Title: Non-surgical periodontal therapy effectively improves patient-reported outcomes: A systematic review.

Running title: patient-reported outcomes and periodontal therapy

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Abstract:

Aim: Modern lifespan oral health research focuses on understanding the impact of periodontitis (or therapy) on clinical and patient-based outcome measures to provide effective care, improve patient safety according to the quality standards. For better targeted intervention and effective disease management this systematically review aimed to investigate the relationship between non-surgical periodontal therapy and patient-based outcomes using OHIP-14.

Methods: Seven Databases were searched for studies on patient-based outcomes responses to periodontal treatment. The time-period defined form search was from January 1977 to January 2019. Two independent reviewers carried out data search, selection of studies, data extraction and quality assessment using Mixed Method Appraisal Tool. Prospective cohort studies, intervention studies and observational studies written in English demonstrating non-surgical periodontal therapy response on the patient reported outcomes (using Oral Health Impact Profile 14) were included in the review.

Results: Thirteen studies were included in the review, which comprised of three randomised control trials, nine case-series, and one was a quasi-experimental study. Eleven out of the 13 studies reported significant improvement in OHIP-14 scores amongst participants who had undergone non-surgical periodontal therapy. Physical disability, psychological discomfort and functional limitation were domains that improved significantly after non-surgical

periodontal therapy in these studies. Physical pain was a common finding in short-term follow-up but improved significantly in long-term follow-up studies.

Conclusion: Based on clinical and patient-based outcomes measurement it is recommended that non-surgical periodontal therapy is a "gold standard" approach towards improving patient-based outcomes, reducing co-morbidities and enhancing patient safely immediately and in long term.

Keywords: Patient-based outcome, Oral health realted quality of life, periodontits, dental hygiene, oral health , status, problems, knowledge, campaigns, care, systemic disease

Introduction

Principles of care for non-communicable diseases prevention and management is nested upon adequate nutrition, ability to function and maintain quality of life (Qol) [1]. Although oral conditions are non-fatal, nevertheless they are modifiable risk factors for various chronic co-morbidities including obesity, type 2 diabetes, stroke and dementia, that are often neglected in integrated models of care currently in place, and significantly impact oral health related Qol [2, 3].

Oral health is a functional, structural, aesthetic, physiologic and psychological state of wellbeing and is essential to an individual's general health and quality of life [4]. Thus, measuring the subjective oral health-related quality of life (OHRQoL) status is important [5-7]. OHRQoL measures are increasingly being adopted to evaluate the patient-based outcomes of people experiencing periodontitis and other oral health conditions [8-10]. OHRQoL instruments have been constructed and validated in population based studies, and include the short and long versions of the Oral Health Impact Profile (OHIP14, OHIP49), Oral Health Quality of Life-UK (OHQoL-UK), Oral Impact on Daily Performance (OIDP), and Euro-Qol [11-15].

Periodontitis is a pro-inflammatory condition with relatively short episodes of exacerbation and signs and symptoms of gingival recession, drifting of teeth, mobility and loss of tooth followed by some natural repair and prolonged intervening periods of remission [16, 17]. The global burden of periodontitis is high, impacting 30-25% of worldwide population [18, 19]. It also has a significant economic impact (USD 54 billion per annum) [1, 20]. Aetiopathogenesis of periodontitis involves interaction of dental plaque biofilm and the immune-inflammatory response of the host [21-23]. Lifestyle factors including smoking, diet and alcohol consumption are also associated with periodontitis [24, 25].

Individuals with periodontitis often have a negative attitudes towards their oral health and have affected physical, social and psychological functioning [26]. Tooth loss, a marker of moderate to severe periodontitis is associated with compromised function and negative impact on OHRQoL [27].

Evidence-based studies suggest that periodontal treatment significantly improves clinical outcomes of the patient. However, the impact of periodontal interventions on patients wellbeing is often neglected in practice. Hence it is necessary to measure the subjective patient-reported outcome measures to assess treatment success and patient satisfaction. Management of moderate/severe periodontitis by non-surgical periodontal therapy significantly improves OHRQoL [10].

Baiju et al., (2017) recommended that a single patient reported outcome measure development is necessary that is reliable, validated and cross-culturally applicable throughout the globe [28]. This may impact in measurement of patients' response to treatment by generating global burden on oral health related quality of life measure that can help measure that can help predict health economic outcomes. Similar recommendations were made by Shanbhag and colleagues (2012) who advised that future studies should adopt a universally applicable OHRQoL measure throughout the world to ensure consistency of assessing and measuring outcomes. The American Academy of Periodontology commissioned systematic review pointed out that patient reported outcome measures used in clinical practice and surveillances are not standardised, which result in biases generation, limiting successful measurement of quality of life impact [29].

