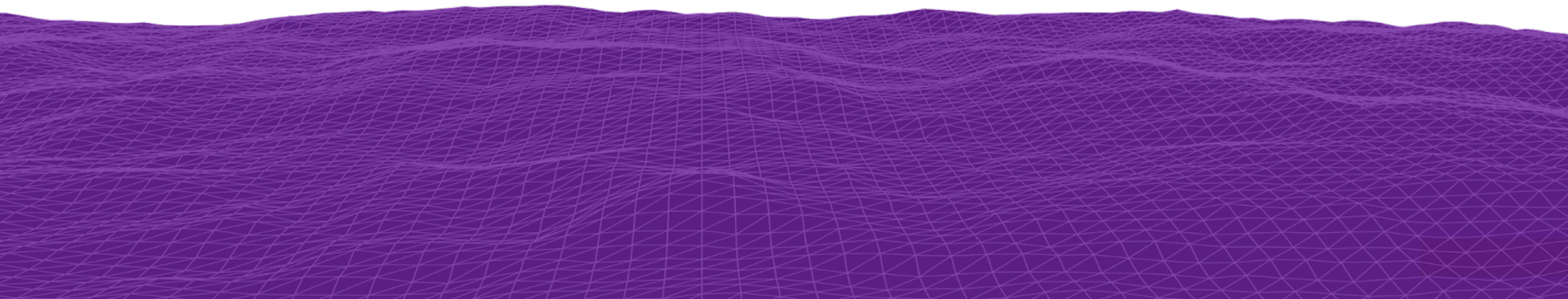


Studies

Linking Oral Care to Health & Mortality

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Correlation Between Oral Health & Mortality

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Oral factors	How it affect mortality	Reference
Tooth number	Maintaining a larger number of teeth results in an extension of life expectancy Reports showed a link between number of teeth and cardiovascular disease (CVD), a leading cause of death	The conclusion is based on 36 studies from 5,766 articles regarding the number of teeth and life expectancy and 2,548 articles regarding dental prosthesis and life expectancy on PubMed, see table 1 in the appendix.
Mastication	The higher the subjective masticatory function, the longer the life-span	The conclusion is based on 15 studies from PubMed and ICHUSHI(top medical publication database in Japan), see table 2 in the appendix.
Periodontal Disease	The risk of death was higher in those persons having at least 3 teeth with PD of 6 mm or more than in those persons having 0 to 2 teeth with a PD of 6 mm or more	The conclusion is based on 6 studies from PubMed and ICHUSHI, see table 3 in the appendix. The American Heart Association (AHA) published similar research in 2012 on the relation between periodontal disease and cardiovascular diseases (atherosclerotic disease)
Oral Care: Brush, floss, denture cleaning, dental office visit	Risk of death was significantly higher in persons having inadequate oral care habits	See table 4 in the appendix.

