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Oral Health Status at Age 60 and 72 Years—A Longitudinal Study

Sladjana Critén[1] | Pia Andersson[1] | Stefan Renvert[1,2] | Bengt Götrick[3] | Johan Sanmartin Berglund[2] | Viveca Wallin Bengtsson[1]

[1]Faculty of Health Sciences, Kristianstad University, Kristianstad, Sweden | [2]Department of Health, Blekinge Institute of Technology, Karlskrona, Sweden | [3]Faculty of Odontology, Malmö University, Malmö, Sweden

Correspondence: Sladjana Critén (sladjana.criten@hkr.se)

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ABSTRACT

Objective: This study investigated oral health status in 60-year-old individuals over 12 years.

Materials and Methods: Data were obtained from The Swedish National Study on Aging and Care (SNAC). One hundred nineteen 60-year-old individuals (48% females) underwent a clinical and radiographic baseline examination (2001–2003) and follow-up examination in 2013–2015. For statistical analyses, paired *t*-tests and McNemar's test were performed. Statistical significance was determined at $p < 0.05$.

Results: At the 12-year follow-up, the mean number of teeth and the proportion of individuals having ≥20 teeth decreased ($p < 0.001$). The mean number of teeth with buccal/lingual and approximal caries lesions increased ($p < 0.029$ and $p < 0.031$). Individuals with a distance from the cement-enamel junction to the bone of ≥5 mm increased in total ($p < 0.002$) and in males ($p < 0.006$). The prevalence of gingivitis increased in total ($p < 0.001$). The prevalence of periodontitis showed a significant increase in total ($p < 0.043$) and in females ($p < 0.039$).

Conclusion: The present study indicates that oral health status in 60-year-old individuals deteriorates over 12 years. However, the deteriorations were minor in terms of tooth loss, caries lesions, and changes in periodontal status.

1 | Introduction

Oral health status impacts general health, well-being, and longevity [1]. In Sweden as well as in other countries, the prevalence of dentate individuals has increased as more older people retain their natural teeth [2, 3], often in combination with complex prosthetic constructions [4]. However, as the number of natural teeth in the older population increases, the risk for oral diseases may also increase [5].

Age-related cognitive impairments, chronic diseases, and overall morbidity and medication use increase with age [6]. Reduced motor skills and impaired ability to perform daily oral hygiene are common in older individuals [7]. More natural teeth, impairments in salivary flow often due to medication side effects and poorer oral hygiene [8] will increase the risk for oral diseases such as caries [9] and periodontal diseases [10]. A repeated national survey in 2009 reported that approximately 27% of British individuals aged 65–74 had caries lesions, while the corresponding figure was 40% for those aged 75–84 [11]. A Swedish study found that manifest caries increased significantly between 2008 and 2013 in the oldest group of individuals (85 years) compared to younger age groups 35–75 years old [12]. Previous studies have shown

that the prevalence of periodontal pocket depth ≥6 mm was common in individuals 75 years and older [2, 13]. Associations have been reported between periodontitis and systemic diseases and increased risk for mortality in individuals 60 years and older [14]. Lipsky et al. [15] reviewed the literature on sex and gender differences and found that the prevalence of oral diseases such as caries and periodontal diseases differ between males and females.

When older individuals become dependent on help of daily activities, their contacts with dental care providers becomes less common [16], which increases the risks of oral infections and tooth loss [17]. Having <20 teeth leads to weaker oral stability potentially resulting in chewing difficulties [18]. This condition may affect dietary intake and lead to deteriorated nutritional status [19]. To prevent impaired health and ensure good oral function, maintaining oral health status becomes crucial in older age [20]. However, data from longitudinal studies investigating oral health status over time in older individuals are limited. Longitudinal studies are essential to increase knowledge and understanding of how oral health status is affected during aging.

The aim of this study was to investigate oral health status in 60-year-old individuals over 12 years.

2 | Materials and Methods

2.1 | Study Design

The data for the present longitudinal study were obtained from the Blekinge database of 'The Swedish National Study on Aging and Care (SNAC)'. The present study was conducted following the checklist of items for observational studies in epidemiology known as 'STROBE' [21].

2.2 | SNAC Study

The SNAC study was initiated in 2001 to increase knowledge about aging in the older Swedish population and in relation to previous health circumstances, lifestyle, and the environment. The study encompasses interviews, self-administered questionnaires, as well as medical, psychological, and dental examinations at a research clinic.