It is important to map the patient-based outcomes to determine the clinical effectiveness of non-surgical periodontal therapy in improving patient outcomes, safety and elimination of discomfort, disability and limitations associated with periodontitis.

The overarching aim of this systematic review was to review the evidence for the relationship between non-surgical periodontal therapy and patient-based outcomes using OHIP-14 as outcome measure. OHIP-14 is based on a quality of life model by Locker (1988) [30] that is a multidimensional subjective measure that records the social, cultural, political and practical context of quality of life. It measures the social impact of oral disorders by its seven dimensions that include: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap [15]. Montero et al. (2010) reported OHIP-14 as the preferred OHRQoL instrument because of its high reliability

and ease of administration. The secondary aim of this review is to measure the impact of non-surgical periodontal therapy on individual domains of OHRQoL that may result in better targeted intervention and effective disease management.

Methodology

Protocol registration

The systematic review was registered as a protocol with PROSPERO (PROSPERO 2016:CRD42016046082) [31]. PRISMA checklist were followed for the construction of the systematic review.

Information sources

An electronic search was conducted using PubMed/MEDLINE (National Library of Medicine, Bethesda, MD), EMBASE, COCHRANE, Google Scholar, LILACS, CINAHL and Web of Science. PROSPERO databases were searched for any registered protocol on a similar topic.

Search

Table 1 lists the Mesh terms, Emtree terms and free text terms used for the search, with the publication date and language restriction "English". An additional search was carried out on the journals relevant to the scope of the study. The references of all selected full text articles and related reviews were checked for relevant additional studies.

Inclusion and exclusion criteria

Studies considered eligible were: (i) original studies and case series on participants with periodontal disease using non-surgical periodontal therapy (scaling/root planning or root debridement or supra-gingival/sub gingival scaling) as a choice of treatment; (ii) studies using OHIP-14 as a primary outcome of OHRQoL; (iii) randomised and non-randomised control trials, prospective clinical trials and case series; and (iv) studies undertaken between January 1977 and January 2019. The studies excluded were: previous systematic reviews, literature reviews, mini reviews, dissertations, short commentaries, letters to the editor, in-vitro studies, cross-sectional, observational studies, studies using OHRQoL tools other than OHIP-14. Studies reporting on children and adolescents were also excluded. Non-English studies were excluded. OHIP-14 was selected because of its high reliability and ease of administration [32].

Screening of studies and data extraction

Data extraction was carried out using a primary screening and data extraction tool (Covidence[TM]) for organized assessment of the systematic review articles titles and abstract by two reviewers (SK, TK). The "*Covidence tool*" was used to avoid errors acquired in manual-searching/screening not previously adopted in systematic reviews [33]. Both reviewers independently carried out screening of full text articles according to the inclusion and exclusion criteria. Any conflicts were resolved with mutual discussion of the inclusion and exclusion of studies according to the criteria. Studies were selected on the inclusion and exclusion criteria. Quality assessment of study design, hypothesis, characteristics of the study participants, type of interventions used, the OHIP-14 outcome and periodontal outcomes were extracted.

Quality assessment and data extraction

The Mixed Model Appraisal Tool (MMAT) [34] was employed for quality assessment and appraisal stage of the included studies by the two independent reviewers (SK,TK). In this study the quantitative randomized control trials and non-randomized control trial questions of MMAT were used for the appraisal and two independent reviewers individually assessed the quality of the study using the MMAT criteria. The outcomes of the review were combined to generate a score based on the qualitative criteria's (randomization, allocation concealment, dropout and completion of outcome data) of the study. The MMAT scores were presented using descriptors such as *, **, ***, and ****. This was calculated using the number of criteria met divided by total number of criteria's. Scores varied from 25% (*), i.e. one criterion met, to 100% (****), i.e. all criteria met.

The strengths of the studies were defined based on the study design assessment, characteristics of population, OHIP-14 outcome and non-surgical periodontal therapy provided. An appropriate validated and accepted case definition for periodontitis used by the study was also considered as a quality assessment criterion. The universally acceptable case definition of periodontitis was based on periodontal pocket depth (PPD) and clinical attachment loss (CAL), which determine the active disease and past disease experience of periodontitis, as well as the recommended Center of Disease Control and American Academy of Periodontology case definition for periodontitis [35].

Results

Screening of studies and study designs

Once the initial screening, duplicates removal and appraisal of studies was completed (Figure 1), 13 articles were included in the review. The full text analysis and quality assessment of the articles according to inclusion criteria yielded ten studies. Nine of the included studies were case-series [36-42], three were randomized control trials (RCT's) [43, 44] and one was a quasi-experimental study [45] (Table 2).

