., performance measures) were excluded.
3. Measures that specifically assess oral health impact were included. Measures that focus on oral health's systemic impacts (e.g., sleep disturbance, depression) were excluded.
4. Measures that are applicable to a broad range of adult dental patients were included. In contrast to these oral health-generic instruments, those for a specific oral disease (e.g., dry mouth, temporomandibular disorders) or specific patient groups (e.g., edentulous patients) were excluded.

PROM Search

A search strategy was developed for MEDLINE (National Library of Medicine, Bethesda, MD, USA) via the Ovid interface and then translated to Embase (Elsevier, Amsterdam, Netherlands) and PsycINFO (American Psychological Association, Washington DC, USA) via the Ovid interface. A combination of keywords and phrase searching was used to identify dPROMs. The full Ovid Medline search was: (exp Esthetics, Dental/ OR exp Facial Pain/ OR (orofacial adj3 pain).ab,ti. OR (oral adj3 function\$.ab,ti. OR (oral health adj3 quality of life).ab,ti.)) AND (exp "Surveys and Questionnaires"/ OR questionnaire\$.ab,ti. OR survey\$.ab,ti. OR (limitation adj3 scale\$.ab, ti. OR (esthetic adj3 scale\$.ab, ti. OR Psychometrics/). Authors also added relevant references from personal libraries meeting

inclusion and exclusion criteria. The initial literature search was conducted in 2014 and refreshed on December 4, 2017. Results were restricted to human, English language, and adults.

Search results were imported into EndNote (Clarivate Analytics, Philadelphia, PA, USA) for de-duplication and included references were imported into Mendeley (Elsevier, Amsterdam, Netherlands) for reference management. Subsequent references were then exported to Microsoft Excel where four reviewers HM, MTJ, SS, and KRS reviewed titles and abstracts for inclusion criteria. Only dPROMs that demonstrated evidence for their score reliability and validity were included and only original questionnaires' publications were assessed.

PROM presentation and analysis

The search identified publications that included dPROMs. A particular dPROM was sometimes combined with other dPROMs within a single questionnaire. For the purpose of this study, we defined a questionnaire as a set of questions or a battery of dPROMs, which can be administered to a patient. Each dPROM is assessing a specific dPRO – the object of measurement, e.g., the dPROM GOHAI⁵ measures the dPRO OHRQoL. However, the number of dPROMs and dPROs does not need to be identical because a dPRO could be measured by several dPROMs within a single questionnaire. For example, in the questionnaire Subjective Oral Health Status Indicators⁹ (SOHSI) a broader dPRO was defined as the “functional, social, and psychological impact of oral conditions,” which is measured with three narrower dPROs, namely “*Functional limitations*”, “*Pain and discomfort*”, and “*Disability and Handicap*”. Sometimes these narrower dPROs are called dimensions of a broader dPRO. We assumed a PROM exists, if a numerical score is derived.

The identified questionnaires as well as their dPROs, dPROMs, and dPROMs' items were characterized in tabular and graphical format. First, an overview of identified questionnaires was provided with information about the original publication. We presented publication year, author names, first author's country, title of the publication, and name of the questionnaire.

Names of dPROs, their definitions, and their dPROMs were listed afterwards. dPROs were labeled as positive or negative concepts in relation to dental patient's oral health experience, e.g., Functional Limitation is a negative concept whereas Function was considered a positive concept. Characteristics of patients that were used for questionnaire development, dPROM dimensionality (a psychometric property that is fundamental for the nature and number of attributes being measured), and recall or reference period (the period of time patients were asked to consider in responding to dPROMs) were also extracted. Finally, dPRO names given by the original authors of the questionnaires were analyzed and linked to the four dimensions of the oral health-related quality of life, i.e., *Oral Function*, *Orofacial Pain*, *Orofacial Appearance*, and *Psychosocial Impact*.^{10,11} For dPROs that had two attributes, e.g., *Pain and Discomfort*, the first attribute was used as the factor for classification. Disability, an interaction between a person's oral health condition and that individual's contextual factors, was classified as a part of *Psychosocial Impact*.

The dPROM's basic components, i.e., the items, were also characterized. The number of items and impact quality, i.e., how the impact affected the patient over time, were recorded. An impact could have a temporal quality such as a frequency, i.e., how often the impact occurred, or duration, i.e., how long the impact lasted. Duration quality could be further differentiated into length of time for an individual impact episode and length of time since the impact occurred first. Impact could also have a magnitude quality, i.e., intensity of the impact. Therefore, we assessed whether items contained frequency, duration, or intensity as the impact quality or just a simple presence of the impact, a "yes/no" response option.

Furthermore, item's response options were also characterized. They were differentiated into a "continuous-adjectival" or a "continuous-numerical" category when responses had an order and were represented by adjectives or by a numerical rating scale, respectively. In contrast, a "categorical-adjectival" category was selected when no order was present in the adjectives. The number of response options, their anchors, and anchors' numerical scores were also extracted as well as items received weights or not for score computation. The source for the questionnaire items was differentiated into patients, experts, or literature.

Results

We identified 20 English-language questionnaires (Figure 1) which specifically measured oral health status and were broadly applicable across oral conditions (Table 1).

These questionnaires were developed in a span of 25 years, between 1989 and 2014 (Table 1). The rate of development of new questionnaires had slowed down with ten developed between 1989 and 2000, eight between 2001 and 2010, and only two after 2010.

Publications' first authors came from ten countries, with the majority of publications originating from an English speaking country (N=13). Only seven questionnaires were developed in languages other than English but were published in English-language articles. Teams of authors developed the questionnaires. The lowest number of authors was two and the highest was eight. The questionnaires were published in dental journals, medical journals, and books. Only four journals published more than one questionnaire. The *Journal of Dental Education*, *Journal of Orofacial Pain*, and *Community Dentistry and Oral Epidemiology* each published two questionnaires, while the *Community Dental Health* journal published three questionnaires. Two questionnaires were introduced in a book.

The 20 questionnaires together contained 53 dPROMs. These dPROMs could be differentiated into measures for narrower dPROs (N=45, Figure 2, first column) and for one broad dPRO, representing perceived oral health in general (N=8, Figure 2, fifth column). Sometimes more than one dPROM targeted a particular dPRO, e.g., *Functional Limitations* were measured in two instruments, the OHIP as well as the SOHSI, resulting in a smaller number of 36 unique dPROs (N=35 narrower unique dPROs, Figure 2, second column, plus N=1 broad unique dPRO, Figure 2, fourth column). The names of 35 narrower unique dPROs suggested they could be grouped into the four dimensions of OHRQoL (Figure 2, third column). *Oral Function* seemed to be represented by 11, *Orofacial Pain* also seemed to be represented by seven, *Orofacial Appearance* seemed to be represented by three, and

Psychosocial Impact seemed to be represented by 14 unique dPROs. These four dimensions are the major components of selfperceived oral health in general which itself is a (broad) dPRO. Eight dPROs targeted this broad dPRO.

