

Age-Related Oral and Systemic Disorders

Roberta Gasparro 

Department of Neuroscience, Reproductive Science and Dentistry, University of Naples Federico II,
80131 Naples, Italy; roberta.gasparro@unina.it

The advancement of medicine has reduced the global mortality rate; the older adult population continues to grow and is expected to reach 1 in 6 people by 2050 [1].

Aging is a universal and irreversible biological process characterized by reduced defense mechanisms against the environment, loss of functional reserves, and a tendency for organs and apparatuses to atrophy [2,3]. Age-related involutational physiological changes underlying the natural aging process can promote the occurrence of oral pathologies in the elderly [4]. Moreover, systemic diseases and conditions may affect oral health, and oral diseases can influence the course of systemic disorders. Such inter-relations are especially evident in elderly patients due to a higher prevalence of both systemic and oral diseases associated with the physiological effects of advancing age [1–3,5,6].

Age-related systemic conditions and diseases predisposing to adverse oral outcomes mainly comprise frailty (malnutrition, sarcopenia, osteopenia, disability, balance disorders, falls, etc.); various severe co-morbid states; Alzheimer's and other forms of dementia; Parkinson's disease and other nervous system degenerative disorders; brain stroke sequelae with severe disability and dysphagia; and neoplastic disease states [7–12]. Consequently, the reduced autonomy in daily activities; cognitive impairment and behavioral symptoms interfering with oral hygiene procedures; swallowing and chewing disorders subsequent to neurological vascular and degenerative diseases; and polypharmacotherapy potentially responsible for xerostomia and other side effects affecting the oral cavity, may promote the occurrence of oral diseases in the elderly [13,14].

As a counterpart, some oral diseases—more frequently odontogenic and periodontal acute or chronic infections—may also negatively impact certain systemic disorders, including cardiovascular diseases, diabetes mellitus, inflammatory and degenerative disorders, benign and malignant solid neoplasms, and respiratory infectious diseases [15]. The inter-connections between oral and systemic inflammatory status and microbiome, along with oral dysbiosis [16–18], have been proposed to potentially encourage—through direct and indirect mechanisms—the development and progression of such systemic disorders.

The most frequent oral conditions and disorders in older patients comprise, along with benign mucosal lesions and oral cancer, edentulism, caries, and periodontal disease [1,2]. It is worth noting that an increased incidence of HPV-related oropharyngeal squamous cell carcinoma has been recorded in White men > 65 years in the United States, with a concurrent decrease in the smoking-associated form of disease [19,20]. Fortunately, similar survival rates between ≤70 and >70 years of age have been recorded [21] in patients undergoing chemoradiotherapy, or radiotherapy alone; nonetheless, these rates have been improved by surgical approaches for elderly patients [22].

Tooth loss has been closely related to age, even though significant differences in prevalence between groups with different socio-cultural and economic statuses have been reported [5]. Socioeconomic status, education, and especially tobacco use [23,24] are known to be risk factors for tooth loss in the elderly, which is nevertheless attributable in most cases to caries and periodontitis.

Dental caries is a chronic disease with multifactorial etiology involving the destruction of dental tissues, proceeding from the outer surface of the enamel toward the pulp. Age-related changes in the enamel surface, facilitating the development of more extensive caries



Citation: Gasparro, R. Age-Related Oral and Systemic Disorders. *Appl. Sci.* **2022**, *12*, 11583. <https://doi.org/10.3390/app122211583>

Received: 29 October 2022

Accepted: 11 November 2022

Published: 15 November 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2022 by the author. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

when exposed to acids compared to young individuals [25,26], and wear phenomena [27,28], may be responsible for a higher incidence of caries, both at the coronal and root level, in the elderly population. In detail, root caries appears to be much more frequent in the elderly than in the young. Indeed, while the prevalence of coronal enamel caries rises to the age of 40–50 years and then slightly decreases, root caries, which is generally less frequent, gradually and continuously increases with higher peaks in advanced age, concurrent with gingival recession increasing with age [29].