Characteristics of studies

Two out of the thirteen studies were conducted in United Kingdom (UK) [36, 38] and the rest were conducted in Brazil, Nepal, Romania, Germany, Malaysia, Sweden, Taiwan, Turkey, India and Hong Kong [37, 39-48]. One of the Malaysian studies was an abstract, published in 6th Postgraduate Forum on Health Systems and Policies [46]. Nine studies were university based research studies [37, 39-44, 46, 47] and three were from a periodontal referral clinic [37, 38, 48]. No gender specific or rural versus urban population studies were reported in the systematic review. The Oanta et al (2015) study was the only distinct study with any systemic condition (diabetes mellitus). The follow up period of studies ranged from one week to 12 months. Three studies had a follow-up period of 12 months [39, 42, 46]. Control groups were found in only three studies [37, 38, 41]. Seven studies compared the severity/extent of periodontitis in relation to OHIP-14 [36, 39, 40, 42-44, 46].

Clinical outcomes

The clinical measures of PPD, CAL, bleeding and plaque index were used to measure the periodontal disease. Seven studies were based on PPD measure for defining periodontitis [37-42, 46]. Out of these seven studies, one used the community-periodontal index (CPI) [37], two employed the basic periodontal examination (BPE) [38, 40], two used PPD 4mm and above and one used PPD 5mm or above as a case definition for periodontitis [42]. One study adopted the CAL-based case definition for periodontitis. Ozcelik et al. (2007) defined periodontitis as 8 teeth with >5 mm CAL and one intra body defect (>=3 mm) in inter-proximal area of lower molar region. Only Mendez et al. (2016) study adopted the Center of Disease Control and American Academy of Periodontology (CDC-AAP) case definition for periodontitis. Eight studies defined the protocol of periodontal examination (full mouth – four studies and partial mouth- four studies) [37-44]. Two studies did not report the examination protocol used [36, 46]. .

Quality appraisal of included studies

The overall quality of the methodology was considered to be medium for all studies. All studies used baseline OHRQoL assessment. Studies reported poor OHRQoL using the OHIP-14 measures of discomfort and disability across domains of physical, psychological and social aspects. Three studies did not report change in periodontal outcome measures after periodontal therapy [36, 38, 42]. Dropout measures were not reported except by the Bajwa et al. study, that reported almost a 57% dropout [36]. Both randomised controlled trials (RCTs) were single blinded, parallel arm trials. The information on randomization, blinding and allocation concealment were appropriately reported in both RCTs. The operators for periodontal therapy varied among the studies (dental hygienists, dental specialists, general dentists and post-graduate students).

Quality of life outcomes

Eleven out of the 13 studies reported significant improvement in OHIP-14 scores amongst participants who had undergone non-surgical periodontal therapy [36-39, 41-44, 46]. Five studies used interviews to administer the questionnaire and obtain responses from participants [37, 38, 41, 43, 44], four were self-reported OHIP-14 questionnaires [36, 39, 40, 42]. The Dom et al. [46] study in the Malaysian population did not report on the mode of administration of the questionnaires. All OHIP-14 questionnaires employed in the study had been constructed, translated, went under pilot testing and validated according to the language and cultural attributes of the country. The total OHIP-14 score ranged between 0 to 56, with a lower score indicating better OHRQoL

The physical disability, psychological discomfort and functional limitation were the domains that improved significantly in all studies after non-surgical periodontal therapy. Improvement in OHIP-14 scores was associated with improved clinical periodontal measures. Studies with 12 month follow-up, reported significant reduction in physical pain [39, 42] compared to studies with immediate or short-term follow-up [37, 40, 41, 44].

Discussion

This review investigated the role of non-surgical periodontal therapy improving the quality of life outcomes of patients using OHIP-14 tool. This results of the review demonstrated that OHIP-14 scores improvement was evident across eleven out of thirteen studies included in the review. Significant improvement in mean short and long-term OHIP-

14 scores was observed after non-surgical periodontal therapy. The items of pain, bleeding gums and halitosis reduced significantly after non-surgical periodontal therapy based on patient-based outcomes reported. Overall, the items of physical disability, psychological discomfort, and functional limitations improved significantly in people who underwent non-surgical periodontal therapy. Pain was an important measure that was observed to reduce in long term follow-up as compared to immediate or short term follow-up of non-surgical periodontal therapy patients.

Based on these outcomes it could be deduced that non-surgical periodontal therapy is effective intervention in maintenance of patients' safety, improving provision of care by addressing quality of life aspects of social and emotional experience, improving physical function and paving way for preventive care.

