Ageing and periodontal disease: is it just a matter of time?

Eric Thevissen, DDS, Msc.

Between 1990 and 2017 the age-standardized *prevalence of edentulism has decreased with 10,4% globally and without gender differences* [1]*. However, this decrease is rather limited to high-income countries due to a positive relationship between economic development and access to dental treatment. In fact, in low to middle-income countries total tooth loss has increased during the same time span with 5,5%, most likely due to untreated caries and/or severe periodontitis. The same article reported a global increase of severe periodontitis with 5,8%. Severe periodontitis was defined as "PPD ≥ 6 mm (CPITN score 4) or CAL > 6 mm." In 2017 an average of 9,8% of the global age-standardized population suffered from severe periodontitis, of whom 6,6% live in high-income countries (decreasing tendency) and 12% in lower-middle-income countries (increasing tendency). These countries with large populations and ongoing growth are not able to balance the high normative need for dental care, showing the highest unmet demand for dental services.*

When looking at the growing proportion of people over 60 years of age, the increase between 2000 and 2025 is on average 10% in Western and Northern Europe, Northern America, Australia and New-Zealand [2]*. To date Japan counts over 80,000 centenarians, of whom 88% are female* [3]*.*

In 2019 life expectancy in Flanders (Northern part of Belgium) was 80,6y for males and 84,7y for females. An increase of 5,3% was calculated compared to the year 2000 with a higher apportionment for men (+5,1y) than for women (+3,3y). this is slightly (0,7y) above the European average [4]*. Nevertheless, following data from the Netherlands (2013) 54% of males and 58% of females suffer from chronic welfare disorders such as hypertension, cholesterolaemia, CVD, cerebral stroke or obesity. Upcoming diseases such as Alzheimer, pancreas or bone cancer are still challenging to be properly treated. According to WHO key facts to date 1 person in 11 has diabetes mellitus. It is predicted that in 2030 10% of our patients will be diabetic* [5]*.*

In the 2019 edition of Bloomberg healthiest country index Spain is ranked first. Italy, Iceland, Japan and Switzerland round out the top 5. Belgium finished 28th after losing two ranks. The health grade in Spain is 92,75, in Belgium 80,46. Of course, this data originates from pre-pandemic eras [6]*. It seems obvious that living in one of the healthiest countries does not automatically include having the highest life expectancy.*

Looked at from a historical point of view the variable age has always been linked to accumulated exposure, meaning that the longer a recipient is in contact with a harmful or toxic agent, the more deleterious the effect will be over time . 4 new findings by Lopez et al. in 2017 (7) however throw new insight on the concept of 'inflammaging', depicting an inflammatory state associated with ageing and not necessarily with infection. The hypothesis of cellular 'scenescense' was described as causing an arrest in cell proliferation capability. Furthermore, with increasing age type 1 collagen proteins are decreasing in the periodontium and periodontal tissues show deficiencies in wound healing response, leaving root surfaces exposed to the biofilm and increasing risk for caries as a consequence.

In this perspective, an interesting question was raised by Sekundo et al (8) about which intraoral signs may be expected after a hundred-year life? It is the first publication about this topic in periodontal literature. The study was conducted in Germany and included 55 centenarians of whom 74% are female. Their mean number of remaining teeth was 9,5 with mean CAL of 4,2mm. 55% of them suffer from moderate periodontitis, 19% show severe periodontitis. 7 patients had all together 27 implants of which 59% were considered healthy. Peri-implantitis was found in 11% of the implants.

It was concluded that natural teeth and implants can be maintained to a very old age, although only 14,3% showed 'successful' oral health. The quality of the oral hygiene habits of the centenarians can be questioned since none of them used any interdental cleaning aid, many were disabled and had impaired motor skills. Although men are accepted to be at higher risk for periodontal breakdown, above 100 years of age no differences in periodontal condition was found between both genders. One would expect that dental implants placed in patients >65 years show higher failure rates than placed in individuals between 35 and 55 y, but this could not be confirmed (9). Age as such is not a contra-indication for implant treatment. It rather is the impact of medication and general health related comorbidities that might negatively affect the wound healing and success rate.

In a publication by Chapple et al about the new classification of periodontal diseases age-related terms such as 'prepubertal' and '(pre-)juvenile' are abandoned and referred to as 'early onset' and 'rapidly progressive'.