References

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Name	Author	Country	Subjects	Follow-up Period	Main results (mortality), HR, OR (95% CI)
Relationship between survival rates and numbers of natural teeth in an elderly Japanese population. Gerodontology 2006, 23: 214-218	Morita et al	Japan	Aged 80 years n=118	10 years	All cause mortality 20 teeth group VS. <20 teeth group 78-month follow-up Male HR2.71 95%CI: 1.05-7.05) Female NS
Dental status and mortality in institutionalized elderly people. Geriatr Gerontol Int 2006, 6: 101-108	Ohruai et al.	Japan	Aged 82.8± 7.7 years n=403	5 years	All-cause mortality Natural teeth only or natural teeth with partial denture group VS. edentate with or without dentures group 2-year follow-up HR 1.84 (95%CI 1.01-3.36) 5-year follow-up HR 1.30 (95%CI 0.90-1.88)
Denture use, malnutrition, frailty, and mortality among older women living in the community. J Nutr Health Aging. 2006 Mar-Apr; 10(2): 161-167	Semba et al.	USA	Aged 70-79 years n=826 female	5 years	All-cause mortality no denture group VS. denture wearer group with difficulty chewing or swallowing HR 1.43 (95%CI 1.05-1.97)
Functional tooth number and 15-year mortality in a cohort of community-residing older people, Geriatr Gerontol Int 2007; 7: 341-347	Fukai et al.	Japan	Aged 40-89 years n=5,830	15 years	All-cause mortality 10 functional teeth group VS. <10 functional teeth group Male HR 1.33 (95%CI 1.11-1.59), Female NS CVD mortality Male p<0.05, Female NS Cancer mortality, pneumonia mortality, cerebrovascular mortality Male NS Female NS
Number of teeth--a predictor of mortality in the elderly? A population study in three Nordic localities. Acta Odontol Scand 2007 Nov; 65(6): 335-340	Osterberg et al.	Denmark	Aged 75 years n=1,004	7 years	All-cause mortality Female HR 0.87 (95%CI 0.78-0.97) Male NS
Associations between tooth loss and mortality patterns in the Glasgow Alumni Cohort. Heart 2007; 93(9): 1098-1103. (Epub 2006 Dec 12.)	Tu et al.	UK	Aged 16-30 years (median age 19 years) n=12,223	57 years	All-cause mortality Number of missing teeth as either continuous HR1.01(95%CI: 1.00-1.02) CVD mortality number of 0-4 missing teeth group VS. number of 9 teeth group HR 1.35 (95%CI 1.03-1.77) Cancer mortality NS

References

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Name	Author	Country	Subjects	Follow-up Period	Main results (mortality), HR, OR (95% CI)
The association between tooth loss and coronary heart disease in men and women. J Public Health Dent 2004 Fall; 64(4): 209-215	Hung et al.	USA	Male Aged 40-75years n=41,407 Female Aged 30-55years n=58,974	Male 12 years Female 6 years	CHD mortality Group of 25-32 functional teeth VS. Male 17-24 teeth HR 1.26 (95%CI 1.01-1.57) 11-16 teeth HR 1.19 (95%CI 0.79-1.80) 0-10 teeth HR 1.79 (95%CI 1.34-2.40) Female 17-24 teeth HR 1.02 (95%CI 0.66-1.55) 11-16 teeth HR 1.07 (95%CI 0.55-2.05) 0-10 teeth HR 1.6 (95%CI 1.11-2.46)
Tooth loss is associated with increased risk of total death and death from upper gastrointestinal cancer, heart disease, and stroke in a Chinese population-based cohort. Int J of Epidemiol 2005; 34: 467-474	Abnet et al.	China	Aged 40-69 years n=29,584 [followers: 28,790]	15 years	Number of age-specific missing teeth (median) group VS Number of age-specific missing teeth (median) group All-cause mortality RR 1.13 (95%CI: 1.09-1.18) Heart disease mortality RR 1.28 (95%CI 1.17-1.40) Stroke mortality RR 1.11 (95%CI 1.01-1.23)
Can the relation between tooth loss and chronic disease be explained by socio-economic status? A 24-year follow-up from the population study of women in Gothenburg, Sweden. Eur J Epidemiol 2005; 20(3): 229-236	Cabrera et al.	Sweden	Aged 38-60 years n=1,462 female	24 years	All-cause mortality <=10 missing teeth group VS. >=11 missing teeth group HR 1.27 (95%CI: 1.09-1.47) CVD mortality HR 1.34 (95%CI 1.05-1.71) Cancer mortality NS
Hämäläinen P, Meurman JH, Kauppinen M, Keskinen M. Oral infections as predictors of mortality. Gerodontology 2005 Sep; 22(3): 151-157	Hämäläinen et al.	Finland	Aged 85 years n=94	5 years	All-cause mortality Small number of remaining teeth group VS. high number of remaining teeth group HR 0.939 (95%CI 0.884-0.998)
Eight-year mortality associated with dental occlusion and denture use in community-dwelling elderly persons. Gerodontology 2005 Dec; 22(4): 234- 237	Yoshida et al.	Japan	Aged 65 years n=1,030	8 years	All-cause mortality No occlusal contact group VS. functionally adequate occlusal contact group HR 0.78(95%CI: 0.60-0.99) No occlusal contact with denture group VS. no occlusal contact with no denture group HR 1.52 (95%CI: 1.25-1.83)