Thirty-six unique dPROs represented 11 (31%) positive and 25 (69%) negative concepts, meaning “more” of a specific positive or negative dPRO was considered a good or bad impact on patients’ oral health experience, respectively (Table 2).

Only for eight questionnaires a specific recall period was defined, which varied from one week to one year. One month was mentioned frequently.

These questionnaires were developed most often in subjects from the general population and usually adults from a broad age range were included. Dental patients were used less often and, typically, their age was not specified.

Dimensionality was only investigated in 13 out of 20 questionnaires with some analysis results not matching initial hypotheses about PRO’s dimensionality.

Three to 49 items characterized a single dPRO (Table 3). The median item number per dPRO was seven. Impact quality was measured most often in terms of its intensity (N=17). Frequency of impacts was identified in 10 dPROs and presence/absence of impacts in 6 dPROs. Measuring impacts in terms of their duration was rarely done (N=2). In six questionnaires, authors combined two or more impact qualities response concepts.

In general, the number and nature of response options varied a lot. All identified dPROs had different response options. Typically, authors preferred to use an adjectival scale as the type of judgement, i.e., they measured impact with an ordinal scale with descriptors for each response option. Often five categories were used, but the number of response options among dPROs ranged from two to 28. Even when impact quality and type of judgement were the same within a particular dPRO, the applied five response options were not always identical.

The direction of impact also varied. Most items’ minimum anchors represented no impact, but for eight questionnaires, the minimum anchors represented an impact. The minimum and maximum anchors also varied substantially across dPROs. Two questionnaires contained both directions of impact, i.e., for some questions, the response with a higher score represented more impact, and for other questions, the higher score represented less impact.

As the source of questionnaire items, the literature (N=12), patients (N=11) and experts (N=10) were almost equally involved.

To characterize the construct with an overall score combining items, most authors used a simple summary of item responses. Only four questionnaires had weighted scores.

Discussion

This systematic review identified 20 English-language, multiple-item questionnaires that are applicable to a broad range of adult dental patients. These questionnaires capture 36

different dPROs measured by 53 dPROMs. Thirty-six dPROs represented all major areas of dental patients' concerns. Fifty-three dPROMs represented the complete set of available measurement tools to assess these concerns. Typically, an individual dPROM contained seven items and the impact intensity was used to capture the patient's suffering with the five-point adjectival response format. For the majority of dPROMs, all item responses were typically summed to derive a score, i.e., to characterize the impact. Researchers often did not pay enough attention to dimensionality of their dPROMs and often did not specify the recall period. When the recall period was provided, longer periods such as three months to one year were not infrequently selected.

PROs and PROMs for adult dental patients

The individual patient is the center of attention for every oral health care professional. Assuming researchers were interested in creating tools for measuring dental patients' concerns, the collection of 36 dPROs represents the entire universe of major concerns dental patients can have. The quantity of 36 dPROs is substantial, but these dPROs also overlap substantially. Actually, these dPROs – when their names were analyzed – just captured four basic aspects of patients' oral health experience, i.e., *Oral Function*, *Orofacial Pain*, *Orofacial Appearance/Aesthetics*, and *Psychosocial Impact*. These aspects have been identified in a large number of international dental patients and general population subjects with exploratory analyses.¹⁰ They were confirmed¹¹ and validated²⁹ as common factors underlying OHRQoL measured with OHIP-49.⁴ It also demonstrated these four factors underlie other widely used OHRQoL instruments as well.³⁰ Because of their significance and universality, these four overarching themes of patient-reported oral health were previously named the “*dimensions of OHRQoL*”.³¹

Comparison of methodological approaches for PROM development between instruments for adult dental patients and patients in general

dPROMs are a subgroup of PROMs in general. Although the content of dPROMs is different compared to more general PROMs because specific PROs pertaining to oral health (dPROs) were targeted, general assessment format and methodologies for development of every PROM should be similar and consistent across all medical (including dental) disciplines. For existing differences, “alignment of oral health-related with health-related quality of life assessment”³² was recommended to make dPROMs comparable to ones developed for patients in general. To evaluate the extent to which dPROMs are similar to PROMs for patients in general, we compared their measurement characteristics with those from PROMIS (Patient-Reported Outcomes Measurement Information System), which is “a set of patient-reported measures for physical, mental, and social health in adults and children.”³³ PROMIS was created in 2004 to develop standardized measures to capture essential patient-reported health outcomes, such as pain, fatigue, physical functioning, and other dimensions of general health.

State-of-the-art approaches in PROM development require first to define what is to be measured. A similar emphasis is placed on dimensionality, i.e., a psychometric property that

refers to the number and nature of underlying attributes reflected in the questionnaire's items.³⁴

With regard to the definition of identified dPROs, the questionnaire authors approached the definition of targeted constructs mostly intuitively without providing formal definition of dPROs in their original publications. In most cases, this approach seemed to be sufficient because for many dPROs, the definition could be easily extracted from the dPRO's name. For example, a questionnaire targeting orofacial pain impact does not need an elaborate construct definition because a general pain definition exists³⁵ and "orofacial" is just the descriptor of location where this pain occurs.

As stated before, dimensionality is fundamental to PROM development³⁶ and this systematic review identified limitations for many dPROMs. In several cases, computation of summary score was not supported by dimensionality analysis. Consequently, it is not known how well dPROMs characterize dPROs, i.e., their validity is questionable.

For every PROM, patients should be the main source of items because they intend to capture patients' concerns. While contemporary approaches for PROM development such as PROMIS recommend involvement of patients in focus groups, cognitive interviews, and similar techniques,³³ only about half of identified questionnaires used patients to derive the items. Instead, authors often selected items from the literature or utilized experts' opinions. Although using experts and literature is methodologically inferior to direct involvement of patients, it can be assumed that an expert opinion reflects indirectly what matters to patients. However, a combination of patients and experts is certainly the best approach.

The median number of items per dPROM was seven. This is similar to PROMIS questionnaires, which typically have between four to twelve items.³⁷ Sometimes researchers introduced first a long PROM and shortened versions were developed later to decrease respondent burden. For the most widely used dPROM, the OHIP, a similar development was observed. The original OHIP 49-item version⁴ was later accompanied by shorter OHIP versions, such as the 14-item³⁸ or the 5-item version³⁹. Only one other questionnaire identified in this review, the JFLS,²² also had a short-form.²²

dPROMs typically captured intensity or frequency quality of oral health impact with a five-step adjectival scale. This is in line with PROMIS instruments.

The term "patient-reported outcome measure" implies that individuals diagnosed with a disease are the major target for PROMs. Typically, these patients receive treatment and the health condition improves. Therefore, to capture rapidly changing health, PROMs need to have a short recall or reference period. PROMIS measures typically have a 7-day recall period. Only one questionnaire in our review had a one-week recall period. For OHIP, such a short recall period was developed later⁴⁰ to make this instrument more suitable for clinical research. Twelve out of 20 questionnaires in our review did not have a defined recall period. Therefore, most of these instruments would be challenged to measure rapidly changing oral health due to dental interventions.