The outcome of this review updated and aligns the Shanbhag et al (2012) systematic review, who suggested non-surgical periodontal therapy improves OHRQoL as compared to surgical periodontal therapy. Non-surgical periodontal therapy is considered as a hallmark treatment in: eliminating dental plaque biofilm associated with the periodontium; reducing pain, halitosis, periodontitis associated complications; and improving quality of life and general health [49]. In contrary, surgical periodontal therapy may be associated with gingival tear, root surface sensitivity, psychological trauma, post-operative swelling and discomfort [50].

This review has several strengths. Firstly, this review utilised a recommended protocol used to conduct and report on the findings. Other strengths include: using a broad search strategy, a specialized screening tool and a quality appraisal protocol to identify OHIP-14. Having a common OHRQoL measure made it easier to compare the OHRQoL studies.

Adoption of the OHIP-14 measure in clinical practice is recommended as best practice for clinicians and population-based surveys to better understand the relationship between treatments and patient OHRQoL outcomes. However, simple comparison between before and after treatment score might show paradoxical findings due to the influence of non-treatment factors on a patient's quality of life. Such response shifts might affect the scoring pattern observed in various studies.

The psychometric properties of OHIP-14 fulfills all criterias of internal consistency, reliability, response to change, validity to discriminate, convergence validity, and construct validity [15, 51]. This is higher than the other oral health related quality of life scales as reported

in a recent systematic review that evaluated the face validity and psychometric properties of oral health related quality of life instruments [52]. OHIP-14 inventory performs better than other oral health related quality of life assessment tools [53-55]. The responsiveness of OHIP-14 as a "gold standard measure" was assessed in a study by Locker et al.,[51] in older people. Using effect sizes scores, it was concluded that OHIP-14 was responsive to one month post-interventions through changes in score. However, the change in magnitude was of modest level when assessed by Cohen's benchmark [51]. This may be due to "OHIP-14 is a discriminative measure" for one-point time [at a cross-sectional level]. Hence, it is not possible to validate that OHIP-14 is a gold standard measure [51].

The periodontal examination protocols adopted by the studies included in this review were partial mouth, split mouth and full mouth protocols. Partial mouth/split mouth protocols may result in an underestimation or over-estimation of periodontal disease [56, 57]. The full mouth protocol is a preferred technique in estimating periodontal disease [58] and should be adopted for predicting the true nature of periodontal disease.

The case definition for periodontitis varied across the included studies in this review. The Center of Disease Control and American Academy of Periodontology advises the use of an updated case definition for periodontitis based on a combination of probing depth and clinical attachment loss measures, which respectively give reports of the existing and previous periodontal disease experience [35]. The randomized control trials included in the systematic review did not follow the CONSORT statement for randomized controlled trials. The CONSORT statement is an evidence based, minimum set of recommendations for the reporting of the randomized controlled trials.

In assessing the domains of OHRQoL, the most consistently affected patterns were, physical disability, psychological discomfort and functional limitation. This suggests that OHIP-14 may not be the most appropriate instrument to assess OHRQoL in patients with periodontitis and a modified or customised version may be required to accurately capture the impact of periodontitis on OHRQoL. In a study by Slade et al., study, it was reported that periodontal pocket had less impact on OHRQoL than other variables and the chronic nature of periodontitis might not be well captured using OHIP-14. In another study by Durham et al (2013), it was reported that Oral Health Quality of Life-UK (OHQoL-UK) displayed stronger association with periodontitis as compared to OHIP. They further suggested that OHQoL-UK possesses good discriminant validity with minimal item redundancy and can be the more

pragmatic choice for the busy clinical environment. Therefore, it is important to highlight the limitations of using OHIP-14 in periodontitis cases for future studies and to devise a more sensitive scale to capture the effect of periodontitis and the effect of treatment on OHRQoL

Future studies should also conduct long term large longitudinal cohort studies with quality of life outcomes of non-surgical periodontal therapy. It is also recommended that there should be universal use of OHIP-14. Universally-acceptable case definitions for periodontitis, full mouth protocols, and recording of putative confounders would be useful in determining the true effect of periodontitis on quality of life.

Conclusion

Non-surgical periodontal therapy improved OHRQoL outcomes, particularly by reducing pain, psychological discomfort, and physical disability. The strength of evidence provided by this paper should be interpreted cautiously because the included studies ranged from case reports to randomised controlled trials, with short-term (1 week) and long-term follow-ups (12 months). The implications of OHRQoL recording is useful in determining the quality of care, evaluation of clinical practice, improving patient safely and developing knowledge on patients-based outcomes research.