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Name	Author	Country	Subjects	Follow-up Period	Main results (mortality), HR, OR (95% CI)
Dental status, quality of life, and mortality in an older community population: a multivariate approach. J Am Geriatr Soc 1997 Nov; 45(11): 1315-1323	Appollonio et al.	Italy	Aged 70-75 years, n=1,303 [followers: 1,201]	10 years	All-cause mortality Naturally adequate dental status group VS. denture wearing group HR 1.34 (95%CI 1.06-1.70) Naturally inadequate dental status and subjects without dentures HR 1.51 (95%CI 1.11-2.05)
Influence of dentition status on physical disability, mental impairment, and mortality in institutionalized elderly people, J Dent Res 2001; 80: 340- 345	Shimazaki et al.	Japan	Aged 79.7± 7.5 years n=1,929	6 years	20 teeth group VS. edentate without denture wearing group OR 1.8 (95%CI 1.1-2.8)
Relationship between oral health and mortality rate. Journal of Clinical Periodontol 2002; 29: 1029-1034	Jansson et al.	Sweden	Aged 18-66 years n=1,393	26 years	All-cause mortality comparison the means for number of remaining teeth (aged 18-30, 31-40, 41-50, 51-60, 61-66 years) between survival and death during the 26 years, For all groups of age, median for number of remaining teeth survival death
Relationship between dental health and 10-year mortality in a cohort of community-dwelling elderly people. Eur J Oral Sci 2003; 111: 291-296	Hämäläinen et al.	Finland	Aged 80 years, n=226	10 years	Number of missing teeth HR 1.026 (95%CI: 1.002-1.051)
Oral health indicators poorly predict coronary heart disease deaths. J Dent Res 2003 Sep; 82(9): 713-718	Tuominen et al.	Finland	Aged 30- 39years, n=6,527	12 years	CHD mortality Group of 25 natural functional teeth VS. Male 11-24 teeth RR 0.8 (95%CI 0.5-1.3) , 0-10 teeth RR 0.9 (95%CI 0.5-1.6) Female 11-24 teeth RR 0.5 (95%CI 0.2-1.8) , 0-10 teeth RR 0.3 (95%CI 0.1-1.0)
Loss of teeth and coronary heart disease. Int J Prosthodont 2004 Jul- Aug; 17(4): 441-446	Ragnarsson et al.	Iceland	Aged 25-74 years, n=2,613	8-15 years	All-cause mortality Number of teeth HR 0.987 (95%CI 0.975-0.999) edentate HR 1.30 (95%CI 1.05-1.64) CVD mortality number of teeth NS edentate HR 1.70 (95%CI 1.03-2.81)