Periodontitis is a chronic inflammatory disease of the tissues supporting the tooth with an infectious etiology [30]. Its prevalence generally increases from 5% at age 15 to 80% at age 60 [31], and periodontal tissue destruction increases with increasing age (UN Decade of Healthy Ageing (who.int)). Several age-related diseases, such as diabetes mellitus, osteoporosis, and blood disorders, also assume risk factors for periodontitis onset and progression [15–17,32]. The high prevalence of periodontal disease in the elderly might be especially relevant, as the disease directly increases the risk of the onset of edentulism and complex rehabilitation needs [24,33], with potential sequelae on the patient's nutrition, general health, and quality of life [3].

Both dysbiotic diseases are etiologically related to biofilm accumulation and favored by the frequent decrease in salivary secretion, particularly in older adults with polypharmacy and poor oral hygiene practice [5], often coupled with scarce oral healthcare literacy and reduced dental care. In an elderly person, the co-existence of minor and major disabling diseases, multi-drug therapies, physical infirmities, and mental disorders may induce them to consider dental treatments less relevant, thus, allowing further deterioration of oral, periodontal, and dental conditions, with possible effects also at the systemic level. In addition, older subjects commonly still ignore the importance of oral health and generally attend dental services less due to several obstacles, including a loss of independence, the onset of disabling conditions, or cognitive and motor deficits.

Moreover, older adults suffering from depression and dementia may not obtain access to dental care due to complicated dental treatment provisions in a supine position. Furthermore, the COVID-19 pandemic has unfortunately enhanced gaps and disparities in dental care services, conceivably linked to the recognition of older age and age-related co-morbidities, also including periodontitis [34–36] and medications as major risk factors for COVID-19 onset and severity [37,38], and increasing the detection of oral coinfections in SARS-CoV-2 positive adult subjects [39] and oral adverse reactions following vaccination [40].

Concomitantly, in recent decades, thanks to the improvement in socioeconomic conditions, nutrition, health education, and oral hygiene maneuvers, a reduced prevalence of total edentulism has fortunately been recorded both in Europe and the US [5]. The progressive decline of edentulism has consequently led to an increasing number of natural teeth in elderly individuals and, thus, to a raised demand for conservative care, on the one side, and, coupled with the increased prevalence of periodontitis, to a higher need for periodontal treatments, on the other side.

Therefore, it appears evident that geriatric dentistry should accurately focus on oral age-related conditions and diseases, adapting dental practice and home care instructions to the elderly's oral and systemic specific needs and providing multidisciplinary solutions and treatment. Elderly oral health home care may benefit from manual toothbrushes with wide-handle grips, electric toothbrushes, and floss-holding devices; moreover, primary care physicians may aid in educating older patients in maintaining good oral health, assessing risk factors through proper oral examination, and identifying physiological oral age-related changes from abnormal conditions and pathologies at an early stage, as well as referring patients to a dentist if needed.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The author declares no conflict of interest.

