Patient Based Outcomes and Quality of Life.

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Introduction

Patient-based outcomes

Traditionally, the status of periodontal health is monitored through clinical oral measures such as clinical attachment level, probing pocket depth, recession, plaque scores and bleeding on probing. These parameters are of uttermost importance due to their relevance in both research and clinical activities as clinical decisions, efficacy of clinical techniques and monitoring of the treatments' progress usually rely on their eventual variations. However, irrespective of their relevance and importance, these measurements do not comprehensively capture the essence of our medical acts. Health is not just the absence of disease and the aims of healthcare is not only to minimize clinical indicators of disease but also to reduce symptoms, disability and improve quality of life; these latter can only be assessed by the patients.[19] Thus, the need for patient-based outcomes, or socio-dental indicators as they were initially termed, has been long advocated in both research and clinical practice.[31]

Patient-based outcomes refer to patients' self-evaluation of the perception of the disease, its impact on their quality of life and the evaluation of the treatment as measured through questionnaires and scales. A number of composite outcome measures have been developed to assess the oral health related quality of life (OHRQoL) in population samples and patients including periodontal patients.[61] Patient–based outcomes are used to complement ~~as~~ surrogate measures, therefore supporting the clinician in understanding the effects of disease/treatment on symptoms, functioning, psychosocial factors and treatment satisfaction.[115] They in fact facilitate clinical decision making to provide more focused patient-centred care; they can also provide data to assess the quality of care provided and evaluate practices and policies.[19]

Definition of quality of life & overall well-being

Health is a complex concept defined as "a complete state of physical, mental, and social well-being and not merely the absence of disease or infirmity".[114] Among the wide range of areas affected by the concept of health, the intangible concept of "quality of life" is receiving increasing attention. The World Health Organization has defined quality of life as people's "perceptions of their position in life in the context of culture and value systems in which they live, and in relation to their goals, expectations, standards, and concerns".[111] Quality of life influences "the degree to which a person enjoys the important possibilities of life as well-being is maintained".[61] It is a concept that involves

many important areas of the human dynamics such as the physical, psychological, social, environmental and spiritual spheres.[111] In essence, it reflects the interaction between and among health conditions, social and contextual factors and it is thus highly subjective and fluctuating over time.

Measuring quality of life is important and has a range of potential applications: it may enhance screening and monitoring for psychosocial problems in individual patient care, allow population surveys of perceived health problems, facilitate medical audit, provide outcome measures in health services or evaluation research, refine clinical trials and allow cost-utility analysis.[41] In the oral health literature, Locker [63] early identified the different potential applications of these measures as political (e.g. using them for resource allocation), theoretical (exploring interesting associations etc) and practical (research; public health; clinical practice).

Oral Health Related Quality of Life

Oral conditions may significantly affect the individual's perception of quality of life. Consequently, oral health-related quality of life has increasingly been studied in the last two decades and this field has come to the forefront of oral health research.[61]

The reader might wonder how oral health might have such a profound impact on quality of life and indeed, like for general health, the possible mechanisms underlying such connection are complex, multi-faceted and heavily influenced by personal beliefs and subjective values.[112] Values and beliefs may vary greatly between different subjects at any chosen time and also within the same subjects over time. Moreover, the presence of an oral disease is not necessarily indicative of a lower quality of life. The reader should also bear in mind that quality of life may be affected by the overall perception about oral health rather than only reflect the impact of one specific disease, particularly as oral conditions may co-exist in a person.

Therefore, generic OHRQoL measures may not reflect accurately the impact of specific oral conditions on the quality of life of people. This could be partly addressed through the use of condition-specific OHRQoL measures (e.g. measures focusing specifically on periodontal conditions), though such an approach may limit the comparability across studies and does not give an overall picture of the quality of life of the individual. Nevertheless, using generic OHRQoL measures it is possible to trace differences in the quality of life in subjects with a periodontally-compromised dentition, particularly when referring to patient samples where the assumption is that

the condition they suffer from (e.g. periodontitis) is the main "driver" of their overall perceptions in relation to symptoms, function and psychosocial impacts.