References

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Name	Author	Country	Subjects	Follow-up Period	Main results (mortality), HR, OR (95% CI)
Findings in a Swedish cohort of 80+ years at baseline. Community Dent Oral Epidemiol 2009 Aug; 37(4): 325-332. doi: 10.1111/j.1600-0528.2009.00467.x	Thorstensson et al.	Sweden	>=80 years (median 86 years) n=357	8	Number of teeth: NS DFS: p = 0.03(Kaplan Meier)
Complete edentulism prior to the age of 65 years is associated with all-cause mortality. J Public Health Dent 2009 Fall; 69(4): 260-266. doi: 10.1111/ j.1752-7325.2009.00132.x	Brown	USA	>= 18 years N = 41,000	16	All-cause mortality Aged 18-64 years RR 1.5 (95%CI 1.13-1.7) Aged 265 years RR 1.3(95%CI 1.2-1.4)
Dental health and longevity. Geriatr Gerontol Int 2010; 10: 275-276	Fukai et al.	Japan	Aged 65-74 years	30 years every 6 years (in 1975, 1981, 1987, 1993, 1999, and 2005)	Male r=0.962 Female r=0.916
Relationship between tooth loss and mortality in 80-year-old Japanese community-dwelling subjects. BMC Public Health 2010 Jul 1; 10: 386. doi: 10.1186/1471-2458-10-386	Ansai et al	Japan	Aged 80 years n=1,282 [followers: 697]	4-5.5 years	4-year follow-up Female OR 0.937 (95%CI 0.889-0.987) Male NS 5.5-year follow-up Female OR 0.946 (95%CI 0.907-0.987) Male NS
Number of teeth as a predictor of cardiovascular mortality in a cohort of 7,674 subjects followed for 12 years. J Periodontol 2010 Jun; 81(6): 870-6. doi: 10.1902/jop.2010.090680	Holmlund et al.	Sweden	Aged 20-89 years n=7,674	12 years (0.2-29 years)	All-cause mortality >=26 teeth group VS. 20-25 teeth HR 1.56(95%CI 1.15-2.13) 15-19 teeth HR 2.33(95%CI 1.66-3.27) 10-14 teeth HR 2.11(95%CI 1.44-3.10) <10 teeth HR 2.75(95%CI 1.81-4.16) CVD mortality 20-25 teeth HR 1.94(95%CI 1.21-3.10) 15-19 teeth HR 3.13(95%CI 1.89-5.17) 10-14 teeth HR 3.41(95%CI 1.98-5.86) >10 teeth HR 4.41(95%CI 2.47-7.85)

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Name	Author	Country	Subjects	Follow-up Period	Main results (mortality), HR, OR (95% CI)
Association between tooth loss and orodigestive cancer mortality in an 80-year-old community-dwelling Japanese population: A 12-year prospective study. BMC Public Health 2013 Sep 8; 13: 814. doi: 10.1186/1471-2458-13-814	Ansai et al	Japan	Aged 80 years n=1,282 [followers: 697]	12 years	Total cancer mortality NS Orodigestive cancer HR 1.06 (95%CI: 1.01-1.13) CVD mortality NS Pneumonia mortality NS
Missing, unplaced teeth and risk of all-cause and cardiovascular mortality. Int J Cardiol 2013 Aug 20; 167(4): 1430-1437	Schwahn et al.	Germany	Aged 64 years (median) n=1,803	9.9 years	All-cause mortality 10-19 remaining teeth group 0-8 unreplaced teeth VS. 09 unreplaced teeth HR 2.19 (95%CI:1.19-4.01) CVD mortality 1-9 remaining teeth group 0-8 unreplaced teeth VS. 29 unreplaced teeth HR 4.11 (95%CI: 1.76-9.50)
Removable dental prostheses and cardiovascular survival: A 15-year follow- up study. J Dent 2013 Aug; 41(8): 740-746. doi: 10.1016/j.jdent.2013.05.009. Epub 2013 Jun 11	Janket et al.	Finland	Aged 60 (median) years n=256	15 years	All-cause mortality NS CVD mortality Edentulous group VS. 221teeth HR 0.40 (95%CI:0.18-0.90)
Associations of number of teeth with risks for all-cause mortality and cause-specific mortality in middle-aged and elderly men in the northern part of Japan: The Iwate-KENCO study. Community Dent Oral Epidemiol 2014; 42(4): 358-365	Ando et el.	Japan	Aged 40-79 years n=7,779 Male	5.6 years	Aged 40-79 years All-cause mortality Aged 40-64 years All-cause mortality 220 teeth group VS edentulous group 10-19 teeth group Cancer mortality 220 teeth group VS edentulous group CVD mortality 220 teeth group VS edentulous group 1-9 teeth group 10-19 teeth group NS HR2.75 (95%CI: 1.37-5.49) HR 1.94 (95%CI: 1.09-3.43) H R4.06 (95%CI: 1.43-11.5) HR9.40 (95%CI: 1.86-48.6) HR5.34 (95%CI: 1.11-25.6) H R4.35 (95%CI: 1.07-1 7.7)