At baseline 2001–2003, individuals aged between 60 and 96 years ($n = 2312$) were invited to participate by regular mail. Participants for the SNAC study were selected randomly from the Swedish population database within the municipality of Karlskrona City, in Blekinge, southeastern Sweden. The random selection process was distributed equally among individuals aged 60, 66, 72, and 78 (younger cohorts) while all individuals in the age groups 81, 84, 87, and older were invited to participate. The response rates were 62% ($n = 1402$) corresponding to 10% of Karlskrona's population. Moreover, data collection for each cohort was conducted at regular intervals: every 6 years for younger cohorts up to 78 years and every 3 years for those aged 81 years and older. Every sixth year a new cohort of 60-year-olds, and every third year, new cohorts of 81-year-olds, were invited to participate. All participants provided informed consent prior to participation. A detailed description of the study population and procedures has been published earlier [22].

2.3 | The Present Study

In the present study, inclusion criteria comprised 'all participants aged 60 years at baseline 2001–2003', 'living in Karlskrona municipality' and 'underwent clinical and radiographical examination at baseline and follow-up in 2013–2015 when they reached the age of 72 years'. At baseline 2001–2003, a total of 191 individuals from the 60-year-old age cohort agreed to participate, of whom, 171 (89.5%) had undergone both clinical and radiographic examinations. Out of these participants, 52 individuals were unable to participate in the follow-up examinations in 2013–2015 for various reasons (Table 1). Consequently, a total of 119 (69.5%) individuals were available for clinical and radiographical re-examination at age 72 years, forming the study population (Figure 1). No additional background characteristics of the participants were considered except for sex.

The Research Ethics Committee, Lund University, Lund, Sweden, approved ethical permission for the SNAC studies (LU 604–00). The principles of the Helsinki Declaration [23] were followed consistently in the study. Access to data collection involved the use of coding, ensuring that no personal data, aside from age and gender was accessible to authors.

2.4 | Oral Health Examination

An oral health examination was conducted at a dental research clinic. A structured study protocol was used during the baseline period of 2001–2003 and the follow-up period of 2013–2015. This protocol involved clinical registration of oral health status, oral mucosa status, salivary secretion rate, and bacterial and halitosis samples. For this study, only the oral health status is reported.

Two experienced dental hygienists performed both clinical and radiographic examinations. The dental hygienists were calibrated before the start of the study. A dentist (specialist in periodontology) was responsible for assessing panoramic radiographs during the baseline and follow-up periods. The dentist was masked to participants´ gender, age, and dental and medical information for all performed readings.

The clinical variables comprised:

a. The number of natural teeth, dental implants, and presence of removable prosthesis.

b. Presence of buccal and/or lingual manifest caries and was registered by visual and tactile examination using a blaster, a mouth mirror, and a double-ended EXD 5 probe (Hu-Friedy Inc., Chicago, IL).

c. Probing pocket depth (PPD) and bleeding on probing (BOP) were measured on four surfaces around each tooth

TABLE 1 | Reasons for exclusion of individuals between baseline ($n = 171$) and the 12-year follow-up ($n = 119$) in total and by gender n (%).

	Deceased	Declined dental clinic examination	Lack of panoramic radiograph	Could not visit the dental clinic
Gender				
Male	11 (6.4)	12 (7.0)	3 (1.75)	0 (0.0)
Female	8 (4.7)	11 (6.4)	3 (1.75)	4 (2.3)
Total, n (%)	19 (11.1)	23 (13.4)	6 (3.5)	4 (2.3)