Periodontal disease symptoms such as swollen gums, sore and receding gums, drifting teeth, and halitosis, deeply affect the patient's physical, social and psychological aspects of quality of life.[14] Indeed, individuals affected by periodontitis reported that the disease and its symptoms (such as sore or receding gums, tooth mobility, oral malodour) had an impact on their function, comfort, appearance and self-confidence.[74]

Function is also essential for maintaining well-being. Periodontitis is a major cause of tooth loss, with extensive tooth loss being associated with masticatory dysfunction.[104] Chewing function is related to the residual dentition[78] and tooth loss is related to impaired OHRQoL[43] Tooth loss, in particular in the posterior areas, as is often the case in periodontitis-affected subjects[49], decreases chewing efficacy, predisposing the patient to an unhealthy diet with lower nutritional intake.[20,54,55] Moreover, tooth loss may lead to an incorrect occlusion with possible incidence of temporomandibular disorders.[92] Accordingly, the substitution of missing teeth resulted in an increase in OHRQoL. Furthermore, tooth loss has a direct effect on the aesthetical appearance and social well-being, being associated with limiting laughing in public, forming relationships and enjoying food, leading to an overall loss of self-confidence[34] Additionally, anterior tooth loss affects the patient's quality of life not only from an aesthetic standpoint, but also because it influences the ability to pronounce words correctly. Nonetheless, tooth loss is not the only condition in periodontal patients that is associated with inferior quality of life. Excessive gingival display is associated with lower levels of oral health related quality of life when compared to subjects with no gingival display[7] and lower levels of quality of life were observed in adolescents with anterior gingival enlargements.[116] Individuals with gingival recession in the anterior teeth of at least 2 mm had approximately two times higher chance of having an oral impact than individuals without recession, and the deeper the recession the lower the scores of quality of life.[108]

The reader should also not be oblivious to the close relationship shared between psychological status and periodontal health and quality of life. Work load, social class, lack of sleep and unhealthy lifestyle[2,66] predisposes individuals to periodontal diseases (Croucher et al. 1997). Stress is associated with periodontitis through both direct and indirect mechanisms.[24] On one hand, an accumulation of allostatic load is related to unhealthy behaviors, like smoking, alcohol abuse, sleep deprivation and poor oral hygiene, increasing thus the susceptibility to periodontitis.[23] Furthermore, high working load with low flexibility (inability to make private phone calls, receive visitors and leave

for private reasons during worktime) causes a reduction in the quality of life and the care of the person. Individuals with a stricter working schedule are more likely to clean their teeth less often, consequently having higher levels of dental plaque.[2] Furthermore, social network parameters, such as being widowed and having fewer friends, were linked to higher extent of periodontal attachment loss among a representative population sample of American older adults.[86]

Self-confidence and appreciation of social life are closely connected to the perception of happiness and quality of life. Periodontal patients tend to show lower levels of enjoyment of life; when taped while watching funny TV shows, their capability of smiling with opening their mouth wide and the frequency of smiling was affected.[83] Moreover, patients considered periodontitis as something they would rather not talk about.[3] The feelings frequently expressed were fear (i.e. of tooth loss), shame (avoidance of food, people, covering hands while smiling) and anger (against the previous dentist that had not alerted them before having periodontitis).

Finally, periodontitis could affect the quality of life of people not exclusively through symptoms and function but "also more subtly from effects such as increased systemic inflammation and psychosocial impacts" that could lead to impaired confidence and socialisation[74] due to the higher inflammatory systemic involvements present in subjects with periodontitis.[82]

OHRQoL measures: psychometric properties and applications

Single-item scales and more composite OHRQoL measures have been frequently used to measure subjective perceptions of oral health and quality of life. Their development and validation have been based on psychometric scaling methods, deriving from social and economic sciences. These methods are particularly challenging, as health is a holistic concept capturing different dimensions that can hardly be compressed in one single assessment.[86] The most widely used types of scales for that purpose refer to the visual analog scale (VAS) and the Likert scale.