The new classification is diversified in stages and grades. Grades A, B and C refer to the progression of the disease. The bone loss/age ratio and the phenotype case provide clinical

information about the indirect evidence of progression. This bone loss/age rule is easy to perform (10).

The formula is: **estimated % bone loss / age < 1**

100 % bone loss corresponds to 10 mm clinical attachment loss.
Look after the worst affected posterior site to estimate the amount of bone loss. If not well interpretable on panoramic X-ray, use apical X-ray. Teeth that are considered irrational to treat and planned to be removed should not be counted in.

Some examples:
0 % bone loss at 35y 0 no risk
10 % bone loss at 40y 0,25 low risk
30 % bone loss at 60y 0.5 moderate risk
50 % bone loss at 50y 1 moderate risk
75 % bone loss at 60y 1.25 high risk
*80 % bone loss at 50y 1,6 high risk*

The rate of progression is called mild below 0,25, between 0,25-1.0 it is moderate and beyond 1.0 the disease is considered rapidly progressive.

This panoramic X-ray belongs to a male patient of 45y of age. Presuming that the bone loss is 66%, his bone loss/age ratio is 1,46. His periodontal diagnosis is formulated as follows: 45-y old male with generalized periodontal bone loss extending to the apical third with possible loss of >4 teeth (stage IV), rapidly progressive (grade C), he is former smoker of >20 cig/day.

Another useful tool in relation to 'age' is the periodontal risk assessment (PRA), alias the spider web by Lang and Tonetti [11]. It is a multifactorial mathematical algorithm you can consult for free at the Bern University website. (http://www.perio-tools.com/pra/en/)

Clinical parameters to be registered are: the % of sites with BOP, the number of extracted teeth from a maximum of 28 teeth, the prevalence of sites with PPD ≥ 5mm, environmental factors (non-smoker, former smoker, moderate or heavy smoker), systemic and genetic conditions (IL1 gene polymorphism) and last but not least again the bone loss/age ratio. Once filled out, a hatched zone is designed by the algorithm. The spider web is divided into 3 zones, the centre circle of the polygon representing a stable condition with good prognosis (low risk), the outer hexagon a critical condition with high risk. Between the two rings there is the area of moderate risk. Consequently a time interval for the next appointment for supportive periodontal therapy is proposed: 3, 6 or 12months, necessary to maintain the attachment levels obtained during active therapy. See example below.
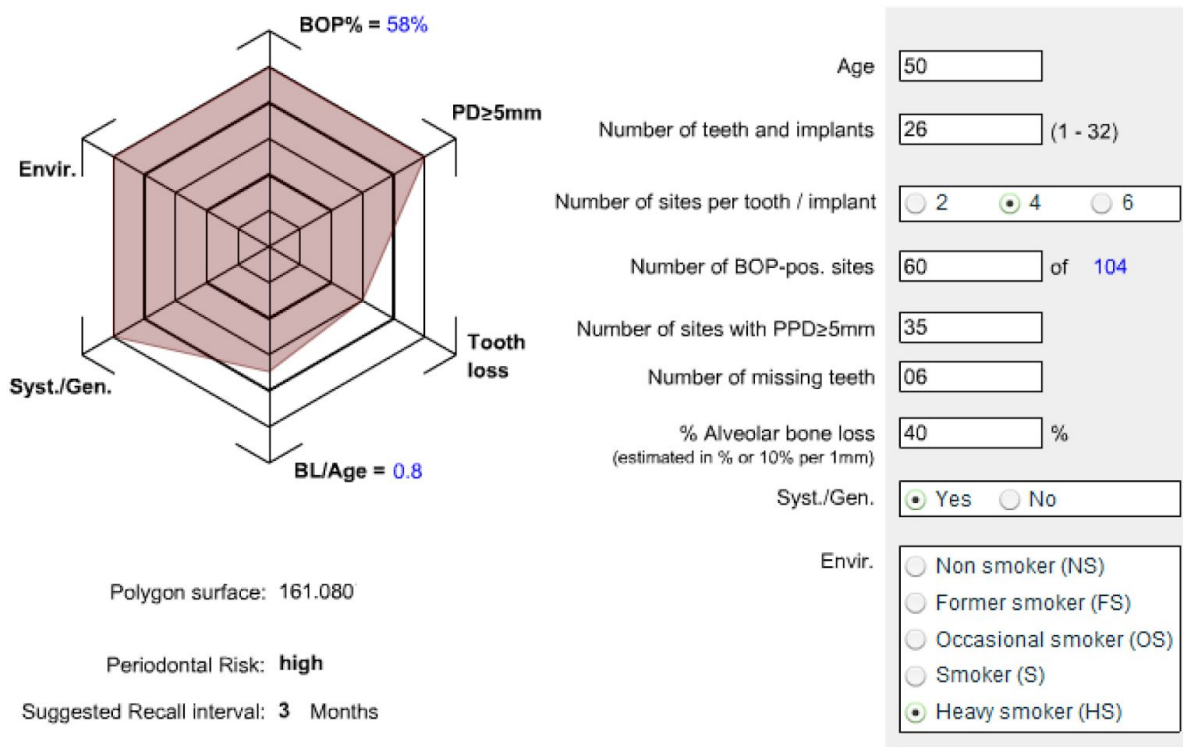
This PRA index was revisited in 2007 by Chandra (12) into a Modified PRA (MPRA) Index. The purpose was to make the index easier to generate, to include diabetes on an individual radius, to incorporate dental-systemic factors and other factors such as stress and socio-economic factors. I was less surprised that the bone loss / age index had been replaced with attachment level/age. The new coding system on each trajectory ranges between 1 and 5 rather than using factor thresholds such as % of BOP or number of sites ≥ 5mm.