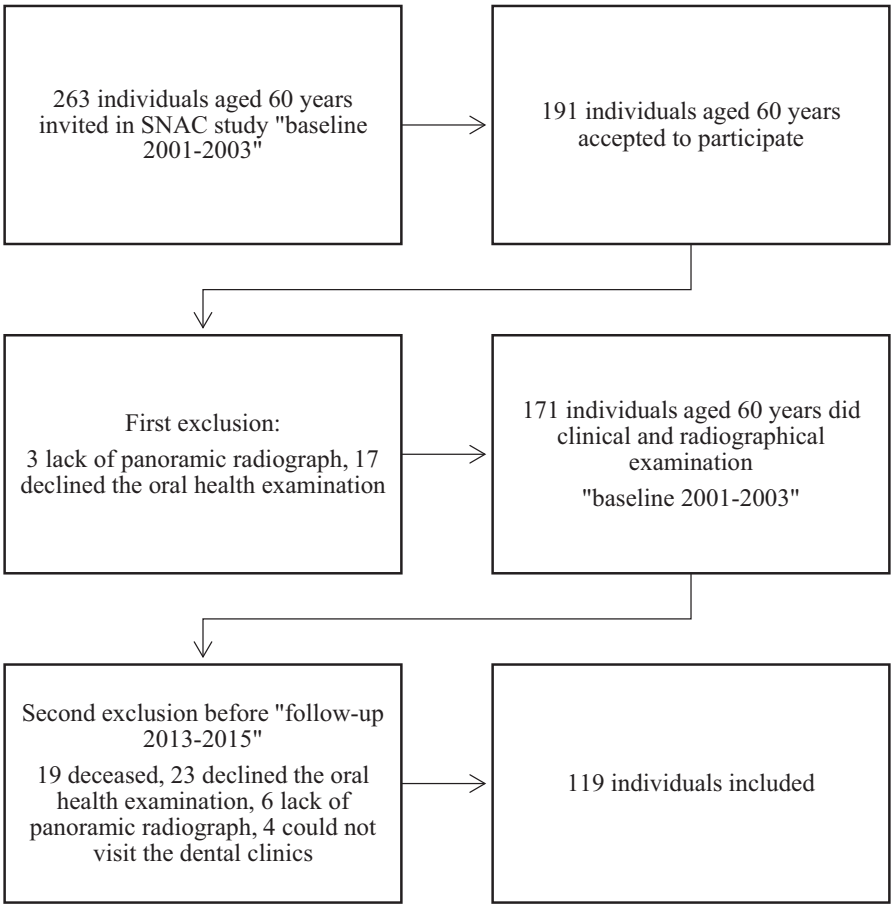

FIGURE 1 | Flow chart of the inclusion process.

(third molar included) using a periodontal probe CP-12 (Hu-Friedy Inc., Chicago, IL). The deepest PPD from 4 mm or deeper on each tooth was registered (from the gingival margin to the pocket base). Therefore, only PPD ≥ 5 mm is presented in the present study. The intra-class correlation (ICC) coefficient between the two dental hygienists who performed the examinations of PPD was 0.76 (95% Cl = 0.67–0.82; $p < 0.001$). This calibration was based on pocket depth measurements from 14 participants, encompassing a total of 318 teeth per examiner (103 incisors, 56 canines, 85 premolars, and 74 molars). BOP was registered as bleeding or not and was calculated as the proportion of sites with bleeding. The classification of gingivitis was BOP ≥ 10% [24]. Individuals with periodontitis were excluded from the analyses of gingivitis. The periodontitis was defined as the distance from the cement-enamel junction (CEJ) to the highest marginal bone level ≥ 5 mm on ≥ 2 nonadjacent teeth. For further classification, the disease activity was included, according to Sanz et al. [25], as PPD ≥ 5 mm and BOP ≥ 10%.

The radiographic examination was performed using a panoramic radiograph (Orthopantomograph OP 100, Instrumentarium, Tuusula Finland). During the baseline period of 2001–2003, the panoramic radiographic technique was analog, while it transitioned to digital during the follow-up period of 2013–2015. The panoramic x-ray images were coded before assessment. The following variables were assessed: (a) the number of natural teeth, (b) the number of dental implants, (c) the number of root residues, root fillings, and approximal carious lesions, and (d) bone level measured in millimeter from cement-enamel junction (CEJ) to the highest marginal bone level mesial and distal on each tooth (third molar included) utilizing a millimeter-scaled transparent plastic ruler, 2×

magnification viewer and a lightbox source. Intraclass correlation (ICC) coefficient for measuring the bone level was 0.93 (95% CI = 0.91–0.96, $p < 0.01$). Intraexaminer calibration was conducted on 20 radiographs.

2.5 | Statistical Analyses

The Statistical Package for Social Science (IBM SPSS, version 27.0) was utilized for both descriptive and analytical statistics. Descriptive statistics, including means, standard deviation (SD), and frequency distribution, were summarized concerning age groups and examinations. Initially, the data were assessed for normal distribution, revealing that mean and median values for 'number of teeth, number of dental implants, root residual, root fillings and BOP' were closely aligned. Consequently, parametric tests were appropriate. The paired samples *t*-test was conducted to compare the means of two measurements within the same individuals between 2001–2003 and 2013–2015. For dichotomous data, McNemar's test was utilized to determine differences in a dichotomous dependent variable between the two examinations such as the presence of removable prosthesis, the prevalence of at least 20 teeth or more, and presence of periodontal conditions. Statistical significance was determined at $p < 0.05$.