The VAS has been used from the 50s, primarily in social sciences and then subsequently in medicine, to measure symptoms such as pain intensity and anxiety. In a VAS, the assessor marks a certain distance along a line representing the continuum of a stimulus, typically pain or overall health status. The two extreme points in the line indicate respectively the absence of a stimulus or its highest level (from "no pain" to "unbearable pain"). A unidimensional self-reporting scale of 100mm has been identified as the current standard for VAS offering greatest potential for discrimination.[50]

In the dental literature, pulpal pain and anxiety of dental procedures have been measured through a VAS. In periodontology, 100mm-VAS have been used to assess patient's reported intra and post-

operative morbidity in non-surgical periodontal treatment,[89] conservative,[101] muco-gingival, [33,117,118] [26] resective[8,28] and regenerative surgery.[79,90] Moreover, VAS have been used in periodontal plastic surgery to measure post-surgical aesthetic appreciation of the root coverage as assessed by both patients[117] and clinicians.[29,117]

The Likert scale, named after psychologist Rensis Likert[58], was introduced in 1932 to measure attitudes and consists typically of a 5- or 7- point ordinal scale used to rate the degree of agreement or disagreement with a statement.[99] Likert scales are ordinal scales, as opposed to the continuous nature of VAS, as the distances between consecutive numbers or responses are not equidistant. Likert scales have been widely used in assessing patient based outcomes. In the periodontal literature, Likert scales have been used to assess patient's satisfaction after periodontal surgery[57] and post-surgical changes after root coverage.[103]

OHRQoL measures

Measuring oral health related quality of life is far from simple as it is subjective in nature and rather unpractical in its assessment and interpretation. OHRQoL measures consist of questionnaires, in which the respondent usually answers each question with a Likert-type scale, assessing the impact of the status of the health of the oral cavity on the patient's daily life.[27] They tend to cover a range of different dimensions such as function (chewing, speaking), psychological aspects (appearance, self-esteem), social perception (intimacy, attractiveness, anxiety), oral symptoms (presence of pain or discomfort, gum bleeding), treatment expectations (satisfaction) and environment (school, job).[93] Clearly, not each OHRQoL measure would cover all these domains and that would depend on their specific focus, purpose and also its length. But they all tend to tap into the physical/functional, psychological and social impacts of the oral conditions on the life of the person. Different OHRQoL measures have been developed varying in terms of number of questions or areas investigated.[15] The most commonly used questionnaires are the Oral Health Impact Profile (OHIP-14) (Slade & Spencer 1994) the Geriatric/General Oral Health Assessment Index (GOHAI), (Atchison & Dolan 1990) the Oral Impacts on Daily Performances (OIDP),[107] and the UK oral health related quality-of-life measure (OHQoL-UK®).[69]

The OHIP (Table 1) was firstly developed as a 49-item questionnaire to assess the frequency of social impacts caused by oral disorders, with the questions grouped in 7 conceptual domains: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap.[95] It is conceptually routed on Locker's adaptation of the WHO classification of impairments, disabilities and handicaps.[62] A key attribute is that the questions were not

conceived by professionals but were derived from patient groups. The necessity of a more concise instrument to assess the perceived impact of oral health promoted the development of OHIP-14, that retained two questions for each of the seven domains.[96] The OHIP-14 has been widely adapted, tested and validated in different settings and population and patient groups, including periodontal patients.[52,75]

The Oral Impacts on Daily Performances (OIDP, Table 2) assesses both the frequency and severity of the impacts of oral conditions on basic daily life activities: eating; speaking; cleaning teeth; going out; relaxing; smiling, laughing and showing teeth without embarrassment; emotional problems (for example becoming more easily upset than usual); carrying out major work or role; and enjoying contact with other people.[6] Its theoretical framework is based on a modification of Locker's adaptation of the WHO classification of impairments, disabilities and handicaps[62] thereby focusing on the concepts of disability and handicap. By adding an assessment of the severity of oral impacts, the OIDP allows for an estimation of how important was the effect of oral impacts on the daily life of the person, rather than only assess how frequently it occurred. In addition to the overall score, the OIDP provides also the option for a condition-specific score whereby the reported oral impacts are attributed to a specific condition (e.g. periodontal disease) by directly asking the respondent about the perceived cause of the oral impact. For example, oral impacts are attributed to periodontal conditions if the respondent reported that they were caused by bleeding gums, receding gums, a loose / mobile tooth or bad breath caused them, but not if they were the result of a fractured tooth or toothache. This feature makes it relevant for a more precise assessment of the oral impacts caused by periodontal disease rather than by multiple oral conditions. The OIDP has been extensively validated in different settings and populations and also used among periodontal patients (e.g.:[80]).