Comparison with the literature

A systematic review of dPROs and dPROMs for adult patients has not been performed yet, but similar reviews are already available for medical patients, e.g., for venous ulceration,⁴¹ cancer cachexia,⁴² and inflammatory bowel disease.⁴³ Health-related quality of life (HRQoL) questionnaires, a widely used type of PROM, were reviewed most often for the three above-mentioned and other diseases. This is in line with our review for dental patients. Nearly half of our identified questionnaires intend to measure the dPRO OHRQoL. In contrast to our review, previously mentioned reviews mainly focused on the assessment of identified PROMs' psychometric properties such as reliability and validity. Our review characterized in detail dPROs, dPROMs, and the questionnaire items. Nevertheless, score reliability as well as validity were used as inclusion criteria for our systematic review. Only questionnaires with these two basic psychometric properties were considered.

Other systematic reviews for dPROMs exist, but they focused on specific diseases, e.g., head and neck cancer⁴⁴ or burning mouth syndrome.⁴⁵ Several narrative reviews are also available for PROMs for dental patients. Most of these reviews targeted OHRQoL.^{7,8}

Scope, advantages, and limitations of this systematic review

As mentioned above, our review's scope is different compared to previous reviews and we discuss essential PROM features such as type, format/length, and target population in more detail.

The type of PROM: as previously stated, PROMs can be divided into three broad categories, measuring (i) status of patient's health condition, (ii) health behaviors, and (iii) experience with health care. We considered the characterization of patient's self-assessed *oral* health condition the most important category in dental medicine and, therefore, we only targeted this type of PROMs. Because the vast majority of scientific journals are published in English, we assumed the majority of dPROMs would also be published in this language. We may have missed non-English instruments but believe, if such instruments would have gained wider acceptance, findings from instrument application studies would have been subsequently published in journals included in our electronic search and therefore we should have identified most of them.

PROM's format and length: we targeted only multi-item PROMs. They can be differentiated from single-item PROMs, e.g., a global overall assessment of person's oral or general health status or a single global oral health rating.⁴⁶ We did not include single-item PROMs in this systematic review because, while they have advantages in terms of reduced patient burden, they are typically considered inferior compared to multi-item PROMs, in particular when broader constructs are measured.⁴⁷ We considered oral health as such a broader construct.

PROM's target populations: our focus was the measurement of patients' self-perceived oral health condition. For assessment of specific psychosocial impact of oral conditions, e.g., oral conditions affecting sleep quality or depression/sadness, disease-specific PROMs exist, e.g., a PROMIS measure for sleep quality and a PROMIS measure for depression.³⁷ We were only interested in capturing direct stomatognathic system-specific oral health experiences

that are applicable to a broad range of adult dental patients, i.e., oral health-generic instruments. dPROs that were developed to assess a particular oral disease/condition impact, such as hypersensitive teeth,⁴⁸ or certain treatments, such as implant-supported dentures,⁴⁹ were not included in our review.

Adults and children are two populations for PROM application. We focused on adults only because of the greater size of this population.

Finally, we would like to emphasize that some dPROs received further methodological studies in other populations or investigations of their dimensionality and recall periods. We did not track resulting dPRO modifications nor included them in this systematic review. While several modifications were suggested, e.g., the use of a more practical 5-point response format for the Orofacial Esthetics Scale,⁵⁰ such modification, except for the use of unweighted (simple) summary scores, were rarely adopted by the international research community. We also would like to point out that investigations of methodological factors such as item-order effects,⁵¹ instrument order effects,⁵² recall periods,⁴⁰ memory effects,⁵³ response shift,⁵⁴ or countable impacts⁵⁵ that were mainly performed for the OHIP questionnaire contribute to better understanding of dPROs psychometric properties in general.

Conclusion

The 36 dPROs represent all major aspects of dental patients' oral health experience; however, they can be summarized into four simple and clinically intuitive dPRO groups - *Oral Function*, *Orofacial Pain*, *Orofacial Appearance*, and *Psychosocial Impact*.

The 53 dPROs measuring the 36 dPROs represent currently available multiple items tools for measurement of self-assessed dental patients' suffering with oral health-generic instruments. While some dPROs have received recommendations for modifications and application of these dPROs in specific settings has contributed to a better understanding of scores' psychometric properties, common limitations of many of these dPROs continue to be their unknown dimensionality and missing recall period. Unknown dimensionality challenges validity of dPROs and missing recall period challenges clinical utility of dPROs, in particular, the assessment of dental interventions' treatment effects.

Acknowledgements

We thank Ms. Kathleen M. Patka, Executive Office and Administrative Specialist and Ms. Shelby LaFreniere, Principal Office and Administrative Specialist, Division of Oral Medicine, School of Dentistry, University of Minnesota, Minneapolis, MN, USA, for proofreading the manuscript.

Research reported in this publication was supported by the National Institute of Dental and Craniofacial Research, United States, under Award Number R01DE022331.

List of Abbreviations:

PRO	Patient-Reported Outcome
dPRO	Dental Patient-Reported Outcome

PROM	Patient-Reported Outcome Measure
dPROM	Dental Patient-Reported Outcome Measure
OHRQoL	Oral Health-Related Quality of Life
PROMIS	Patient-Reported Outcomes Measurement Information System