Clinical relevance

Scientific rationale for the study: A patient-based outcome measure that assesses the OHRQoL throughout the world ensuring consistency of assessing and measuring outcomes is necessary for determining the true impact of non-surgical periodontal therapy on patient-reported outcomes.

Principal findings: OHIP-14 was effective measure in reporting response to change to non-surgical periodontal therapy. Non-surgical periodontal therapy was significantly associated with improvement in perceived oral health related quality of life. Pain was significant factor in immediate and short-term responses of patients following treatment. Long term follow-up studies showed reduction in pain, psychological discomfort, and physical disability.

Practical implications: The patient-reported outcomes could be useful in defining quality standards in dental care, and in informing patients about importance of regular dental visits and periodontal therapy for their wellbeing.

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Figure caption:

- Figure 1. PRISMA flow diagram for the studies retrieved from the search and selection criteria

Tables (each table complete with title and footnotes);

- Table1. Search terms (Mesh and Free text (FT))

- Table2. Included studies in the systematic review and their measures.

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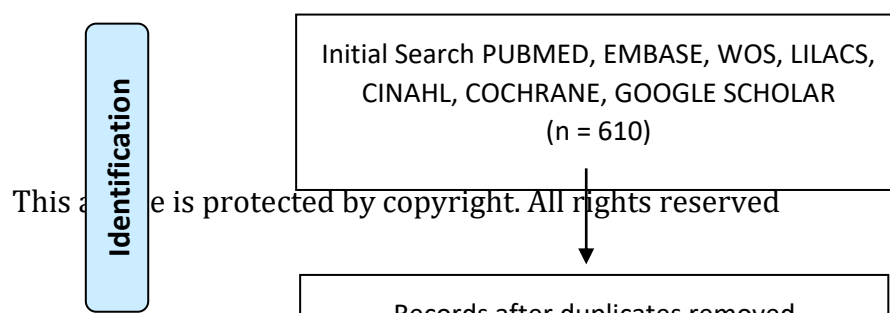
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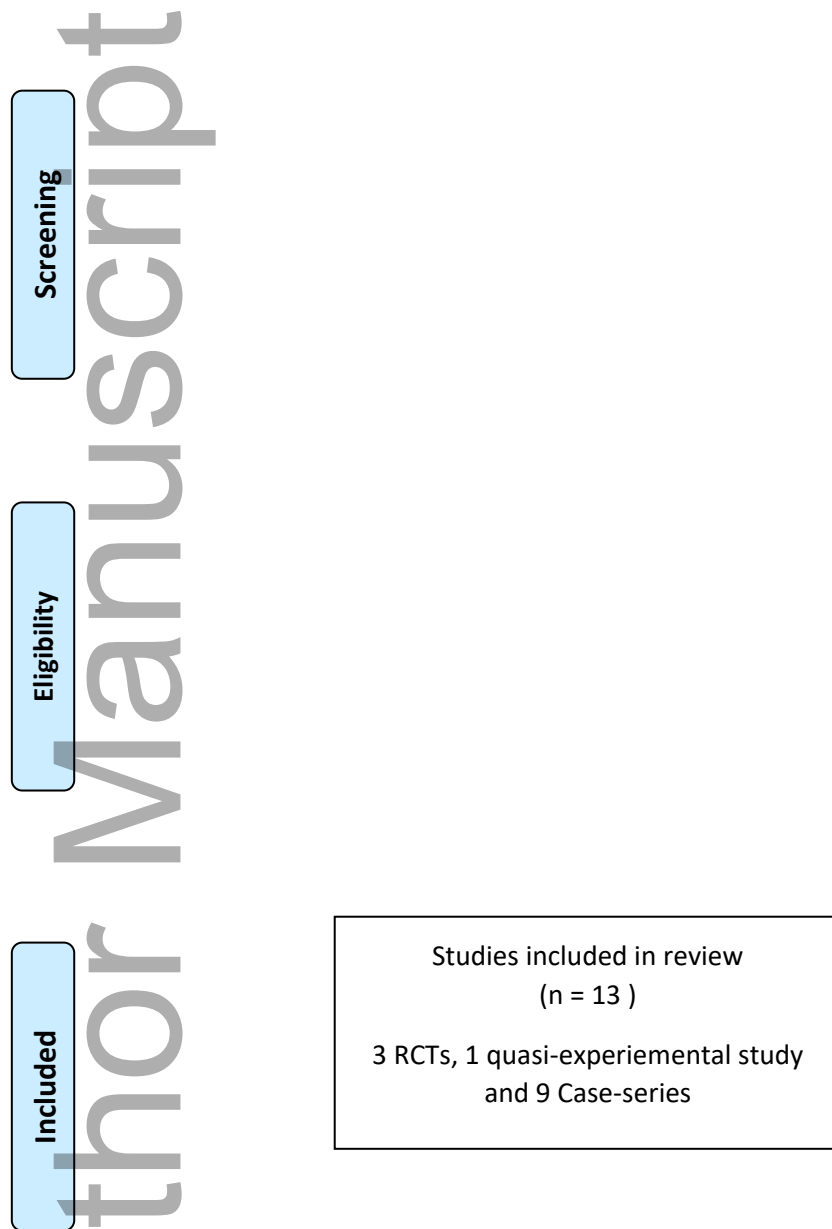
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55.	Lawrence HP, Thomson WM, Broadbent JM, et al. Oral health-related quality of life in a birth cohort of 32-year olds. Community Dent Oral Epidemiol 2008; 36: 305-316.