3 | Results

The sample consisted of 119 (69.5%) individuals (48% females) who received clinical and radiographic examination at baseline (60 years) and 12-year follow-up (72 years). Among these individuals, five were edentulous and were thus excluded from further analysis. Consequently, a total of 114 dentate individuals were included in all analyses presented in the study results.

The mean number of teeth significantly decreased for males and females at the 12-year follow-up (Table 1). Having 20 teeth or more significantly decreased in total and females. Prevalence of individuals with dental implants significantly increased from 4.3% to 14.7% ($p < 0.001$). A significantly higher prevalence of dental implants was observed among females, with 16.4% at 12-year follow-up compared to 3.6% at baseline ($p < 0.016$). The corresponding figure among males was 13.1% at the 12-year follow-up compared to 4.3% at baseline ($p = 0.063$). Statistical analyses of the mean number of dental implants are presented in Table 1. The proportion of individuals with removable prostheses, and those who were edentulous remained unchanged at the 12-year follow-up. Specifically, 11.5% of males had removable prostheses while prevalence among females was 1.8%. Additionally, 3.4% of males and 0.9% of females were edentulous (not presented in tables).

There were no significant differences in the prevalence of root residues, root fillings, manifest buccal/lingual or approximal caries, neither overall nor divided by gender. Table 2 presents mean values of root residues, root fillings, manifest buccal/lingual and approximal caries as well as their prevalence in total (%). The mean values of manifest buccal/lingual caries and manifest approximal caries significantly increased (Table 2). Eighty-six percent had no manifest buccal/lingual caries and 85.0% had no manifest approximal caries (not presented in the table).

Clinical and radiographical periodontal findings are presented in Table 3. The presence of at least one PPD ≥ 5 mm and at least one PPD ≥ 6 mm was approximately the same. Individuals with at least one surface bone level ≥ 5 mm or more significantly increased. Bleeding on probing (BOP) significantly increased in both males and females as well as the prevalence of gingivitis. The corresponding prevalence of periodontitis showed a significant increment, but not in males (Table 3).

4 | Discussion

Over a 12-year follow-up period, statistical differences in oral health status were observed in the same individuals from 60 to 72 years old. These findings include a decreased number of natural teeth, an increased prevalence of dental implants, an increase in the number of teeth affected by caries, and a higher prevalence of periodontal diseases.

The number of natural teeth decreased by 1.5 in the present study population, which aligns with earlier follow-up studies [26, 27] and the Swedish Dental Health Registry [28]. For older people, the number of teeth has an impact on general health and quality of life. To maintain good oral function in older individuals, at least 20 teeth are considered necessary to retain [29]. In the present study, the proportion of individuals with ≥ 20 teeth had decreased significantly. However, despite this significant reduction, most of the study population (79.0%) still had ≥ 20 teeth at 72 years, which is positive but also raises questions. What will happen if they continue to lose teeth? Having < 20 teeth may put individuals at risk for malnutrition [30] and the development of systemic diseases [31]. Systemic disease may result in the use of medication that may reduce saliva flow and increase the risks for oral diseases [8]. Follow-up studies have confirmed that caries lesions and periodontitis are risk factors for tooth loss [27, 32].

In the present study, among those with caries lesions, the mean number of teeth with decayed buccal/lingual and approximal surfaces increased by 0.3 for both. While this increase in caries may not pose a significant immediate threat, the long-term impact, and consequences of an increased caries rate over time should be noted [33]. However, around 85% of the study population in the present study had no manifest buccal/lingual or approximal caries lesions at age 72 years. Prevention strategies, such as regular toothbrushing with fluoride toothpaste and the use of other fluoridated supplements, could explain the relatively low caries prevalence in these individuals [34]. Previous research in Sweden noted that older persons born in the early 1940s were more likely to visit dental hygienists over time than younger adults [35]. This notable aspect may contribute to increased interest in oral health behavior and attitudes among participants in the present study who were born between 1941 and 1943. In the last 3 years, individuals between 65 years and 79 years visited dental care to a greater extent compared to younger adults [36]. The findings regarding caries prevalence in the present study are similar to results from other studies in Sweden and Norway [26, 37]. Edman, Holmlund and Norderyd [26] showed in their study that 80% of individuals aged 75 had no

TABLE 2 | Clinical and radiographic data presented the mean number of natural teeth, dental implants, root residuals, root fillings, teeth with buccal/lingual, approximal caries and having ≥ 20 teeth at baseline (BL) and 12-year follow up (12y) in total and by gender.