References

1. Gwaltney CJ. Patient-reported outcomes (PROs) in dental clinical trials and product development: introduction to scientific and regulatory considerations. *J Evid Based Dent Pract.* 2010;10(2):86–90. [PubMed: 20466315]
2. U.S. Department of Health and Human Services FDA Center for Drug Evaluation and Research; U.S. Department of Health and Human Services FDA Center for Biologics Evaluation and Research; U.S. Department of Health and Human Services FDA Center for Devices and Radiological Health. Guidance for industry: patient-reported outcome measures: use in medical product development to support labeling claims: draft guidance. *Health Qual Life Outcomes.* 2006;4:79. [PubMed: 17034633]
3. John MT. Health outcomes reported by dental patients. *J Evid Based Dent Pract;* 2018, 10.1016/j.jebdp.2018.09.001.
4. Slade GD, Spencer AJ. Development and evaluation of the Oral Health Impact Profile. *Community Dent Health.* 1994;11(1):3–11. [PubMed: 8193981]
5. Atchison KA, Dolan TA. Development of the Geriatric Oral Health Assessment Index. *J Dent Educ.* 1990;54(11):680–687. [PubMed: 2229624]
6. Jokovic A, Locker D, Stephens M, Kenny D, Tompson B, Guyatt G. Validity and reliability of a questionnaire for measuring child oral-health-related quality of life. *J Dent Res.* 2002;81(7):459–463. [PubMed: 12161456]
7. Bennadi D, Reddy CVK. Oral health related quality of life. *ISPCD.* 2013;3(1):1–6.
8. Allen PF. Assessment of oral health related quality of life. *Health Qual Life Outcomes.* 2003;1(1):40. [PubMed: 14514355]
9. Locker D, Miller Y. Evaluation of subjective oral health status indicators. *J Public Health Dent.* 1994;54(3):167–176. [PubMed: 7932353]
10. John MT, Reissmann DR, Feuerstahler L, et al. Exploratory factor analysis of the Oral Health Impact Profile. *J Oral Rehabil.* 2014;41(9):635–643. [PubMed: 24909881]
11. John MT, Feuerstahler L, Waller N, et al. Confirmatory factor analysis of the Oral Health Impact Profile. *J Oral Rehabil.* 2014;41(9):644–652. [PubMed: 24909797]
12. Gooch BF, Dolan TA, Bourque LB. Correlates of self-reported dental health status upon enrollment in the Rand Health Insurance Experiment. *J Dent Educ* 1989;53(11):629–637. [PubMed: 2808877]
13. Dworkin SF, LeResche L. Research diagnostic criteria for temporomandibular disorders: review, criteria, examinations and specifications, critique. *J Craniomandib Disord.* 1992;6(4):301–355. [PubMed: 1298767]
14. Strauss RP, Hunt RJ. Understanding the value of teeth to older adults: influences on the quality of life. *J Am Dent Assoc.* 1993;124(1):105–110.
15. Stegenga B, de Bont LG, de Leeuw R, Boering G. Assessment of mandibular function impairment associated with temporomandibular joint osteoarthritis and internal derangement. *J Orofac Pain.* 1993;7(2):183–195. [PubMed: 8358365]
16. Leao A, Sheiham A. The development of a socio-dental measure of dental impacts on daily living. *Community Dent Health.* 1996;13(1):22–26. [PubMed: 8634892]
17. Cornell JE, Saunders MJ, Paunovich ED, Frisch MB. Oral health quality of life inventory (OH-QoL) In: Slade GD, ed. *Measuring Oral Health and Quality of Life.* Chapel Hill, NC: University of North Carolina; 1997:136–149.
18. Adulyanon S, Sheiham A. Oral impacts on daily performances In: Slade GD, ed. *Measuring Oral Health and Quality of Life.* Chapel Hill, NC: University of North Carolina; 1997:151–160.

19. McGrath C, Bedi R. An evaluation of a new measure of oral health related quality of life--OHQoL-UK(W). *Community Dent Health*. 2001;18(3):138–143. [PubMed: 11580088]
20. Aggarwal VR, Lunt M, Zakrzewska JM, Macfarlane GJ, Macfarlane TV. Development and validation of the Manchester orofacial pain disability scale. *Community Dent Oral Epidemiol*. 2005;33(2):141–149. [PubMed: 15725177]
21. Klages U, Claus N, Wehrbein H, Zentner A. Development of a questionnaire for assessment of the psychosocial impact of dental aesthetics in young adults. *Eur J Orthod*. 2006;28(2):103–111. [PubMed: 16257989]
22. Ohrbach R, Larsson P, List T. The jaw functional limitation scale: development, reliability, and validity of 8-item and 20-item versions. *J Orofac Pain*. 2008;22(3):219–230. [PubMed: 18780535]
23. Baba K, John MT, Inukai M, Aridome K, Igarashi Y. Validating an alternate version of the chewing function questionnaire in partially dentate patients. *BMC Oral Health*. 2009;9(1):9. [PubMed: 19291293]
24. Nixdorf DR, John MT, Wall MM, Friction JR, Schiffman EL. Psychometric properties of the modified Symptom Severity Index (SSI). *J Oral Rehabil*. 2010;37(1):11–20. [PubMed: 19889036]
25. Larsson P, John MT, Nilner K, Bondemark L, List T. Development of an Orofacial Esthetic Scale in prosthodontic patients. *Int J Prosthodont*. 2010;23(3):249–256. [PubMed: 20552092]
26. Lee JY, Chen HI, Urban C, et al. Development of and psychometric testing for the Brief Pain Inventory-Facial in patients with facial pain syndromes. *J Neurosurg*. 2010;113(3):516–523. [PubMed: 20151778]
27. Peršić S, Palac A, Bunjevac T, Celebić A. Development of a new chewing function questionnaire for assessment of a self-perceived chewing function. *Community Dent Oral Epidemiol*. 2013;41(6):565–573. [PubMed: 23551089]
28. La Touche R, Pardo-Montero J, Gil-Martínez A, et al. Craniofacial pain and disability inventory (CF-PDI): development and psychometric validation of a new questionnaire. *Pain Physician*. 2014;17(1):95–108. [PubMed: 24452650]
29. John MT, Renner-Sitar K, Baba K, et al. Patterns of impaired oral health-related quality of life dimensions. *J Oral Rehabil*. 2016;43(7):519–527. [PubMed: 27027734]
30. John MT, Reissmann DR, Čelebić A, et al. Integration of oral health-related quality of life instruments. *J Dent*. 2016;53:38–43. [PubMed: 27353210]
31. John MT, Hujoel P, Miglioretti DL, LeResche L, Koepsell TD, Micheelis W. Dimensions of oral-health-related quality of life. *J Dent Res*. 2004;83(12):956–960. [PubMed: 15557405]
32. Reissmann DR. Alignment of oral health-related with health-related quality of life assessment. *J Prosthodont Res*. 2016;60(2):69–71. [PubMed: 26874925]
33. Wikipedia contributors. Patient-Reported Outcomes Measurement Information System. Wikipedia, The Free Encyclopedia. https://en.wikipedia.org/wiki/Patient-Reported_Outcomes_Measurement_Information_System/; 2017 Accessed 17 September 2017.
34. Mokkink LB, Terwee CB, Patrick DL, et al. The COSMIN study reached international consensus on taxonomy, terminology, and definitions of measurement properties for health-related patient-reported outcomes. *J Clin Epidemiol*. 2010;63(7):737–745. [PubMed: 20494804]
35. Pain terms: a list of definitions and notes on usage. Recommended by the IASP Subcommittee on Taxonomy. *Pain*. 1979;6(3):249–252. [PubMed: 460932]
36. Reeve BB, Hays RD, Bjorner JB, et al. Psychometric evaluation and calibration of health-related quality of life item banks: plans for the Patient-Reported Outcomes Measurement Information System (PROMIS). *Med Care*. 2007;45(5):S22–S31. [PubMed: 17443115]
37. Northwestern University. List of adult measures: available PROMIS measures for adults. <http://www.healthmeasures.net/explore-measurement-systems/promis/intro-to-promis/list-of-adult-measures/>; Accessed 27 November 2017.
38. Slade GD. Derivation and validation of a short-form oral health impact profile. *Community Dent Oral Epidemiol*. 1997;25(4):284–290. [PubMed: 9332805]
39. Naik A, John MT, Kohli N, Self K, Flynn P. Validation of the English-language version of 5-item Oral Health Impact Profile. *J Prosthodont Res*. 2016;60(2):85–91. [PubMed: 26795728]
40. Waller N, John MT, Feuerstahler L, et al. A 7-day recall period for a clinical application of the oral health impact profile questionnaire. *Clin Oral Investig*. 2016;20(1):91–99.