The GOHAI (Table 3) consists of 12 items that evaluate problems related to oral health and the frequency of the associated psychosocial impacts in the past 3 months.[11] It contains the following items that are hypothesized to cover three underlying constructs (physical function; psychological function; pain and discomfort): eating without discomfort; limit foods due to oral problems; trouble in biting/chewing; trouble in speaking; uncomfortable eating with people; being nervous / self-conscious; limit social contacts; being worried / concerned; use medication for teeth; sensitive teeth or gums; being pleased with how your teeth look; being able to swallow comfortably. The GOHAI is based on a "patient-centered definition of oral health" without further specifying its overall

theoretical framework and construct. It has been successfully validated and also used among periodontal patients (e.g.:[80]).

The UK oral health related quality of life measure (OHQoL-UK®, Table 4) has been developed to assess the impacts of oral diseases on the quality of life, specifically for the UK population,[69] Indeed the quality of life and individual perceptions and needs are influenced by the experiences, uses, living environment, economy of different countries However, this measure has later been used in other countries, in general population as well as patient groups, including periodontal patients (e.g.:[74]) .

Beyond reliability and validity into interpretation of findings

These measures need to possess some key attributes such as be based on a conceptual and measurement model, perform well psychometrically in terms of reliability, validity, responsiveness, interpretability, have reasonable respondent and administrative burden, allow for alternative forms, and follow established procedures for cultural and language adaptations to allow transcultural validation.[1] Some of these, like reliability and validity, are core properties and apply irrespective of study design and purpose of use, while others, such as responsiveness (an instrument's ability to detect change over time), refer to the use of these measures longitudinally to assess change. Responsiveness is essential in terms of assessing the effect of periodontal treatment on the patients' OHRQoL, as a non-responsive measure may not be able to pick change when in fact it occurred. All aforementioned OHRQoL questionnaires have been assessed for validity and reliability and to some degree for their ability to assess change over time.

More importantly, if these outcome measures are going to be relevant for clinicians and policy makers, their scores need to be interpreted within a context of whether the observed differences are meaningful or not. This brings forward the notion of interpretability, i.e. the degree to which one can assign easily understood meaning to an instrument's quantitative scores. The relevance of interpretability as a way to give meaning to the otherwise meaningless OHRQoL scores has also been raised in the dental literature.[105]

Indeed, the importance of potentially improved quality of life observed after treatment is put into context by the understanding of whether the improvement assessed is clinically meaningful.[52] Comparing baseline and follow-up measurements is straightforward, but changes can occur in either direction; therefore, positive and negative changes may cancel each other out, thus giving

the impression of no change. Furthermore, change scores, also known as raw gain scores, are difficult to interpret because intrinsically they have no meaning. It is, therefore, not possible to describe a change score in either a positive or negative direction as clinically meaningful. However, this critique applies to both cross-sectional studies (referring to differences between groups) and also longitudinal ones (covering primarily changes in OHRQoL scores before and after an intervention). Due to the scoring characteristics of these measures, the same aggregate score (or change in scores) may refer to different quality of life profiles, i.e. different set of responses can end up at the same aggregate (change) score. Therefore, "reporting aggregate scores and assessing the statistical significance of differences is insufficient in and of itself" and, therefore, reporting standards for studies using OHRQoL outcomes have been put forward (Tsakos et al, 2012). This calls for the necessity to calculate the Minimally Important Difference (MID) for these outcomes; this is the smallest score or change in a score in the domain of interest that would be considered important from the patient's or clinician's perspective.[85] Some oral health studies have indeed calculated the MID for OHRQoL outcomes, including studies on periodontitis patients[106] as well as on periodontal patients to assess dentine hypersensitivity.[45]