	In total			Male			Female		
Variables	**BL *n* = 114**	**12y *n* = 114**	***p***	**BL *n* = 58**	**12y *n* = 58**	***p***	**BL *n* = 56**	**12y *n* = 56**	***p***
Natural teeth, mean (SD)	24.6 (4.5)	23.0 (5.4)	0.001*	24.1 (5.2)	22.4 (6.2)	0.001*	24.9 (3.5)	23.8 (4.4)	0.001*
Range	8–32	2–32		8–32	2–32		10–31	7–31	
Total, %	95.8	95.8		87.9	87.9		87.5	87.5	
Dental implants, mean (SD)	0.2 (1.1)	0.7 (1.9)	0.004*	0.3 (1.3)	0.9 (2.3)	0.031*	0.1 (0.8)	0.5 (1.5)[a]	0.058
Range	0–6	0–9		0–6	0–9		0–6	0–9	
Total, %	4.3	14.7		4.3	13.1		3.6	16.4	
Root residuals, mean (SD)	0.04 (0.3)[a]	0.6 (0.2)	0.566	0.9 (0.4)	0.9 (0.3)	1.000	—	0.04 (0.2)[a]	0.159
Range	0–2	0–1		0–2	0–1		—	0–1	
Total, %	2.7	6.2		5.2	8.6		—	3.6	
Root fillings, mean (SD)	2.9 (2.3)[c]	2.7 (1.9)[c]	0.097	2.8 (2.1)	2.6 (2.0)	0.260	3.1 (2.4)[c]	2.8 (2.2)[c]	0.226
Range	0–10	0–9		0–9	0–8		0–10	0–9	
Total, %	83.8	86.5		82.8	87.9		84.9	84.9	
Teeth with buccal/lingual caries, mean (SD)	0.1 (0.6)[b]	0.3 (1.2)[b]	0.029*	0.1 (0.6)[a]	0.5 (1.6)[a]	0.022*	0.2 (0.6)[a]	0.2 (0.5)[a]	0.687
Range	0–4	0–11		0–4	0–11		0–3	0–2	
Total, %	7.1	14.3		7.0	17.5		7.3	10.9	
Teeth with approximal caries, mean (SD)	0.1 (0.4)[a]	0.3 (0.8)[a]	0.031*	0.1 (0.5)	0.3 (0.9)	0.040*	0.1 (0.4)[a]	0.2 (0.8)[a]	0.278
Range	0–3	0–5		0–3	0–5		0–2	0–4	
Total, %	9.7	15.0		8.6	17.2		10.9	12.7	
Having ≥ 20 teeth, *n* (%)	101 (88.6)	90 (78.9)	0.001†	49 (84.5)	44 (75.9)	0.063	52 (92.9)	46 (82.1)	0.031†

Abbreviations: — = no data; *n* = the number of individuals; SD = standard deviation; total (%) = the number (percent) of totals.
[a]One missing cases.
[b]Two missing cases.
[c]Three missing cases.
*$p < 0.05$, Paired-samples *t* test was used. Statistical significance is reported at 12-year follow-up. Edentulous individuals were not included in the analyses ($n = 5$).
†$p < 0.05$, McNemar's test was used for analyses of prevalence of at least 20 teeth or more. Statistical significance is reported at 12-year follow-up.

TABLE 3 | Clinical and radiographic findings of prevalence of probing pocket depths ≥ 5 mm and ≥ 6 mm, mean value BOP, prevalence of bone level ≥ 5 mm, prevalence of gingivitis and periodontitis, in individuals at 'baseline' = BL and '12-year follow-up' = 12 years (y), in total and by gender.

