



# Quality of life associated with implant-supported prostheses: An introduction to implant dentistry

According to the World Health Organization, 'Health is a state of complete physical, mental, and social well-being and not merely the absence of disease, or infirmity' (WHO, 1946). Based on this definition, the WHO defines quality of life (QoL) 'as individuals' perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns' (WHO, 1997). In other words, 'QoL is a popular term that conveys an overall sense of well-being, including aspects of happiness and satisfaction with life as a whole' (CDC, 2000).

The concept of health-related quality of life (HRQoL) on an individual level 'includes physical and mental health perceptions (e.g., energy level, mood) and their correlates including health risks and conditions, functional status, social support, and socioeconomic status' (CDC, 2000). In short, the Centers for Disease Control and Prevention have defined HRQoL as 'an individual's or group's perceived physical and mental health over time'.

## Oral health quality of life

Questionnaires have been developed to assess the impact of oral conditions on HRQoL. Oral health-related quality of life (OHRQoL) encompasses a collection of metrics such as Dental Impact on Daily Living (DIDL), Geriatric/General Oral Health Assessment Index (GOHAI), Oral Health Impact Profile (OHIP) and Oral Impacts on Daily Performances (OIDP). Among these metrics, the 14-item OHIP-14 is the most popular. The diversity of measures makes it difficult to adopt a global approach to assess the impact of missing teeth on OHRQoL.

## Dental implants and oral health

Implant dentistry aims to replace missing teeth. This is a very challenging aspect of dentistry: Should dentists replace the teeth that have been lost? However, from the patient's perspective, it makes sense to ask the question: What are the benefits of dental implant placement? In other words, the following issues should be addressed:

- Should missing teeth be replaced?
- Does implant dentistry improve a patient's quality of life?
- Is implant dentistry a cost-effective option?

We hope that this chapter will help the practitioner, not to convince patients to have dental implants, but to provide them with sufficient information to assist in the decision-making process.

## Should missing teeth be replaced?

It is beyond the scope of this book to explore the scientific rationale supporting the replacement of missing teeth. However, logic dictates that we need a minimum number of teeth and functional masticatory units (FMUs, defined as pairs of opposing teeth or

dental restoration allowing mastication, excluding incisors) to ensure an acceptable OHRQoL.

## Number of teeth

A significant link has been established between the number of teeth and OHRQoL (Tan *et al.*, 2016). Fewer than 17 teeth is associated with poor OHRQoL in the elderly (Jensen *et al.*, 2008).

The concept of shortened dental arches (SDAs) has been proposed (Witter *et al.*, 1999). This concept refers to dentition with intact anterior teeth and loss of posterior teeth; that is, molar teeth. It has been suggested that at least 20 teeth are required in order to maintain functional, aesthetic and natural dentition, and to meet oral health targets (Petersen and Yamamoto, 2005). Dentists advocate the practical applicability of SDAs. A recent multicentre survey showed that about 80% of participating professionals agreed with the SDA concept (Abuzar *et al.*, 2015).

Moreover, there is no significant difference in terms of OHRQoL between subjects with SDAs and those with removable dentures (Antunes *et al.*, 2016; Tan *et al.*, 2015). This means that a worse OHRQoL is not SDA related and that the concept of directing treatment and resources to anterior and premolar teeth, without molar teeth replacement, is an acceptable option. In other words, there is a need to replace some but not all missing teeth.

## Functional masticatory units

FMUs are needed to facilitate the chewing process. Masticatory function differs somewhat from masticatory capacity. Evaluation of masticatory function is based on complex laboratory methods. Qualitative assessment is based on video or electromyographic examination (Hennequin *et al.*, 2005). Quantitative assessment focuses on measuring particle size values for masticated raw carrots collected just before swallowing (Woda *et al.*, 2010). However, in clinical and epidemiological studies, the number of FMUs is a validated parameter for discriminating between functional and dysfunctional masticatory capacities (Godlewski *et al.*, 2011). A threshold of five FMUs generally serves as the cut-off in epidemiological studies (Adolph *et al.*, 2017; Darnaud *et al.*, 2015).

A limited biting/chewing capacity is not conducive to a healthy diet and can lead to a high glycaemic index, increased fat consumption and reduced fibre consumption. In other words, 'good nutrition is a cornerstone of good health' (WHO, 2017) and masticatory capacity is one of the most important factors for ensuring a healthy diet. A systematic review of longitudinal studies reported that signs of impaired swallowing efficacy were deemed a risk factor for malnutrition in elderly people (odds ratio [OR]=2.73;  $p=0.015$ ; Moreira *et al.*, 2016). The number of FMUs has been positively linked (OR=2.79, 95% confidence interval [CI]: 1.49–5.22) with

poor nutritional status in individuals over 65 years of age, according to the Mini-Nutritional Assessment (MNA; El Osta *et al.*, 2014). Malnutrition is associated with an increase in inflammatory biomarkers in post-menopausal women (Wood *et al.*, 2014). A higher morbidity/mortality risk was observed among haemodialysis patients with a high malnutrition-inflammation score (Pisetzky *et al.*, 2010). To conclude, a minimum of five FMUs is needed not only to ensure an adequate masticatory capacity, but also to guarantee a healthy diet.