References

1. Chan, A.K.Y.; Tamrakar, M.; Jiang, C.M.; Lo, E.C.M.; Leung, K.C.M.; Chu, C.-H. Common Medical and Dental Problems of Older Adults: A Narrative Review. *Geriatrics* **2021**, *6*, 76. [\[CrossRef\]](#) [\[PubMed\]](#)
2. Kim, Y.G.; Lee, S.M.; Bae, S.; Park, T.; Kim, H.; Jang, Y.; Moon, K.; Kim, H.; Lee, K.; Park, J.; et al. Effect of Aging on Homeostasis in the Soft Tissue of the Periodontium: A Narrative Review. *J. Pers. Med.* **2021**, *11*, 58. [\[CrossRef\]](#)
3. Khanagar, S.B.; Al-Ehaideb, A.; Shivanna, M.M.; Haq, I.U.; Kheraif, A.A.A.; Naik, S.; Maganur, P.; Vishwanathaiah, P. Age-Related Oral Changes and Their Impact on Oral Health-Related Quality of Life among Frail Elderly Population: A Review. *J. Contemp. Dent. Pract.* **2020**, *21*, 1298–1303.
4. Adamo, D.; Canfora, F.; Calabria, E.; Coppola, N.; Leuci, S.; Pecoraro, G.; Cuocolo, R.; Ugga, L.; D’Aniello, L.; Aria, M.; et al. White matter hyperintensities in Burning Mouth Syndrome assessed according to the Age-Related White Matter Changes scale. *Front. Aging Neurosci.* **2022**, *14*, 923720. [\[CrossRef\]](#)
5. Petersen, P.E.; Kandelman, D.; Arpin, S.; OgawaGlobal, H. Oral Health of Older People—Call for Public Health Action. *Community Dent. Health* **2010**, *27*, 257–267.
6. Gonsalves, W.C.; Wrightson, A.S.; Henry, R.G. Common Oral Conditions in Older Persons. *Am. Fam. Physician* **2008**, *78*, 845–852. [\[PubMed\]](#)
7. Clark, D.; Kotronia, E.; Ramsay, S.E. Frailty, Aging, and Periodontal Disease: Basic Biologic Considerations. *Periodontol. 2000* **2021**, *87*, 143–156. [\[CrossRef\]](#) [\[PubMed\]](#)
8. di Spirito, F.; Sbordone, L.; Pilone, V.; D’Ambrosio, F. Obesity and Periodontal Disease: A Narrative Review on Current Evidence and Putative Molecular Links. *Open Dent. J.* **2020**, *13*, 526–536. [\[CrossRef\]](#)
9. Tan, E.C.K.; Lexomboon, D.; Sandborgh-Englund, G.; Haasum, Y.; Johnell, K. Medications That Cause Dry Mouth as an Adverse Effect in Older People: A Systematic Review and Metaanalysis. *J. Am. Geriatr. Soc.* **2018**, *66*, 76–84. [\[CrossRef\]](#)
10. di Spirito, F.; Schiavo, L.; Pilone, V.; Lanza, A.; Sbordone, L.; D’ambrosio, F. Periodontal and Peri-Implant Diseases and Systemically Administered Statins: A Systematic Review. *Dent. J.* **2021**, *9*, 100. [\[CrossRef\]](#)
11. Wong, F.M.F.; Ng, Y.T.Y.; Leung, W.K. Oral Health and Its Associated Factors Among Older Institutionalized Residents—A Systematic Review. *Int. J. Environ. Res. Public Health* **2019**, *16*, 4132. [\[CrossRef\]](#) [\[PubMed\]](#)
12. Albandar, J.M.; Susin, C.; Hughes, F.J. Manifestations of Systemic Diseases and Conditions That Affect the Periodontal Attachment Apparatus: Case Definitions and Diagnostic Considerations. *J. Clin. Periodontol.* **2018**, *45*, S171–S189. [\[CrossRef\]](#) [\[PubMed\]](#)