	In total			Male			Female		
Variables	**BL *n* = 114**	**12y *n* = 114**	***p***	**BL *n* = 58**	**12y *n* = 58**	***p***	**BL *n* = 56**	**12y *n* = 56**	***p***
PPD ≥ 5 mm, *n* (%)	72 (63.2)	67 (58.8)	0.533	42 (72.4)	37 (63.8)	0.332	30 (53.6)	30 (58.8)	1.000
PPD ≥ 6 mm, *n* (%)	39 (34.2)	42 (36.8)	0.736	25 (43.1)	24 (41.4)	1.000	14 (25.0)	18 (32.1)	0.503
BOP, mean (SD)	20.9 (19.2)	48.2 (26.7)	0.001*	22.1 (21.5)	45.4 (28.2)	0.001*	18.0 (16.2)	51.1 (25.1)	0.001*
Range (%)	0–94	5–100		0–94	8–100		0–63	5–100	
Bone level ≥ 5 mm, *n* (%)	64 (57.7)	80 (72.1)	0.002†	36 (62.1)	46 (79.3)	0.006†	28 (52.8)	34 (64.2)	0.180
Gingivitis, *n* (%)	42 (57.4)	78 (97.9)	0.001†	17 (48.6)	35 (100)	0.001†	25 (55.6)	43 (95.6)	0.001†
Periodontitis, *n* (%)	16 (14.0)	27 (23.7)	0.043†	13 (22.4)	17 (29.3)	0.454	3 (5.4)	10 (17.9)	0.039†

Abbreviations: n/t = number of totals; SD = standard deviation.
*$p < 0.05$, statistical significance is reported at 12-year follow-up. Paired-samples *t* test was used for analyses of BOP.
†$p < 0.05$, McNemar's test was used for analyses of prevalence of periodontal pocket depth, bone level, gingivitis, and periodontitis. Statistical significance is reported at 12-year follow-up. Calculation of PPD was on tooth level. Prevalence of PPD ≥ 5 mm and ≥ 6 mm at least one site per individual; Bone level was measured at the mesial and distal surfaces by x-ray. Prevalence of bone level ≥ 5 mm at least one site per individual. Gingivitis defined as BOP ≥ 10% of teeth. Individuals with periodontitis was excluded in calculation of gingivitis. Periodontitis defined BOP ≥ 10% + PPD ≥ 5 mm at ≥ 2 surfaces + bone loss ≥ 5 mm. Calculation of periodontitis included individuals with periodontitis at baseline and individuals with periodontitis at 12-year follow-up. In the analyses, edentulous individuals were excluded.

manifest caries after a 10-year follow-up. Dobloug and Grytten [37] reported that 87.4% of individuals aged 72 in Norway were caries-free for at least 5 years during the study period 2003–2012.

Although caries is a preventable disease, it remains the most prevalent noncontagious disease globally affecting the adult population. A systematic literature review and meta-regression analysis identified that the prevalence of caries disease, except for younger age groups, is now peaking at 70 years [38]. It is worth mentioning that the presence of root fillings in the present study had increased by 3% (not significantly) at age 72 years. Root-filled teeth primarily result from earlier caries experiences [39]. Krustrup and Petersen [40] demonstrated that earlier caries experience was one of the risk factors for an increased prevalence of more active caries in older age. We can assume that this development may also be seen as a risk factor for tooth loss as reported by Paulander et al. [32] Dental care providers play a significant role in long-term preventive care planning to ensure that contact with dental care is not lost when obstacles arise for various reasons in older individuals [41]. These actions may result in controlling risk factors and preventing caries lesions.

In this study, the prevalence of periodontitis at 72 years was 23.7%. A systematic review and meta-regression analysis reported the prevalence of periodontitis to increase with age, affecting approximately 30% of individuals at age of 70 years [42], which is consistent with our findings. However, Nilsson, Sanmartin Berglund and Renvert [43] reported a higher proportion, 39%, of older individuals with periodontitis after a 12-year follow-up. There might be several explanations for this discrepancy. Nilsson, Sanmartin Berglund and Renvert [43] performed examination on individuals aged 60–81 years and older, defining periodontitis as having at least two sites with a distance ≥ 5 mm from the CEJ to the marginal bone level and at least one tooth with pockets ≥ 5 mm. In contrast, the definition of periodontitis used in the present study was determined to be BOP ≥ 10% + PPD ≥ 5 mm at ≥ 2 teeth + bone loss ≥ 5 mm which may account for the differences in prevalence between our studies. However, a study conducted in Japan by Furuta et al. [44] reported a significant decrease in periodontitis after 10 years in individuals aged 40–79 who were examined in 2007, 2012, and 2017. A possible explanation for the disparities could be the differences in the methods of periodontal examination between their study and ours. Furuta et al. [44] only conducted periodontal examination on half of the mouth and used two different periodontal definitions, which may have led to an underestimation of periodontitis in their study. It has been determined that periodontal examination needs to include all teeth and tooth surfaces because periodontitis can affect not only single teeth or surfaces but can be widespread throughout the dentiotion [45]. The aforementioned discrepancies could potentially explain the decreased prevalence of periodontitis in their study compared to ours.