In a systematic review by Lang et al. in 2015 (13) different periodontal risk assessment tools are compared. I was interested in those indices where, the parameter 'age' is included and found two studies worth mentioning, i.e. the periodontal risk calculator (PRC) by Page in 2003 (14) and the retrospective study by Lu in 2013 (15) trying to classify Chinese patients with generalized aggressive periodontitis as low, medium or high risk profiles by comparing the original PRA to 3 MPRA models. New is that a distinction was made between worst posterior site bone loss/age (original PRA and MPRA Model 1) and average bone loss/age (MPRA models 2 and 3). All data was sampled from full-mouth periapical radiographs. In the first case (worst site) 100% of patients were declared at high risk, while for the mean bone loss/age measurements a thorough difference between and segmentation over the 3 risk levels could be found.

I want to add two comments regarding this study.

Typical for aggressive periodontitis in young patient cases is the fact that bone may regenerate following APT. In this study 75.0% of patients had a positive bone loss balance between the final and the first visit, indicating a bone increment tendency (range -0,144 to 0,120). As expected, regular compliers with high-risk profiles showed statistically significant more bone gain than irregular compilers.

Secondly, in the original PRA index the benchmark for worst site bone loss/age was set at <0,5 (low risk), 0,5-1 (moderate risk) and >1 (high risk). Regarding average bone loss screening in MPRA 2 and 3 models, cut-offs were <0,75 (low risk), 0,75-1,25 (moderate risk) and >1,25 (high risk).

By modifying the original PRA from 2003 and applying it in multiple populations and settings around the world so far, the tool has not only been made applicable for the dental profession, but it has also proven to be externally validated. This emphasizes the concern of every practitioner is to apply risk assessment tools and to improve their ability to manage the multifactorial burden of periodontitis.

*Based in Hasselt (B) **Eric Thevissen** is a private-practicing periodontist trained at KULeuven. He is part-time staff member at the dept of Periodontology and Implant Therapy (UGhent), a teacher at the School for dental hygienists (UCLL), a teacher at the School for dental assistants (Syntra Hasselt), active reserve-major at the military hospital in Nederoverheembeek (MHKA) . Since 2019 he has been an iTOP teacher.*
He is a board member of the professional committee of the Belgian Society of Periodontology.