13. Müller, F.; Shimazaki, Y.; Kahabuka, F.; Schimmel, M. Oral Health for an Ageing Population: The Importance of a Natural Dentition in Older Adults. *Int. Dent. J.* **2017**, *67*, 7–13. [\[CrossRef\]](#)
14. Gil-Montoya, J.; Ferreira de Mello, A.L.; Barrios, R.; Gonzalez-Moles, M.A.; Bravo, M. Oral Health in the Elderly Patient and Its Impact on General Well-Being: A Nonsystematic Review. *Clin. Interv. Aging* **2015**, *10*, 461–467. [\[CrossRef\]](#) [\[PubMed\]](#)
15. di Spirito, F.; la Rocca, M.; de Bernardo, M.; Rosa, N.; Sbordone, C.; Sbordone, L. Possible Association of Periodontal Disease and Macular Degeneration: A Case-Control Study. *Dent. J.* **2020**, *9*, 1. [\[CrossRef\]](#) [\[PubMed\]](#)
16. di Spirito, F.; Amato, A.; Romano, A.; Dipalma, G.; Xhajanka, E.; Baroni, A.; Serpico, R.; Inchingolo, F.; Contaldo, M. Analysis of Risk Factors of Oral Cancer and Periodontitis from a Sex- and Gender-Related Perspective: Gender Dentistry. *Appl. Sci.* **2022**, *12*, 9135. [\[CrossRef\]](#)
17. Amato, A. Oral-Systemic Health and Disorders: Latest Advances on Oral–Gut–Lung Microbiome Axis. *Appl. Sci.* **2022**, *12*, 8213. [\[CrossRef\]](#)
18. di Spirito, F.; Argentino, S.; Martuscelli, R.; Sbordone, L. Mronj incidence after multiple teeth extractions in patients taking oral bis-phosphonates without “drug holiday”: A retrospective chart review. *ORAL Implantol.* **2019**, *12*, 105–110.
19. Zumsteg, Z.S.; Cook-Wiens, G.; Yoshida, E.; Shiao, S.L.; Lee, N.Y.; Mita, A.; Jeon, C.; Goodman, M.T.; Ho, A.S. Incidence of Oropharyngeal Cancer Among Elderly Patients in the United States. *JAMA Oncol.* **2016**, *2*, 1617. [\[CrossRef\]](#)
20. Gasparro, R.; Calabria, E.; Coppola, N.; Marenzi, G.; Sammartino, G.; Aria, M.; Mignogna, M.D.; Adamo, D. Sleep Disorders and Psychological Profile in Oral Cancer Survivors: A Case-Control Clinical Study. *Cancers* **2021**, *13*, 1855. [\[CrossRef\]](#)
21. Malik, A.; Mishra, A.; Chopda, P.; Singhvi, H.; Nair, S.; Nair, D.; Laskar, S.G.; Prabhash, K.; Agarwal, J.P.; Chaturvedi, P. Impact of Age on Elderly Patients with Oral Cancer. *Eur. Arch. Oto-Rhino-Laryngol.* **2019**, *276*, 223–231. [\[CrossRef\]](#)
22. Shia, B.-C.; Qin, L.; Lin, K.-C.; Fang, C.-Y.; Tsai, L.-L.; Kao, Y.-W.; Wu, S.-Y. Outcomes for Elderly Patients Aged 70 to 80 Years or Older with Locally Advanced Oral Cavity Squamous Cell Carcinoma: A Propensity Score-Matched, Nationwide, Oldest Old Patient-Based Cohort Study. *Cancers* **2020**, *12*, 258. [\[CrossRef\]](#) [\[PubMed\]](#)
23. Caggiano, M.; Gasparro, R.; D’Ambrosio, F.; Pisano, M.; di Palo, M.P.; Contaldo, M. Smoking Cessation on Periodontal and Peri-Implant Health Status: A Systematic Review. *Dent. J.* **2022**, *10*, 162. [\[CrossRef\]](#) [\[PubMed\]](#)