References

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Name	Author	Country	Subjects	Follow-up Period	Main results (mortality), HR, OR (95% CI)
Critical tooth number without subjective dysphagia. Geriatr Gerontol Int 2011 Oct; 11(4): 482-487. doi: 10.1111/j.1447-0594.2011.00722.x. Epub 2011 Jun 27	Fukai et al.	Japan	Aged 40-89 years n=5,643	15 years	All-cause mortality < gender and age specific, number of critical functional teeth group VS. number of critical teeth group Male HR 0.72 (95%CI 0.55-0.93) Female HR 0.71 (95%CI 0.51-0.99)
Oral health and cancer, cardiovascular, and respiratory mortality of Japanese. J Dent Res 2011 Sep; 90(9): 1129-1135. doi: 10.1177/0022034511414423. Epub 2011 Jul 5	Aida et al.	Japan	Aged >65 years n=18,936	4.28 years	>=20 teeth group VS <=19 teeth & restricted eating group CVD mortality HR 1.83 (95%CI 1.12-2.98) Respiratory mortality HR 1.85 (95%CI 1.09-3.14) Cancer mortality NS
Dental health behaviors, dentition, and mortality in the elderly: The Leisure World Cohort Study. J Aging Res 2011; 1560-1561	Paganini-Hill	USA	Aged 52- 105 yers n=5	17 years (median 9 years)	All-cause mortality 26-32 teeth group VS, 1-15 teeth group male HR 1.21 (95%CI 1.05-1.40), female HR1.17(95%CI 1.06- 1.30) 0 teeth group male HR 1.18(95%CI 1.00-1.39), female HR 1.21(95%CI 1.07-1.37)
Tooth loss and cardiovascular disease mortality risk--results from the Scottish Health Survey. PLoS One 2012; 7(2): e30797. doi: 10.1371/journal.pone.0030797. Epub 2012 Feb 20	Watt et al	Scotland	Aged 1.35 (SD 48.7± 10.6) years n=12,871	8 years (SD3.3 years)	All-cause mortality Chewing with only natural teeth group VS. Edentate group i 1.65 (95%CI 1.31-2.07) CVD mortality IIR 1.76(95%CI: 1.19-2.59) Cancer mortality NS
Tooth loss and mortality in elderly Japanese adults: Effect of oral care. J Am Geriatr Soc 2013 May; 61(5): 815-820. doi: 10.1111/jgs.12225. Epub 2013 Apr 16	Hayasaka et al	Japan	Aged >65 years n=21,730	4 years	All-cause mortality 220 teeth group VS. 10-19 teeth (no denture) HR 1.34 (95%CI:1.09-1.64) 0-9 teeth (no denture) HR 1.73 (95%CI:1.47-2.04)

