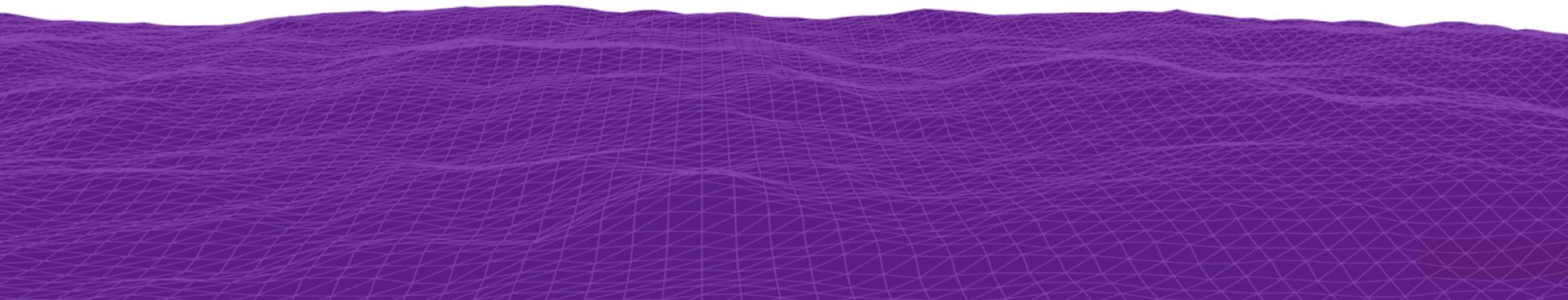


Studies

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) |

References

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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 teethHR 3.41(95%CI 1.98-5.86) >10 teeth HR 4.41(95%CI 2.47-7.85) |

References

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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 al. | 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: 1.07-17.7) |

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. <i>Geriatr Gerontol Int</i> 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. <i>J Dent Res</i> 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. <i>J Aging Res</i> 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. <i>PLoS One</i> 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. <i>J Am Geriatr Soc</i> 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 flow-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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