24. Di Spirito, F.; Toti, P.; Brevi, B.; Martuscelli, R.; Sbordone, L.; Sbordone, C. Computed tomography evaluation of jaw atrophies before and after surgical bone augmentation. *Int. J. Clin. Dent.* **2019**, *12*, 259–270.
25. Kidd, E.A.M.; Richards, A.; Thylstrup, A.; Fejerskov, O. The Susceptibility of ‘Young’ and ‘Old’ Human Enamel to Artificial Caries in Vitro. *Caries Res.* **1984**, *18*, 226–230. [[CrossRef](#)]
26. Sammartino, G.; Cerone, V.; Gasparro, R.; Riccitiello, F.; Trosino, O. Multidisciplinary Approach to Fused Maxillary Central Incisors: A Case Report. *J. Med. Case Rep.* **2014**, *8*, 398. [[CrossRef](#)]
27. Amato, M.; Zingone, F.; Caggiano, M.; Iovino, P.; Bucci, C.; Ciacci, C. Tooth Wear Is Frequent in Adult Patients with Celiac Disease. *Nutrients* **2017**, *9*, 1321. [[CrossRef](#)]
28. Romano, A.; di Spirito, F.; Amato, A.; Ferraro, G.A.; Dipalma, G.; Xhajanka, E.; Serpico, R.; Inchingolo, F.; Contaldo, M. Dental Microstructural Imaging: From Conventional Radiology to In Vivo Confocal Microscopy. *Appl. Sci.* **2022**, *12*, 10654. [[CrossRef](#)]
29. Chan, A.K.Y.; Tamrakar, M.; Jiang, C.M.; Lo, E.C.M.; Leung, K.C.M.; Chu, C.H. A Systematic Review on Caries Status of Older Adults. *Int. J. Environ. Res. Public Health* **2021**, *18*, 10662. [[CrossRef](#)]
30. Gasparro, R.; Sammartino, G.; Mariniello, M.; di Lauro, A.E.; Spagnuolo, G.; Marenzi, G. Treatment of Periodontal Pockets at the Distal Aspect of Mandibular Second Molar after Surgical Removal of Impacted Third Molar and Application of L-PRF: A Split-Mouth Randomized Clinical Trial. *Quintessence Int.* **2020**, *51*, 204–211. [[CrossRef](#)]
31. Billings, M.; Holtfreter, B.; Papapanou, P.N.; Mitnik, G.L.; Kocher, T.; Dye, B.A. Age-Dependent Distribution of Periodontitis in Two Countries: Findings from NHANES 2009 to 2014 and SHIP-TREND 2008 to 2012. *J. Periodontol.* **2018**, *89*, S140–S158. [[CrossRef](#)] [[PubMed](#)]
32. di Spirito, F.; Toti, P.; Pilone, V.; Carinci, F.; Lauritano, D.; Sbordone, L. The Association between Periodontitis and Human Colorectal Cancer: Genetic and Pathogenic Linkage. *Life* **2020**, *10*, 211. [[CrossRef](#)] [[PubMed](#)]
33. Gasparro, R.; Qorri, E.; Valletta, A.; Masucci, M.; Sammartino, P.; Amato, A.; Marenzi, G. Non-Transfusional Hemocomponents: From Biology to the Clinic—A Literature Review. *Bioengineering* **2018**, *5*, 27. [[CrossRef](#)]
34. di Spirito, F.; Pelella, S.; Argentino, S.; Sisalli, L.; Sbordone, L. Oral Manifestations and the Role of the Oral Healthcare Workers in COVID-19. *Oral Dis.* **2022**, *28*, 1003–1004. [[CrossRef](#)]
35. Scelza, G.; Amato, A.; Rongo, R.; Nucci, L.; D’Ambrosio, F.; Martina, S. Changes in COVID-19 Perception and in TMD Prevalence after 1 Year of Pandemic in Italy. *Eur. J. Dent.* **2022**. [[CrossRef](#)] [[PubMed](#)]
36. di Spirito, F.; Iacono, V.J.; Alfredo, I.; Alessandra, A.; Sbordone, L.; Lanza, A. Evidence-Based Recommendations on Periodontal Practice and the Management of Periodontal Patients During and After the COVID-19 Era: Challenging Infectious Diseases Spread by Airborne Transmission. *Open Dent. J.* **2021**, *15*, 325–336. [[CrossRef](#)]
37. Marchini, L.; Ettinger, R.L. Coronavirus Disease 2019 and Dental Care for Older Adults. *J. Am. Dent. Assoc.* **2020**, *151*, 881–884. [[CrossRef](#)]
38. Ettinger, R.; Marchini, L.; Zwetchkenbaum, S. The Impact of COVID-19 on the Oral Health of Patients with Special Needs. *Dent. Clin. N. Am.* **2022**, *66*, 181–194. [[CrossRef](#)]
39. di Spirito, F.; Iandolo, A.; Amato, A.; Caggiano, M.; Raimondo, A.; Lembo, S.; Martina, S. Prevalence, Features and Degree of Association of Oral Lesions in COVID-19: A Systematic Review of Systematic Reviews. *Int. J. Environ. Res. Public Health* **2022**, *19*, 7486. [[CrossRef](#)]
40. di Spirito, F.; Amato, A.; di Palo, M.P.; Contaldo, M.; D’Ambrosio, F.; Lo Giudice, R.; Amato, M. Oral Lesions Following Anti-SARS-CoV-2 Vaccination: A Systematic Review. *Int. J. Environ. Res. Public Health* **2022**, *19*, 10228. [[CrossRef](#)]