References:

1. Bernabé, Eduardo & Marcenes, Wagner & Hernandez, C. & Bailey, J. & Guimarães Abreu, Lucas & Alipour, Vahid & Amini, Saeed & Arabloo, Jalal & Arefi, Zohreh & Arora, A & Mohammadpourhodki, Reza & Bärnighausen, Till & Bijani, Ali & Cho, Daniel & Stein, Caroline & Demoz, Gebre & Demsie, Desalegn Getnet & Forooshani, Zahra & Kassebaum, Nicholas. (2020). Global, Regional, and National Levels and Trends in Burden of Oral Conditions from 1990 to 2017: A Systematic Analysis for the Global Burden of Disease 2017 Study. Journal of Dental Research. 99. 362-373. 10.1177/0022034520908533.
2. UN report 2017. World population ageing. https://www.un.org/en/development/desa/population/publications/pdf/ageing/WPA2017_Highlights.pdf consulted on Jan 29th, 2021.
3. https://www.telegraph.co.uk/news/2020/09/16/japans-centenarian-population-tops-80000-first-time-88-per/ consulted on Jan 29th, 2021
4. Statistiek.Vlaanderen.be: levensverwachting. https://www.statistiekvlaanderen.be/nl/levensverwachting, consulted on Jan 29th, 2021
5. Website WHO health topics. https://www.who.int/news-room/fact-sheets/detail/diabetes. Consulted on Jan 29 th, 2021
6. Miller L, Lu W. Bloomberg Economics. These Are the World's Healthiest Nations. 24 februari 2019. Consulted on jan 29th, 2021

7. López R, Smith PC, Göstemeyer G, Schwendicke F. Ageing, dental caries and periodontal diseases. J Clin Periodontol. 2017 Mar;44 Suppl 18:S145-S152. doi: 10.1111/jcpe.12683. PMID: 28266118.

8. Sekundo, C, Langowski, E, Kilian, S, Frese, C. Periodontal and peri-implant diseases in centenarians. J Clin Periodontol. 2020; 47: 1170– 1179. https://doi.org/10.1111/jcpe.13350

9. Sanz, M, Herrera, D, Kebschull, M, et al; On behalf of the EFP Workshop Participants and Methodological Consultants. Treatment of stage I–III periodontitis—The EFP S3 level clinical practice guideline. J Clin Periodontol. 2020; 47: 4– 60. https://doi.org/10.1111/jcpe.13290

10. Iain L.C. Chapple, Brian L. Mealey , Thomas E. Van Dyke P. Mark Bartold ,+Henrik Dommisch, Peter Eickholz, Maria L. Geisinger, Robert J. Genco, Michael Glogauer, Moshe Goldstein, Terrence J. Griffin, Palle Holmstrup, Georgia K. Johnson, Yvonne Kapila, Niklaus P. Lang, Joerg Meyle, Shinya Murakami, Jacqueline Plemons, Giuseppe A. Romito, Lior Shapira, Dimitris N. Tatakis, Wim Teughels, Leonardo Trombelli, Clemens Walter, Gernot Wimmer, Pinelopi Xenoudi, Hiromasa Yoshie. Periodontal health and gingival diseases and conditions on an intact and a reduced periodontium: Consensus report of workgroup 1 of the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions. https://doi.org/10.1111/jcpe.12940

11. Lang, N. P. & Tonetti, M. S. (2003) Periodontal risk assessment (PRA) for patients in supportive periodontal therapy (SPT). Oral Health & Preventive Dentistry **1**, 7–16.

12. Chandra, R. V. (2007) Evaluation of a novel periodontal risk assessment model in patients presenting for dental care. Oral Health & Preventive Dentistry 5, 39–48

13. Lang, NP, Suvan, JE, Tonetti, MS. Risk factor assessment tools for the prevention of periodontitis progression a systematic review. J Clin Periodontol 2015; 42 (Suppl. 16): S59– S70. doi: 10.1111/jcpe.12350.

14. Page, R. C., Krall, E. A., Martin, J., Mancl, L. & Garcia, R. I. (2002) Validity and accuracy of a risk calculator in predicting periodontal disease. Journal of the American Dental Association **133**, 569–576.

15. Lü, D., Meng, H., Xu, L., Lu, R., Zhang, L., Chen, Z., Feng, X., Shi, D., Tian, Y. & Wang, X. (2013) New attempts to modify periodontal risk assessment for generalized aggressive periodontitis: a retrospective study. Journal of Periodontology **84**, 1536–1545.

16. Qvist V. 2015. Longevity of restorations: the "death spiral." In: Fejerskov O, Nyvad B, Kidd E, editors. Dental caries: the disease and its clinical management. London (UK): Wiley-Blackwell. p. 443–456.

17. Tamim, Abdul Naser & Junaibi, Arif & Banday, Ninette. (2010). Cumulative Interceptive Supportive Therapy (C.I.S.T). 10.13140/2.1.3208.4488.