Finally, it must be emphasised that the number of teeth and FMUs is not sufficient to portray the overall picture of edentulism. Teeth also contribute to an individual's appearance; that is, they have an aesthetic connotation. Dental aesthetics are known to be associated with OHRQoL (Broder and Wilson-Genderson, 2007; Klages *et al.*, 2004). Teeth are also important for phonation. Last but not least, missing teeth are associated with poor self-esteem and can thus have a psychological impact.

## Does implant dentistry improve the patient's quality of life?

Most studies evaluate the advantages of implant-supported overdenture in the mandible. Limited research has focused on maxillary overdentures. Many different studies from various centres using a range of protocols suggest that patients positively rate their QoL after dental implant therapy. OHRQoL is generally better in patients with fixed prostheses than in those with a removable prosthesis (OHIP-14; Brennan *et al.*, 2010). Based on OHIP-21 metrics, assessment of post-implant therapy confirmed a significant improvement in terms of OHRQoL (Nickenig *et al.*, 2008). However, a recent systematic review indicates that the use of implant-supported overdentures to treat individuals with 100% dentures improves chewing efficiency, bite force and patient satisfaction. Nevertheless, no effect on nutritional status is apparent and QoL results remain inconclusive (Boven *et al.*, 2015).

Studies dealing with fixed implant-supported prostheses in the maxilla region are few and far between, and are mostly based on single-implant placement. A significant implant-related improvement in OHRQoL is evident from aesthetic and functional perspectives in patients with at least one implant in the anterior dental region (Pavel *et al.*, 2012). In addition, an extremely positive response in OIDP has been reported in all patients treated for single-tooth replacement with an anterior maxillary implant (Angkaew *et al.*, 2017). Finally, based on a seven-question customised, mailed questionnaire, elderly patients receiving dental implants had an excellent QoL score (Becker *et al.*, 2016).

## Is implant dentistry a cost-effective option?

Of completely edentulous elderly individuals with implants, 70% were willing to pay three times the cost of conventional dentures

for implant prostheses (Esfandiari *et al.*, 2009); the willingness to pay [WTP] is the maximum amount a person would be willing to pay for an implant in order to obtain effective treatment or avoid an undesirable event such as disease or discomfort. In the anterior area, 94% of edentulous patients chose implant-supported prostheses instead of conventional prostheses to replace missing teeth and, on average, a high number of patients are willing to pay for this type of treatment (Leung and McGrath, 2010). In other words, the question of cost-effectiveness in implant dentistry is important and cost is the first obstacle to growth in the dental implant market.

The average cost-effectiveness of the tooth-supported prosthesis strategy is higher than that of the implant strategy, even if greater initial costs are associated with implant-supported prostheses (Bouchard *et al.*, 2009). A systematic literature review including 14 studies revealed that, in the case of single-tooth replacement, one dental implant placement is a cost-effective treatment option compared to a three-unit fixed dental prosthesis (Vogel *et al.*, 2013). A two-implant overdenture is a cost-effective option for restoring complete edentulism in the lower jaw (Feine *et al.*, 2002; Thomason *et al.*, 2009). However, there is little evidence to show that implant-supported fixed prostheses perform better than implant-supported overdentures, especially from a cost-effectiveness perspective. No significant difference in muscular activity during clenching has been observed when comparing implant-supported overdentures and implant-supported fixed prostheses (von der Gracht *et al.*, 2016).

To conclude, implant dentistry as a first-line strategy appears to be the 'dominant' strategy compared to conventional tooth-supported prostheses, especially for single-tooth replacement and complete edentulism in the mandible using overdentures retained with two dental implants. However, further well-designed studies are essential in order to establish the extent of the improvement in OHRQoL with fixed and removable implant-supported prostheses, especially in the upper jaw.

### Key points

- There is no need to replace all missing teeth.
- The concept of shortened dental arches – 20 teeth without molar teeth replacement – is an acceptable and cost-effective option.
- A minimum of five to six functional masticatory units is required to chew.
- Impaired chewing not only has impacts on general health but also on oral health-related quality of life.
- Implant dentistry improves the patient's quality of life.
- A two-implant overdenture is a cost-effective option for restoring complete edentulism in the lower jaw.