41. Palfreyman SJ, Tod AM, Brazier JE, Michaels JA. A systematic review of health-related quality of life instruments used for people with venous ulcers: An assessment of their suitability and psychometric properties. *J Clin Nurs*. 2010;19(19–20):2673–2703. [PubMed: 20846219]
42. Wheelwright S, Darlington AS, Hopkinson JB, Fitzsimmons D, White A, Johnson CD. A systematic review of health-related quality of life instruments in patients with cancer cachexia. *Support Care Cancer*. 2013;21(9):2625–2636. [PubMed: 23797577]
43. Drossman DA, Patrick DL, Mitchell CM, Zagami EA, Appelbaum MI. Health-related quality of life in inflammatory bowel disease. Functional status and patient worries and concerns. *Dig Dis Sci*. 1989;34(9):1379–1386. [PubMed: 2766905]
44. Ojo B, Genden EM, Teng MS, Milbury K, Misiukiewicz KJ, Badr H. A systematic review of head and neck cancer quality of life assessment instruments. *Oral Oncol*. 2012;48(10):923–937. [PubMed: 22525604]
45. Ni Riordain R, McCreary C. Patient-reported outcome measures in burning mouth syndrome - a review of the literature. *Oral Dis*. 2013;19(3):230–235. [PubMed: 22748023]
46. Thomson WM, Mejia GC, Broadbent JM, Poulton R. Construct Validity of Locker's Global Oral Health Item. *J Dent Res*. 2012;91(11):1038–1042. [PubMed: 22983410]
47. Sloan JA, Aaronson N, Cappelleri JC, Fairclough DL, Varricchio C. Assessing the Clinical Significance of Single Items Relative to Summated Scores. *Mayo Clin Proc*. 2002;77(5):479–487. [PubMed: 12004998]
48. Boiko OV, Baker SR, Gibson BJ, Locker D, Sufi F, Barlow AP, Robinson PG. Construction and validation of the quality of life measure for dentine hypersensitivity (DHEQ). *J Clin Periodontol*. 2010;37(11):973–980. [PubMed: 20860720]
49. Preciado A, Del Río J, Lynch CD, Castillo-Oyagüe R. A new, short, specific questionnaire (QoLIP-10) for evaluating the oral health-related quality of life of implant-retained overdenture and hybrid prosthesis wearers. *J Dent*. 2013;41(9):753–763. [PubMed: 23831418]
50. Persic S, Milardovic S, Mehulic K, Celebic A. Psychometric properties of the Croatian version of the Orofacial Esthetic Scale and suggestions for modification. *Int J Prosthodont*. 2011;24(6):523–533. [PubMed: 22146251]
51. Kieffer JM, Hoogstraten J. Item-order effects in the Oral Health Impact Profile (OHIP). *Eur J Oral Sci*. 2008;116(3):245–249. [PubMed: 18471243]
52. Kieffer JM, Verrips GH, Hoogstraten J. Instrument-order effects: using the Oral Health Impact Profile 49 and the Short Form 12. *Eur J Oral Sci*. 2011;119(1):69–72. [PubMed: 21244514]
53. John MT, Reissmann DR, Schierz O, Allen F. No significant retest effects in oral health-related quality of life assessment using the Oral Health Impact Profile. *Acta Odontol Scand*. 2008;66(3):135–138. [PubMed: 18568471]
54. Reissmann DR, Erler A, Hirsch C, Sierwald I, Machuca C, Schierz O. Bias in retrospective assessment of perceived dental treatment effects when using the Oral Health Impact Profile. *Qual Life Res*. 2018;27(3):775–782. [PubMed: 29063350]
55. Reissmann DR, Sierwald I, Heydecke G, John MT. Interpreting one oral health impact profile point. *Health Qual Life Outcomes*. 2013;11.