Periodontal diseases and OHRQoL

Gingival diseases

OHRQoL has been investigated towards plaque-induced gingivitis (Table 5), while a study also looked at necrotizing gingivitis. Inconsistent findings are reported in terms of gingivitis and quality of life. On the one hand, gingivitis measured with partial examination, does not appear to be associated with lower levels of OHRQoL in children and preadolescents,[37] adolescents attending hospital clinics and dental practices,[67] as well as adolescents and young adults undergoing orthodontic treatment, though anterior gingival enlargements seemed to be associated with worse OHRQoL.[116] Furthermore, a small population study on 247 adolescents in a Brazilian town reported no association between periodontal conditions, including gingivitis as measured through the CPI, and OHIP.[18]

On the other hand, gingivitis was significantly associated with inferior OHRQoL. A study on 612 16-32 year-old patients from a hospital clinic in Belgium, showed that subjects with some periodontal condition, including gingivitis, were more likely to present with worse OHRQoL, measured through the OHIP-14 questionnaire.[30] Nevertheless, the lack of stratification by periodontitis and gingivitis patients complicates the understanding of these findings. A study on a representative sample of

1,109 schoolchildren in Khartoum, Sudan, showed that those with gingivitis, measured through the Gingival Index, reported worse OHRQoL, assessed through the Child-OIDP; the association was marginally significant in the crude model but became non-significant after adjustment for sociodemographic, behavioral and other clinical oral health measures.[76] In a nationally representative population study on 1874 Thai 12 and 15 year-old adolescents, where OHRQoL was assessed with the Child-OIDP for 12-year-olds and the OIDP for 15-year-olds, gingivitis had a negative impact on OHRQoL. More importantly, while a large proportion of adolescents with gingivitis did not report oral impacts, showing that at low levels of disease the OHRQoL of children was not considerably impaired, those that had more extensive gingivitis were also associated with reporting more severe oral impacts.[56] In a study on 1,134 Brazilian 11-14 years-old adolescents, the presence and extent of gingival bleeding, as measured with full mouth examination, was associated with worse OHRQoL, measured through the Child Perception Questionnaire, when compared to subjects with mild or no gingivitis.[102] Necrotizing gingivitis has also been associated with lower OHRQoL even after adjustment for tooth loss, gender and various socio-economic indicators in a study on 9155 young Chilean adolescents.[64]

While the majority of the studies indicate an association between gingivitis and worse OHRQoL, this is not a uniform pattern across all studies and the associations tend to be rather weak. There are many reasons to potentially explain this inconsistency in the findings. First, the studies used a variety of different settings and samples, with some referring to specific patient samples while others to general population samples where the prevalence of any specific condition is expected to be lower than in patient samples. As such, grouping them together to extract robust conclusions might not be appropriate. Furthermore, they collectively used a variety of different OHRQoL measures as outcomes and they were mostly generic OHRQoL measures, though one study that showed association employed the condition-specific OIDP.[56] Third, there was an age variation across the studies and there is evidence of high prevalence of the disease in the samples studied among adolescent and pre-adolescent populations.[53] Moreover, the clinical examination of the gingival status varied considerably between studies and this may very well have had an impact, as it was shown that partial clinical examinations of gingival bleeding may underestimate the strength of the association compared to full mouth examination.[39]