56.	Owens JD, Dowsett SA, Eckert GJ, et al. Partial-mouth assessment of periodontal disease in an adult population of the United States. J Periodontol 2003; 74: 1206-1213.

57.	Eke P, Dye B, Wei L, et al. Prevalence of periodontitis in adults in the United States: 2009 and 2010. J Dent Res 2012; 91: 914-920.

58.	Thomson W and Williams S. Partial-or full-mouth approaches to assessing the prevalence of and risk factors for periodontal disease in young adults. J Periodontol 2002; 73: 1010-1014.

Identification

Initial Search PUBMED, EMBASE, WOS, LILACS, CINAHL, COCHRANE, GOOGLE SCHOLAR
(n = 610)

Records after duplicates removed

Screening

Eligibility

Included

Studies included in review
(n = 13)

3 RCTs, 1 quasi-experiemental study
and 9 Case-series

Figure 1. PRISMA flow diagram for the studies retrieved from the search and selection criteria

Table1. Search terms (Mesh and Free text(FT))	
1	(Periodontal disease (Mesh) OR Periodontitis (Mesh) OR Adult Periodontitis

		(FT) OR Chronic periodontitis (Mesh) OR gum disease (FT) OR gingival disease (FT))
	2	(Dental scaling (Mesh) OR non-surgical periodontal therapy (FT) OR periodontal therapy (FT) OR periodontal treatment (FT) OR NSPT (FT) OR SRP (FT) OR periodontal debridement (FT) OR scaling (FT) OR root planing (FT) OR periodontal management (FT))
	3	(quality of life (Mesh) OR oral health related quality of life (FT) OR QoL (FT) OR OHRQoL (FT) OR OHIP (FT) OR Oral health impact profile (FT) OR wellbeing (FT) OR impact (FT)).
	4	Combined 1 AND 2 AND 3
Publication period:		1977 to January 2019**.**
Language restrictions:		Only articles in English language selected.

Table2. Included studies in the systematic review and their measures.								
Author, Year, Country	Study design, Follow up	Participants	Periodontal disease Case Definition	Periodontal probe/ Examination	Qol measure	Intervention	Clinical outcomes	QoL significance with periodontal outcomes.
Wang et al 2018 Taiwan	Quasi-experimental design	32 patients in experimental group, 32 patients in control group Follow up at 14 days, 28 days and 90 days	≥6 teeth with a periodontal pocket depth ≥5mm	Full mouth periodontal examination	WHOQOL BREF and OHI-14 (Taiwanese version)	Comprehensive Periodontal Disease Care Plan (experimental group) of three steps. Control group received no NSPT (received dental scaling only).	Number of teeth with pocket depth ≥5mm was significantly reduced post comprehensive periodontal disease care plan (p<0.001)	OHIP-14 scores significantly improved after 28 days and 90 days of comprehensive periodontal treatment (12.31±8.49 at baseline vs 10.19±7.86 for the 28 day score; p<0.05 and 10.79±8.59 for the 90 day score p<0.05). The item of "Unable to work," significantly reduced 28 days after comprehensive periodontal

								treatment (0.66±0.90 for the initial score vs 0.41±0.56 for the 28 day score; p<0.05 and 0.50±0.72 for the 90 day score; p<0.05).
Basher et al 2017 Malaysia	RCT 12 wks	66 participants experiencing obesity (BMI ≥ 27.5 kg/m²) 33 participants in treatment group and 33 participants in control group Two participants dropped out at follow-up (12 week post intervention)	CDC AAP	Williams Probe (Hu-Friedy, Chicago USA) Full mouth periodontal examination	OHIP-14 (Malaysian version)	Treatment group received NSPT and oral hygiene education and control group received no treatment	Improvement in periodontal parameters was significant between treatment and control groups (p <0.05)	No difference was observed in OHIP-14 parameters of prevalence of impact, severity score, and extent of impact (EI) at the 12-week follow up. However, within the groups NSPT significantly improved the OHIP-14 scores in both treatment and control group.
Goel et al	Interve	50 individuals	at least one	UNC-15	OHIP-14	NSPT	Not reported	OHIP-14 scores