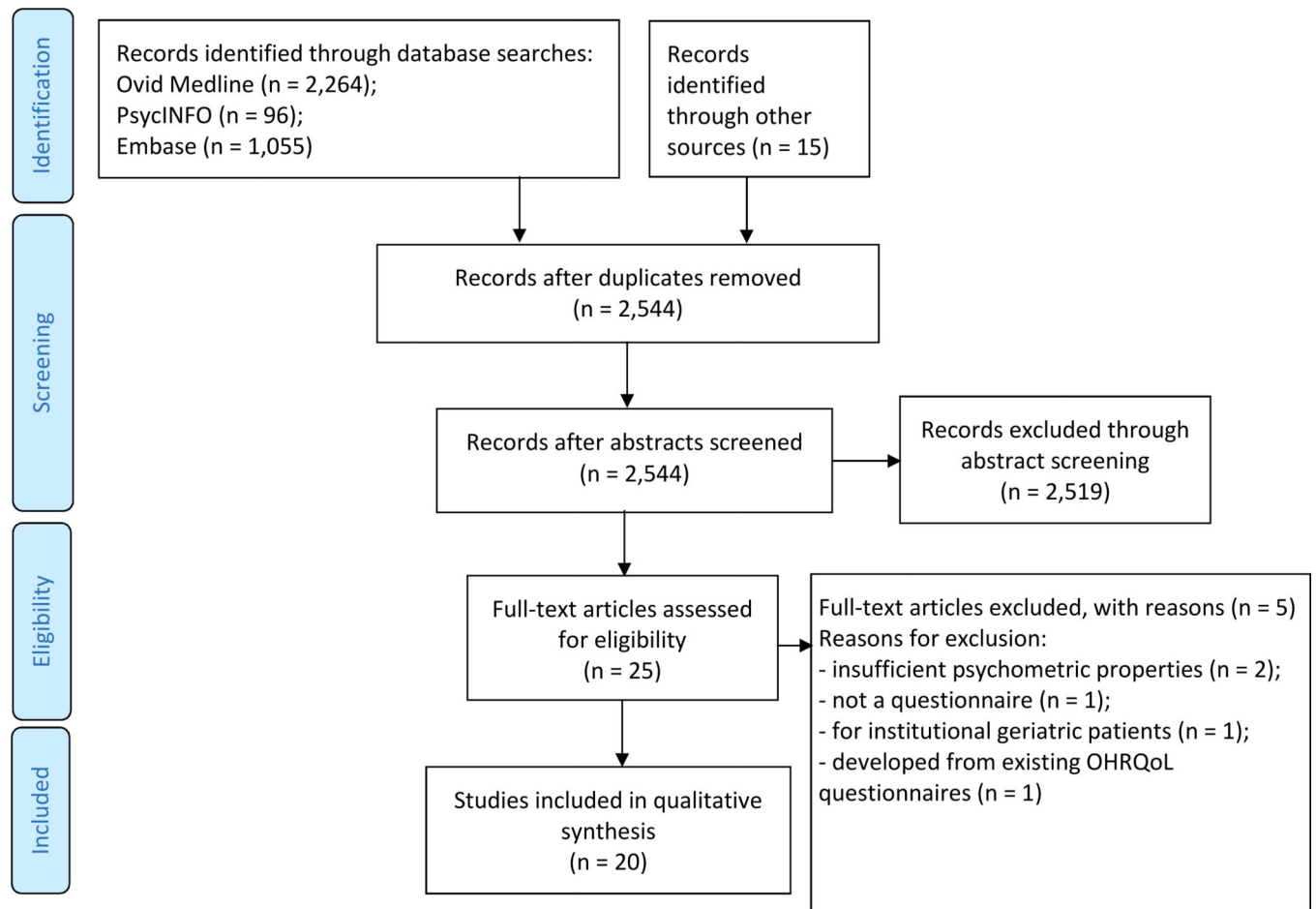


Figure 1.
PRISMA flowchart of included studies

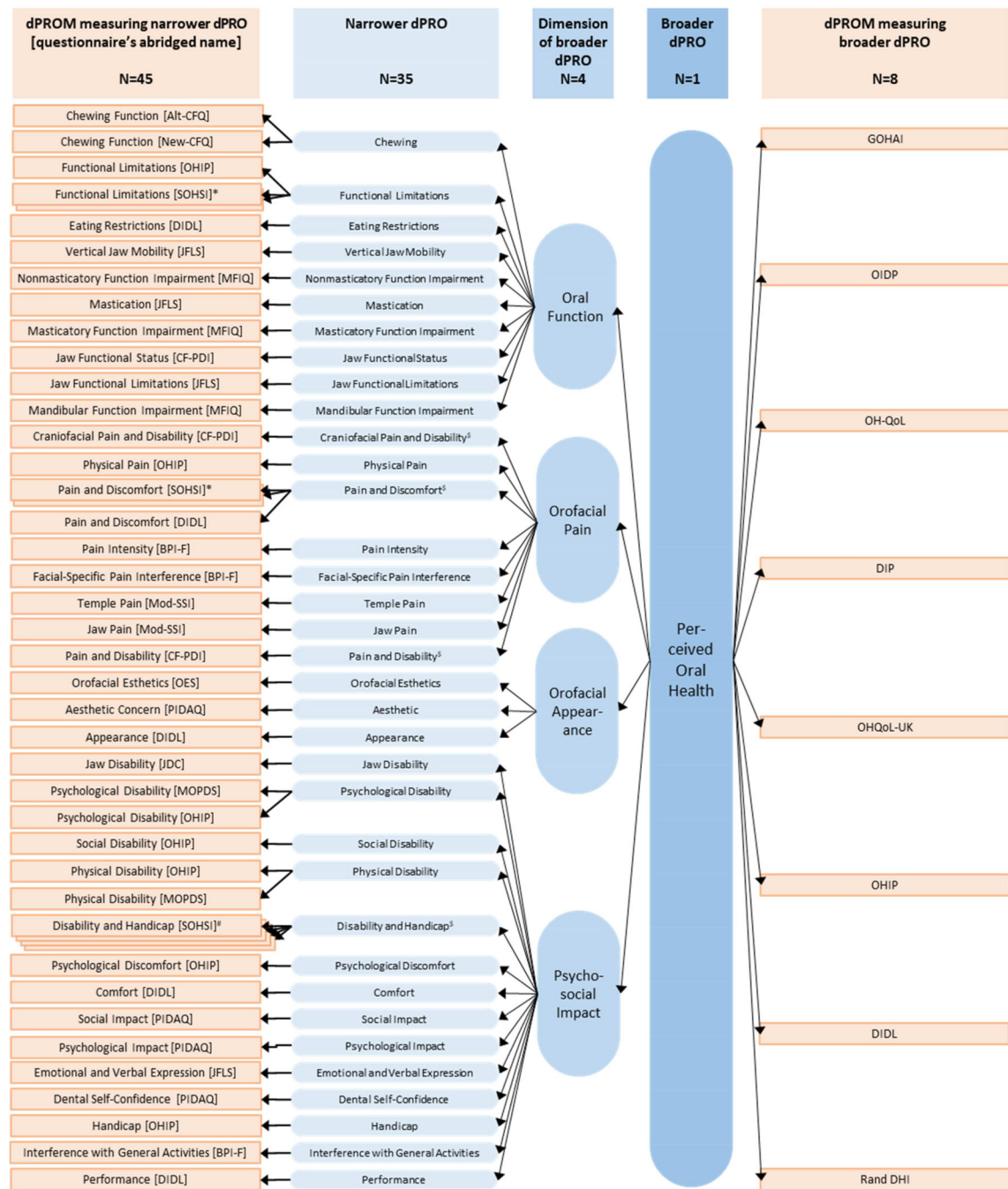


Figure 2. Linking dPROMs to their dPROs. dPROMs are represented as rectangles (orange). dPROs are represented as rounded rectangles.

* authors developed two dPROMs for the same dPRO; # authors developed four dPROMs for the same dPRO; \$ first of the two attributes was used for linking with broader dPRO

Table 1.

General information of patient-reported oral health questionnaires

No.	Questionnaire	Abridged name	Authors	Publication year	Journal or book	First author's country
1	Rand Dental Health Index ¹²	Rand DHI	Gooch, Dolan, Bourque	1989	Journal of Dental Education	USA
2	Geriatric Oral Health Assessment Index ⁵	GOHAI	Atchison, Dolan	1990	Journal of Dental Education	USA
3	Jaw Disability Checklist ¹³	JDC	Dworkin, LeResche	1992	Journal of Craniomandibular Disorders: Facial & Oral Pain	USA
4	Dental Impact Profile ¹⁴	DIP	Strauss, Hunt	1993	Journal of the American Dental Association	USA
5	Mandibular Function Impairment Questionnaire ¹⁵	MFIQ	Stegenga, de Bont, de Leeuw, Boering	1993	Journal of Orofacial Pain	The Netherlands
6	Oral Health Impact Profile ⁴	OHIP	Slade, Spencer	1994	Community Dental Health	Australia
7	Subjective Oral Health Status Indicators ⁹	SOHSI	Locker, Miller	1994	Journal of Public Health Dentistry	Canada
8	Dental Impacts on Daily Living ¹⁶	DIDL	Leao, Sheiham	1996	Community Dental Health	United Kingdom
9	Oral Health Quality of Life Inventory ¹⁷	OH-QoL	Cornell, Saunders, Paunovich, Frisch	1997	Measuring Oral Health and Quality of Life, p. 136–149	USA
10	Oral Impacts on Daily Performance ¹⁸	OIDP	Adulyanon, Sheiham	1997	Measuring Oral Health and Quality of Life, p. 151–160	Thailand
11	Oral Health Related Quality of Life-UK ¹⁹	OHQoL-UK	McGrath, Bedi	2001	Community Dental Health	United Kingdom
12	Manchester Orofacial Pain Disability Scale ²⁰	MOPDS	Aggarwal, Lunt, Zakrzewska, Macfarlane GJ, Macfarlane TV	2005	Community Dentistry and Oral Epidemiology	United Kingdom
13	Psychological Impact of Dental Aesthetics Questionnaire ²¹	PIDAQ	Klages, Claus, Wehrbein, Zentner	2006	European Journal of Orthodontics	Germany
14	Jaw Functional Limitation Scale ²²	JFLS	Ohrbach, Larsson, List	2008	Journal of Orofacial Pain	USA
15	Chewing Function Questionnaire - Alternative Version ²³	Alt-CFQ	Baba, John, Inukai, Aridome, Igarashi	2009	BMC Oral Health	Japan
16	Modified Symptom Severity Index ²⁴	Mod-SSI	Nixdorf, John, Wall, Friction, Schiffman	2010	Journal of Oral Rehabilitation	USA
17	Orofacial Esthetic Scale ²⁵	OES	Larsson, John, Nilner, Bondemark, List	2010	The International Journal of Prosthodontics	Sweden
18	Brief Pain Inventory-Facial ²⁶	BPI- F	Lee, Chen, Urban, Hojat, Church, Xie, Farrar	2010	Journal of Neurosurgery	USA
19	New Chewing Function Questionnaire ²⁷	New-CFQ	Persic, Palac, Bunjevac, Celebic	2013	Community Dentistry and Oral Epidemiology	Croatia
20	Craniofacial Pain and Disability Inventory ²⁸	CF-PDI	La Touche, Pardo-Montero, Gil-Martinez, Paris-Aleman, Angulo-Diaz-Parreno, Suarez-Falcon, Lara-Lara, Fernandez-Carnero	2014	Pain Physician	Spain