Periodontitis

There is a much larger and ever increasing volume of literature in terms of the association between periodontitis and OHRQoL and the overall picture is clearer, with periodontitis being associated with lower OHRQoL among a range of different populations and settings. The vast majority of the studies indicated that chronic periodontitis has a remarkable impact on quality of life (Table 5) .[4,5,9,10,13,17,22,25,36,38,42,47,48,51,60,70,74,75,81,83,84,87,94,97,100,109] This is also the case in studies with young subjects and in cases of aggressive periodontitis.[30,40,60,77] The oral impacts reported cover a wide range of functional and psychosocial aspects. The studies have collectively covered both clinical samples of periodontal patients as well as general population samples. As expected, the clinical samples were usually smaller, though this was not always the case (see, for example the study by Cunha-Cruz et al.[35] on 1497 periodontal patients). An early contribution to the relevant literature[74] showed a considerable impact of periodontal status on quality of life, with many individuals experiencing significant effects on symptoms (such as breath odour), physical (eating), psychological (mood), and social (happiness) aspects. Using the OHIP-14 in a sample of more than 700 patients, those with higher levels of loss of periodontal attachment rated significantly worse their functional limitation, physical pain, psychological discomfort, and physical and psychological disabilities compared to those with lower loss of attachment.[75] A good example of a large epidemiological study in the general population is provided by Bernabe and Marcenes;[17] they used secondary analysis of the Adult Dental Health Survey in the UK (n=3,122) to show that periodontitis was associated with worse OHRQoL even after adjusting for age, sex, socioeconomic status, geographic location and number of teeth in UK adults.

In general, periodontitis affected subjects tend to show worse quality of life when compared to subjects with no periodontitis. Moreover, when studies looked at the extension and the severity of the disease and not just its presence or absence, they have also shown a stepwise association, whereby higher severity and extent of periodontal disease was associated with worse OHRQoL .[25,47,48,51,70,72,74,81,87] In a study on 205 patients recruited from a private periodontoal clinic in the UK, the scores of OHQoL-UK correlated significantly but moderately with the number of teeth with probing depths $\geq$5mm, supporting the concept that there might be a linear association among the periodontal destruction and the overall quality of life.[74] Wide-mouth smiling and its frequency was related to the severity (number of pockets) of the disease.[83] In their systematic review, Buset et al[27] reported a significant association between periodontal diseases and OHRQoL in 28 studies, eight of which reported a dose-response type of relationship, with increasing impact with greater disease

severity or extent. Indeed, localized forms of periodontitis do not affect quality of life as much as generalized ones.[60]

Effect of Periodontal treatment on OHRQoL

Periodontal treatment has consistently shown efficacy and effectiveness in treating periodontitis as measured by the significant reduction of the clinical indicators of the disease.[46] Nevertheless, the effects of the treatment should extend far beyond the anatomical borders of the oral cavity, with focus on the patients' experience being increasingly considered important as it is one of the three pillars of quality in healthcare alongside clinical effectiveness and patient safety.[110] Quality of life has been shown to improve after periodontal treatment in subjects with various levels of periodontal involvement (Table 6). Patients with gingivitis, treated with supragingival scaling and oral hygiene instruction, showed a modest but significant improvement in OHRQoL.[32,44] Furthermore, much larger volume of evidence has shown that treatment of periodontitis is almost unanimously associated with an improvement in OHRQoL.[80] Most importantly, a relevant systematic review indicated that non-surgical treatment resulted in improvement in quality of life irrespectively of the instrument used (i.e. lasers vs. traditional instrumentation) or the technique of non-surgical instrumentation.[91] A clinical study on Chinese adult patients showed that the improvement in quality of life following non-surgical treatment was stable over time, indicating no relapse up to one year after treatment.[113] The type of treatment delivered has also had little effect in the reduction of quality of life. Indeed, 90 chronic periodontitis patients were divided in two groups comparing scaling and root planing per quadrant versus one-stage full-mouth disinfection.[88] Periodontal clinical parameters and OHRQL (assessed through the OIDP and OHQoL-UK) improved after treatment, however no significant differences were found between the two treatment groups. Interestingly, no additional reduction of quality of life was noticed after the surgical phase of the treatment.[80] Probably symptoms are mainly solved, or considerably reduced, after non-surgical treatment and thus the self-perception of the disease may be diminished to an extent to which variations cannot be appreciated. One should also bear in mind the possibility of the so-called "floor effect" that can be a feature of OHRQoL measures, i.e. it is more difficult to reduce lower scores to the same magnitude as with higher scores,[12,65] though floor effects are not prevalent among samples of patients undergoing treatment.