2017 Nepal	ntion study 9-12 weeks	Group 1. 25 individuals with generalised chronic periodontitis; Group 2. 25 individuals with generalised chronic gingivitis. One participant lost on follow-up in group 1.	tooth having PD ≥ 5–7 mm with ≥3 mm CAL in different quadrants	periodontal probe Full mouth periodontal examination	(Nepalese version)			significantly after NSPT (from 7 at baseline to 3 at follow-up) The OHIP-14 scores improved significantly in the periodontitis group (52%) as compared to gingivitis group (27%).
Mendez et al 2016 Brazil	RCT Day 30 and Day 90	55 pts (10pts with gingivitis and 45pts with moderate/severe periodontitis, Mean age (51.4 years) 36 females No dropouts	CDC AAP	UNC-15 periodontal probe Gracey curettes Full mouth periodontal examination	OHIP-14	Day 0 – supra-gingival scaling and oral hygiene instructions Day 30 – Sub-gingival scaling and root planing	Baseline: Day 30: Reduced GBI, VPI, PPD and CAL as compared to Day 0. Day 90: PPD and BoP	OHIP-14 Mean Scores: Baseline: 17.3 (10.5) After supra-gingival scaling: 9.7 (8.3) After sub-gingival scaling: 9.5 (7.4) OHIP-14 reduced significantly on Day 30 after supragingival scaling. Slight improvement was

						under local anesthesia	reduced significantly	observed in OHRQoL after Day 90 as compared to Day 30. Age, SES, education level, gender and smoking didn't show any significant correlation with change in OHIP-14.
Oanta et al 2015 Romania	Case series 4weeks, 6month and 12month	21pts with Type1 diabetes mellitus and periodontitis	PPD>4mm HbAlc for glycemic control	Partial mouth (Ramfjord teeth) for PPD, CAL, BoP, Calculus index, plaque index	OHIP-14	SRP + 0.10 CHX and 0.50 Clorbuthanol rinse after SRP for 2 weeks. Amoxicillin 2grams for individuals with poor	No significant improvement in PPD and BoP observed in poor glycemic control patients after 12months of SRP	OHIP-14 domains significantly improved after SRP at 6months.

						glycemic control was given. Prior to SRP		
Brauchle et al 2013 Germany	Case-series 6-8 week.	93pts with (82pts) Periodontitis, (11pts) Control 27-74 years 35 males, 58 females Mean age (51 years)	Periodontitis: CPI 3 (PPD= 4-5mm) or CPI 4 (PPD>5mm) Control: CPI score 0-2 (PPD<4mm)	Partial mouth	OHIP-G-14	Periodontal treatment provided according to recommendation of German society of periodontology. Supra-gingival and sub-gingival scaling and debridement	CPI 3 Baseline: PPD: 4.3mm PBI: 0.56 Follow-up at 6-8wks: PPD=3.1mm PBI: 0.20 CPI 4 Baseline: PPD: 5.8mm PBI: 0.82 Follow-up at 6-8wks: PPD=4.1mm	OHIP-G-14 score decreased significantly among periodontitis patients. Baseline: 6.3 6-8week after periodontal treatment: 4.8 Individuals with PPD>7mm had a higher positive impact on OHRQoL, where OHIP-G-14 scores significantly Baseline: 14.4 6-8wk after periodontal treatment: 5.5.

							PBI: 0.19 PPD and PBI decreased significantly in CPI 3 and 4.	Reduction in items of psychological discomfort had the highest impact (gum bleeding and unpleasant taste) Tobacco consumption, lower age, female gender had high OHOP-14 scores. Psychological discomfort/disability were the most improved domains. Bleeding gums and unpleasant taste reduced by 29.3% and 19.5%
Dom et al 2012	Prospective	145patients with periodontitis, however	PPD 4mm and above	Not reported	OHIP-14S, EQ-5D-3L-	Comprehensive	Improved clinical	OHIP score significantly decreased 12month after