Regarding periodontitis, we observed a significant increase in the prevalence of bone loss, while simultaneously, the proportion of deeper PPD did not increase, which is consistent with findings from other studies [43, 46]. Billings et al. [46] found that bone loss was an effect of the increased recession, especially in older individuals, which may explain why the prevalence of deeper PPD did not increase in the present study. However, it cannot be ignored that approximately 60% of individuals had at least

one PPD ≥ 5 mm at 12-years follow-up and 37% had PPD ≥ 6 mm. Deeper pockets, combined with bone loss and increased BOP indicate the presence of periodontal instability [47, 48].

The dental profession plays a crucial role in preventing periodontitis [45], especially considering that older populations are retaining natural dentitions today, which has a positive impact on the periodontal bone health [49]. Regular periodontal examination in older individuals can help identify risk factors and maintain good oral stability well into their old age. Individuals with periodontitis not only require routine periodontal treatment but also need to receive supportive information and instructions on oral self-care regularly. In this regard, the dental hygienists play an important role.

The present study found several gender differences. Analyses revealed that males exhibited a higher prevalence of dental implants, more manifest buccal/lingual and approximal caries lesions, and greater bone loss. This finding, particularly the higher prevalence of caries in males compared to females, aligns with results from other Scandinavian studies [40, 50]. Conversely, females in the present study showed a decreased prevalence of ≥ 20 teeth, and an increase in periodontal diseases contrasting with studies that reported males to be more affected [51, 52]. The reasons for these gender differences in the present study are unclear. It is important to note that the prevalence and progression of periodontal diseases are linked to host interaction with oral microbiota and hormones play a significant role in immune response [53]. Hormonal-related events with advancing age such estrogen deficiency may potentially explain why periodontal disease could be more prevalent in females [54]. However, dental care need to consider gender differences and adapt strategies to prevent the development of periodontal diseases in older females. Additionally, further research is needed to seek answers, as data regarding this area are lacking as noted in studies elsewhere [15, 55].

The primary strength of this study was the ability to longitudinally investigate the same randomly selected individuals over a period of 12 years. Additional strengths included the consistent use of the same study protocol over the years, full-mouth examinations conducted by calibrated dental hygienists, and a 62% reexamination rate of total participants at the 12 years follow-up. Orthopanoramic radiograph used to measure bone loss was evaluated before [56]. Another strength was that the measurement of bone loss was performed by a single periodontics. This study also has some limitations that need to be considered. Panoramic radiographs were used to examine the presence of manifest approximal caries lesions, which may have led to an underestimation of manifest caries. A combination of intraoral and panoramic radiographs would have provided more accurate information.

Consequently, minor changes have occurred in the oral health status over time. One observation from this study is that individuals at age of 72 years maintain their natural teeth. Despite this positive trend, it should be considered that individuals will continue to age and may eventually become dependent on care, which poses risks for lost contact with the dental care [16, 50] and poorer oral health. The results of this epidemiological study can contribute to a better understanding for both dental professions as for other care actors about changes in oral health status over time in older populations. This, in turn, can lead to more effective and targeted strategies to promote lifelong oral health and ensure that oral health needs are regularly addressed regardless of older age and functional disability.

5 | Conclusion

The present study indicates that oral health status in 60-year-old individuals deteriorates over 12 years. However, the deteriorations were minor in terms of tooth loss, caries lesions and changes in periodontal status.

Author Contributions

All authors were involved of the study design. S.C., V.W.B., and P.A. performed material preparation and analysis. The manuscript drafting and design of tables and figure was led by S.C. During the drafting process all authors revised the manuscript and gave approval for final version of the manuscript. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

This study uses data from the Swedish National Study on Aging and Care (SNAC), Blekinge (supported by The Ministry of Health and Social Affairs). Specifically, the following SNAC B databases have been included: DATABASE_BAS1, DATABASE_Re-Examination 12 year. The data are not publicly available due to privacy and ethical restrictions.

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