Future directions about PBOs in periodontal research and practice

It is evident that PBOs are increasingly seen as relevant for health care stakeholders. While the vast majority of studies have successfully used generic OHRQoL measures to reflect the perceptions of patients, there are examples where condition-specific measures have also been introduced. In such studies, the condition-specific OIDP performed better than the generic version of the same measure, indicating its appropriateness with samples of periodontal patients.[16,106] The employed OHRQoL measures have broadly demonstrated adequate psychometric properties in terms of reliability and validity, while responsiveness (sensitivity to change) is an essential property for those used in clinical studies to record change in OHRQoL before and after periodontal treatment. Furthermore, establishing the minimally important difference facilitates understanding of the OHRQoL scores.[105] Such a direction that complements the traditional psychometric assessment should be essential for future research using PBOs.

Furthermore, the relevant research can extend to incorporating other tools reflecting dimensions of the overall general health and wellness. However, one of the most complex aspects of some of these outcomes is that they might be context specific and affected by people's cultural background and internal beliefs. To capture the complexity of patterns of perception, decision-making and motivations, qualitative research methods have also been used to complement quantitative data.

Qualitative research is based on case-study models or focus groups and can be a promising tool to assess and evaluate true outcomes even when mild variation occurs. In periodontology, qualitative research has been used to analyse the impact of psychosocial processes in periodontal treatment. The actual questionnaires used to evaluate quality of life are focusing on the impact of the disease on the patient's perception of life. They are also often used as a secondary outcome to evaluate the potential effect of periodontal treatment on quality of life. To fully understand, however, the impact of health on the quality of life, different approaches can also be relevant to provide some further insight into the issue. The salutogenic approach, and in particular the concept of sense of coherence, is oriented more towards the causes of health rather than the causes of disease.[59] Both sense of coherence and the perceived susceptibility to periodontal disease were shown to be predictors of OHRQoL in a population epidemiological study of middle-aged women in Sweden,[21] while an intervention to increase sense of coherence in schoolchildren in Thailand led to improved gingival health and OHRQoL.[73] Qualitative research based on the grounded theory gave important insight in the psychosocial dynamic occurring during and after periodontal treatment.[98] Similarly, perceived social support and self-efficacy have been shown to be potentially relevant resources to improve OHRQoL after periodontal treatment.[71] In essence, these are aspects that can help elucidate further

and provide context and potential explanations to the OHRQoL scores. Mixed methods of research, integrating qualitative research that provides more depth in explanations with hard quantitative data with patient based outcomes could be a very helpful future development in the field, as they can shed further light on the complexity of clinical scenarios when patients are so heavily involved, as is clearly the case for periodontology.

Summary and Conclusions

- ✓ Patient based outcomes can be used to capture subjective perceptions about the impact of either the periodontal disease or its treatment on the quality of life of patients as well as the general population.
- ✓ They provide an important opportunity to complement hard clinical data with the views of the patients, thereby collectively assessing the physical, psychological and social well-being and not just the absence/presence of disease. As such, they allow better clinical decision-making and facilitate comparisons.
- ✓ Most of the relevant research has used a limited number of validated generic oral health related quality of life measures and, in general, they have performed successfully. The use of condition-specific versions has potential to provide relevant estimates of OHRQoL for periodontal conditions.
- ✓ Quality of life is profoundly influenced by the status of the health of the periodontium. There is evidence for a dose-dependent relationship: the higher the level of periodontits, the worse is the oral health related quality of life. In particular, when symptoms such as bleeding, halitosis and mobility are present, quality of life is impaired even more.
- ✓ Periodontal treatment contributes to improved quality of life of patients. These effects are mainly related to non-surgical treatment, irrespectively of the method of delivery/instruments used. Interestingly, it would appear that during a common course of periodontal treatment, i.e. both non-surgical and surgical, the first phases of the treatment show the higher improvements of perception of quality of life.
- ✓ Future research should complement the assessment of OHRQoL with the estimation of minimally important differences in OHRQoL, in order to provide increased meaning and relevance of the subjective perceptions. Furthermore, research based on mixed methods will complement the quantitative assessment of OHRQoL with in-depth qualitative insight about the context and characteristics of their application, while also focusing on surrogate

measures to facilitate explanation of the pathways between periodontal conditions and treatment and the well-being of the patients. In fact these are essential for the care providers: we treat people not millimetres.

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