Malaysia (Conference paper)	case-series 12 months	only 139 patiens completed 12-month study period. Dropout: 4.2%			index	periodontal treatment (NSPT)	outcomes	treatment Baseline=22.0 12month=7.0 EQ5D utility and visual analogue score increased significantly post treatment (12 month).
Ohrn et al 2012 Sweden	Prospective case-series 2weeks	42pts with periodontitis, mean age 52.6 (SD 8.1) 23 females and 19 males	BPE 3 or 4 PPD >4mm (shallow pocket) and PPD >6mm (Deep pocket)	Partial mouth	OHIP-14 and GOHAI	NSPT-dental hygiene treatment (4-5 visits) by dental hygienist and oral health education	PPD, BoP, Plaque index significantly reduced after dental hygiene treatment.	Baseline OHIP-14 Mean: 8.0 SD(10) Review OHIP-14 Mean: 7.0 SD(8) No significant improvement in Qol after treatment using OHIP and GOHAI.
Jowett et al 2009 UK	Prospective study,	29pts (15 "case" and 14 "controls")	BPE 3 or 4 i.e. PPD>4mm	Partial mouth	OHIP-14	Case= NSPT+OHI , 24hr RD	Not reported	OHIP 14 scores improved after treatment. 1st wk: reduced impact on

	1wk and 3mth		in 1 sextant			Control= OHI, Scaling		OHRQoL after NSPT in case group (p<0.05). Control group remained unaffected. 3months: Improved Qol as compared to baseline (p<0.05)
Ozcelik et al 2007 Turkey	RCT 1week	60 psychologically matched patients with periodontitis	8 teeth with >5 mm CAL and 1 IBD (>=3 mm) in inter-proximal area of lower molar region	Gracey curettes Ultrasonic scaler Full mouth periodontal examination	OHIP-14 GOHAI	G 1:20pts NSPT+OHI G2:20pts SG+OHI G3: 20pts SG+EMD+ OHI Patients were advised not to use analgesic or CHX mouth	BL: no difference in CAL and BoP in all 3groups	ST: poor QoL (pain, discomfort). ST was associated with more functional limitation, pain and discomfort compared with NSPT and ST+EMD groups. NSPT and ST+EMD showed improvement in Qol as compared to ST

								rinse.
Bajwa et al 2007 UK	Case-series 6month	127 pts with periodontitis 20-60years 39% males 54patients on follow up. Dropout: 57%	Not reported	Not reported	OHIP-14 and LOC	OHI+NSPT, with local anesthesia	Little change in LOC after periodontal therapy, Periodontal parameters not reported	Significant improvement in OHIP-14 after periodontal therapy at 6mths. OHIP-14 mean score: Baseline: 1.85 (3.0) Review: 1.5 (2.7) 59.3% individuals showed a positive impact on OHRQoL.
Shah et al 2011 India	Case-series wk.(1,2,3,4)	50 dentate adults 25 case and 25 control	PPD 4mm or more in 1 proximal site	Williams periodontal probe Full mouth periodontal examination	OHIP-14 Assessed at baseline, 1,3,6,9 and 12 months.	NSPT in case group and OHI in controls Modifying habits like smoking	Clinical periodontal parameters improved significantly after 4 weeks of SRP.	OHRQoL improved significantly after 4weeks of NSPT (p<0.001)

							were advised to be stopped		
Wong et al 2012 Hong Kong	Prospective Case-series 12 months	65 non-smoking patients with moderate/severe periodontitis 35-64 years 25 males Dropout: 0%	At least 2 sites with PPD 5mm and more in each quadrant	Florida probe Full mouth periodontal examination	OHIP-14S	NSPT-OHI, supragingival/subgingival scaling under LA performed over 4-6weeks	Mean PPD improved from 3.25 (0.70) at baseline to 1.75 (0.23) at 12 months. % of sites with PPD > 4-5mm decreased from 25.9% to 3.5% at 12 months.	OHRQoL improved after NSPT. Mean OHIP-14: Baseline: 17 (0-41) 1-3 month: 15 (0-42) 6 months: 14 (0-45) 12 months: 13 (0-48) Domains of Physical pain, psychological discomfort and disability improved significantly.

							% of sites with PPD >6=mm decreased from 11.2% to 0.8% at 12 months. Mean PI and BoP decreased significantly at 12 months.	

CST: Conventional surgical therapy, BL: Baseline, OHI: Oral hygiene instructions, G: group, EMD: enamel matrix derivative. SG: Surgical, NSPT: Non-surgical periodontal therapy, RCT: Randomized control trial, IBD: Intra-bony defect, VPI: Visible plaque index, GBI: Gingival bleeding index, PPD: Probing pocket depth, CAL: Clinical attachment loss, BoP: Bleeding on Probing, LOC: Locus of control, OHIP: Oral health impact profile, SRP: Scaling and Root Planing, STAI: State trail anxiety inventory, CDC AAP: Center of Disease Control and American Academy of Periodontology, CPI: Community periodontal index, BPE: Basic periodontal examination, Hba1c: glycosylated hemoglobin