Table 2.

dPRO characterization

No	Questionnaire Name	Construct		Dimension		No. of items		Recall Period	GP / DP	Dimensionality Analyses	
		Name	Definition	Score	Name	Definition	Score				
1	<i>Rand Dental Health Index</i>	PsychosocialImpact of Oral Conditions ^N	The amount of pain, worry, and concern with social interaction (i.e., avoidance of conversation) attributed to problems with teeth or gumsYes	Yes	n/a	n/a	3	3 months	Denatated GP: 16–61 yrs	No	No
2	<i>Geriatric Oral Health Assessment Index</i>	Oral Health Status ^P	Assessment index for oral health in older adult populations	Yes	n/a	n/a	n/a	3 months	GP: 65+ yrs	Yes	Yes
3	<i>Jaw Disability Checklist</i>	Jaw Disability ^N	Limitations related to mandibular functioning	Yes	n/a	n/a	n/a	-	DP: TMD patients	No	No
4	<i>Dental Impact Profile</i>	Quality of Life ^P	Positive and negative influences on the lives of older adults	Yes	n/a	n/a	25	-	GP: 65+ yrs	No	No
5	<i>Mandibular Function Impairment Questionnaire</i>	Mandibular Function Ipairment ^N	Patient’s appreciation of mandibular function impairment	Yes	Masticatory Function Impairment ^N	Perception of masticatory ability	Yes	-	DP: TMD patients	Yes	Yes
6	<i>Oral Health Impact Profile</i>	Social Impact of Oral Disorders ^N	Social impact and oral disorder assessments	Yes	Functional Limitations ^N	Loss of function of body parts or systems	Yes	-	GP: 60+ yrs	No	No
				Physical Pain ^N	-	-	Yes	9			
				Psychological Discomfort ^N	-	-	Yes	5			
				Physical Disability ^N	Any limitation in or lack of ability to perform activities of daily living	Any limitation in or lack of ability to perform activities of daily living	Yes	9			
				Psychological Disability ^N	Any limitation in or lack of ability to perform activities of daily living	Any limitation in or lack of ability to perform activities of daily living	Yes	6			
				Social Disability ^N	Any limitation in or lack of ability to perform activities of daily living	Any limitation in or lack of ability to perform activities of daily living	Yes	5			

No	Questionnaire Name	Name	Construct		Dimension		No. of items	Recall Period	GP / DP	Dimensionality Analyses
			Definition	Score	Name	Definition				
7	Subjective Oral Health Status Indicators	-	-	-	Handicap ^N	Experience of disadvantage	Yes	6	GP: 18+ yrs	No
					Functional Limitations ^N	Limitations in the functions performed by body parts or systems	Yes ^{II}	6, 3		
					Pain and Discomfort ^N	Experiential aspect of oral conditions in the form of symptoms	Yes ^{II}	9, 10		
					Disability and Handicap ^N	Disability: any difficulty performing activities, Handicap: broader social disadvantage and deprivation occurring as a result of impairment, functional limitation, pain and discomfort, or disability	Yes ^{IV}	3, 4, 6, 2		
8	Dental Impacts on Daily Living	Quality of Life ^P	Measures of the impacts of oral health status on the quality of daily living	Yes	Comfort ^P	Related to complaints such as bleeding gums and food packing	Yes	7	GP and DP: 35–44 yrs	Yes
					Appearance ^P	Self-image	Yes	4		
					Pain and Discomfort ^N	Physical suffering of discomfort	Yes	4		
					Performance ^P	Ability to carry out daily function and interact with people	Yes	15		
9	Oral Health Quality of Life	Oral Health Quality of Life ^P	Evaluates a person's subjective wellbeing with respect to her/his oral health and functional status	Yes	n/a	Difficulties chewing or biting	Yes	6	DP: 18+ yrs	No
					Eating Restrictions ^N	n/a	n/a	15		
10	Oral Impacts on Daily Performance	Impacts on Daily Performances ^N	Serious oral impacts on the person's ability to perform daily activities	Yes	n/a	n/a	n/a	8	GP: 35–44 yrs	No
11	Oral Health Related Quality of Life-UK	Impact of Oral Health on Quality of Life ^N	Individuals rating of the impact or oral health effects on quality of life	Yes	n/a	n/a	n/a	16	GP: 18+ yrs	Yes
12	Manchester Orofacial Pain Disability Scale	-	-	-	Physical Disability ^N	-	Yes	7	GP: 18–65 yrs, DP: not specified	Yes