References

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Name	Author	Country	Subjects	Follow-up Period	Main results (mortality), HR, OR (95% CI)
Number of teeth--a predictor of mortality in 70-year-old subjects. Community Dent Oral Epidemiol 2008; 36(3): 258-268	Osterberg et al.	Sweden	Aged 70 years 7-year follow-up n=1803 18-year follow-up n=1,381	7 years and 18 years	Edentulous no teeth group VS. All-cause mortality 7 years follow-up, Female HR 0.97 Male HR 0.96 (95%CI 0.94-0.98) 18 years follow-up, Female NS Male HR 0.97(95%CI: 0.97-0.99)
Number of teeth and mortality risk in the Baltimore Longitudinal Study of Aging. J Gerontol A Biol Sci Med Sci 2008 Jul; 63(7): 739-744	Pdihia et al.	USA	Aged 57.46 ±17.37 years n=500	15-year 5-month(±90 months)	All-cause mortality >= 20 teeth group VS.1-19 teeth group HR 2.17 (95%CI 1.50-3.13) 0 teeth HR 1.76 (95%CI 1.04-2.98)
Tooth loss and subsequent disability and mortality in old age. J Am Geriatr Soc 2008, 56: 429-435	Holm-Pedersen et al.	Denmark	Aged 70, 75, 80, 85, 90 years n=573	21 years	All-cause mortality >= 20 teeth group VS.0 teeth edentulous HR 1.26(95%CI: 1.03-1.55)
Mortality rates of community-residing adults with and without dentures, Geriatr Gerontol Int 2008; 8 152-159	Fukai et al.	Japan	Aged 40 89 years n=5,688	15 years	All-cause mortality <=10 teeth without denture wearing group VS. <=10 teeth with denture wearing group Male NS Female HR 0.72(95%CI: 0.58-0.91)
Oral health and mortality risk from pneumonia in the elderly. J Dent Res 2008 Apr; 87(4): 334-339	Awano et al.	Japan	Aged 80 years N = 697	4 years	All-cause mortality Edentulous group VS. 1-9 teeth NS 10-19 teeth NS >20 teeth NS Pneumonia mortality 1-9 teeth, >10 teeth and no periodontal pocket VS. 1-9 teeth (periodontal pocket) HR 3.9 (95%CI 1.1-13.9) >10 teeth (periodontal pocket) HR3.9(95%CI :1.1 -13.9)

References

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Name	Author	Country	Subjects	Follow-up Period	Main results (mortality), HR, OR (95% CI)
Number of teeth--a predictor of mortality in 70-year-old subjects. Community Dent Oral Epidemiol 2008; 36(3): 258-268	Osterberg et al.	Sweden	Aged 70 years 7-year follow-up n=1803 18-year follow-up n=1,381	7 years and 18 years	Edentulous no teeth group VS. All-cause mortality 7 years follow-up, Female HR 0.97 Male HR 0.96 (95%CI 0.94-0.98) 18 years follow-up, Female NS Male HR 0.97(95%CI: 0.97-0.99)
Relationship between self-assessed masticatory disability and 9-year mortality in a cohort of community-residing elderly people. J Am Geriatr Soc 2005; 53: 54-58	Nakanishi et al.	Japan	1,405 community residents aged 65 years or more Male: 564 Female: 841	9 years	HR, 1.63 (1.30- 1 2.03)
Eight-year mortality associated with dental occlusion and denture use in community-dwelling elderly persons. Gerodontology 2005; 22: 234-237	Yoshida et al.	Japan	1,030 females aged 65 years or more	8 years	A:HR, 0.78 (0.6-0.99) B: HR, 1.08 (0.85-1.36) C:HR, 1 [more detailed for C: using dentures vs. not using dentures: HR, 1.52 (1.25-1.83)]
Denture use, malnutrition, frailty, and mortality among older women living in the community. J Nutr Health Aging 2006; 10: 161-167	Semba et al.	Maryland	826 females aged 70-79 years	5 years	HR, 1.43 (1.05-1.97)
Chewing problems and mortality in older adults in home care: results from the aged in home care study. J Am Geriatr Soc 2007; 55: 1961-1966	Onder et al.	European countries	2,755 people (mean age: 82 years)	1 year	Risk of death was 1.45 to 1.62 times higher in subjects with mastication problems than those without mastication problems
Chewing ability in conjunction with food intake and energy status in later life affects survival in Taiwanese with the metabolic syndrome. J Am Geriatr Soc 2010; 58: 1072-1080	Lee et al.	Taiwan	1,410 community residents aged 65 years or more Male:729, Female: 681	8 years	Decreased masticatory function with MS 5 parameters vs satisfactory masticatory function without MS 5 parameters: HR, 1.65 (1.11-2.46) For MS 3 parameters: HR, 2.58 (1.58- 4.23)



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