No	Questionnaire Name	Name	Construct		Dimension		No. of items	Recall Period	GP / DP	Dimensionality Analyses
			Definition	Score	Name	Definition				
13	<i>Psychological Impact of Dental Aesthetics Questionnaire</i>	-	-	-	Psychosocial Disability ^N	-	Yes	19	GP: 18–30 yrs	Yes
					Dental Self confidence ^P	Impact of dental aesthetics on the Yes	Yes	6		
					Social Impact ^N	Potential problems in social situations due to subjective perception of an unfavorable own dental appearance	Yes	8		
					Psychological Impact ^N	Feeling of inferiority and unhappiness when the affected individual compares him/herself with persons with superior dental aesthetics	Yes	6		
14	<i>Jaw Functional Limitation Scale</i>	Overall Jaw Functional Limitation ^N	Alterations in jaw functions that individuals with orofacial disorders report as significant	Yes	Aesthetic Concern ^N	Disapproval of one’s own dental Yes appearance when confronted with mirror, photographic and/or video images	Yes	3	DP: 18+ yrs	Yes
					Mastication ^P	-	Yes	6		
					Vertical Jaw Mobility ^P	-	Yes	4		
					Emotional and Verbal Expression ^P	-	Yes	10		
15	<i>Chewing Function Questionnaire-Alternative Version</i>	Chewing Function ^P	Ability to chew	Yes	n/a	n/a	n/a	20	DP: partially dentate patients	Yes
16	<i>Modified Symptom Severity Index</i>	-	-	-	Temple Pain ^N	-	Yes	5	DP: TMD patients	Yes
17	<i>Orofacial Esthetic Scale</i>	Orofacial Esthetics ^P	Direct impacts of impaired orofacial esthetics	Yes	Jaw Pain ^N	-	Yes	10	DP: not specified	Yes
					n/a	n/a	n/a	8		
18	<i>Brief Pain Inventory-Facial</i>	-	-	-	Pain Intensity ^N	-	Yes	4	DP with trigeminal neuralgia or facial pain	Yes
					Interference With General Activities ^N	-	Yes	7		
					Facial-Specific Pain Interference ^N	-	Yes	7		

No	Questionnaire Name	Construct		Dimension		No. of items		Recall Period	GP / DP	Dimensionality Analyses
		Name	Definition	Score	Name	Definition	Score			
19	<i>New Chewing Function Questionnaire</i>	Chewing Function ^P	Patients' self-assessment of their chewing function	Yes	n/a	n/a	n/a	-	DP with natural teeth	Yes
20	<i>Craniofacial Pain and Disability Inventory</i>	Craniofacial Pain and Disability ^N	Pain, disability, and functional status of the mandibular and craniofacial regions	Yes	Pain and Disability ^N	-	Yes	-	DP: chronic craniofacial pain patients	Yes

DP dental patients; GP general population and other non-patient populations;^{II} and ^{IV} number of dPROMs for the target dPRO; - not provided by authors; n/a not applicable; ^P and ^N positive and negative concept

Table 3.

dPROM item characterization

Questionnaire	No. of items	Impact concept	Type of judgement	Min. Anchor	Max. Anchor	Response options	Item Source	Sum score calculation
<i>Rand Dental Health Index</i>	3	Intensity	Continuous - adjectival	A lot(1)	None (4)	4	Experts	Not weighted
		Intensity	Continuous - adjectival	A lot (1)	None (4)	4		
		Frequency	Continuous - adjectival	Most (1)	None (4)	4		
<i>Geriatric Oral Health Assessment Index</i>	12	Frequency	Continuous - adjectival	Never (0)	Always (5)	6	Patients, experts, literature	Not weighted
<i>Jaw Disability Checklist</i>	12	Presence	Categorical	No (0)	Yes (1)	2	-	-
<i>Dental Impact Profile</i>	25	Presence	Categorical - adjectival	Good effect (1)	No effect (3)	3	Patients, experts	-
<i>Mandibular Function Impairment Questionnaire</i>	17	Intensity	Continuous - numerical	No difficulty (0)	Very difficult or impossible	5 without help (4)	Patients	Not weighted
<i>Oral Health Impact Profile</i>	49	Frequency	Continuous - adjectival	None (0)	Very often (4)	5	Patients, literature	Weighted
<i>Subjective Oral Health Status Indicators</i>	43	Presence	Categorical	Yes (0)	No (1)	2	Experts, literature	Not weighted
		Presence	Categorical	No (0)	Yes (1)	2		
<i>Dental Impacts on Daily Living</i>	36	Frequency	Continuous - adjectival	All the time (1)	Never (5)	5		
		Intensity	Continuous - Likert	Very unsatisfied (-1)	Very satisfied (+1)	5	Patients, literature	Weighted
		Frequency	Continuous - adjectival	Always (-1)	Never (+1)	5		
		Presence	Categorical	Yes (-1)	No (+1)	2		
		Intensity	Continuous - adjectival	Extremely (-1)	Not at all (+1)	5		
		Intensity	Continuous - Likert	Very badly (-1)	Very well (+1)	5		
<i>Oral Health Quality of Life Inventory</i>	15	Frequency	Continuous - adjectival	Every day (-1)	None (+1)	5		
		Intensity	Continuous - Likert	Disturbs a lot (-1)	Helps a lot (+1)	5		
		Intensity	Continuous - Likert	Not at all important (1)	Very important (3)	3	Experts, literature	Weighted
		Intensity	Continuous - Likert	Unhappy (1)	Happy (4)	4		
		Frequency	Continuous - adjectival	Never (0)	Every or nearly every day(5)	6	Literature	Not weighted
		Duration	Continuous - adjectival	0 days (0)	Over 3 months in total (5)	6		
<i>Oral Health Related Quality of Life-UK</i>	16	Intensity	Continuous - numerical	None (0)	Very severe (5)	6		
		Intensity	Continuous - Likert	A bad effect of extreme impact (1)	A good effect of no impact (9)	9	Patients	Not weighted
		Frequency	Continuous - adjectival	None of the time (0)	On most/ everyday(s) (2)	3	Patients	Not weighted
<i>Manchester Orofacial Pain Disability Scale</i>	26	Intensity	Continuous - adjectival	Not at all (0)	Very strongly (4)	5	Experts, literature	Not weighted
<i>Jaw Functional Limitation Scale</i>	20	Intensity	Numerical	No limitation (0)	Severe limitation (10)	11	Experts, literature	Not weighted

Questionnaire	No. of items	Impact concept	Type of judgement	Min. Anchor	Max. Anchor	Response options	Item Source	Sum score calculation
<i>Chewing Function Questionnaire – Alternative Version</i>	20	Presence	Categorical	Difficult (0)	Easy (1)	2	Literature	Not weighted
<i>Modified Symptom Severity Index</i>	15	Intensity	Continuous - numerical	No difficulty or never (0)	Worst imaginable or constant (1)	28	Patients	Not weighted
<i>Orofacial Esthetic Scale</i>	8	Intensity	Continuous - numerical	Very dissatisfied (0)	Very satisfied (10)	11	Patients	Not weighted
<i>Brief Pain Inventory-Facial</i>	18	Intensity	Continuous - numerical	Does not interfere (0)	Completely interferes (10)	11	Experts, literature	Weighted
		Intensity	Continuous - numerical	No pain (0)	Pain as bad as you can imagine (10)	11		
<i>New Chewing Function Questionnaire</i>	10	Intensity	Continuous - numerical	No problem (0)	Severe problem (4)	5	Patients, experts, Literature	Not weighted
<i>Craniofacial Pain and Disability Inventory</i>	21	Presence	Continuous - numerical	(0)	(3)	4	Patients, experts, Literature	-