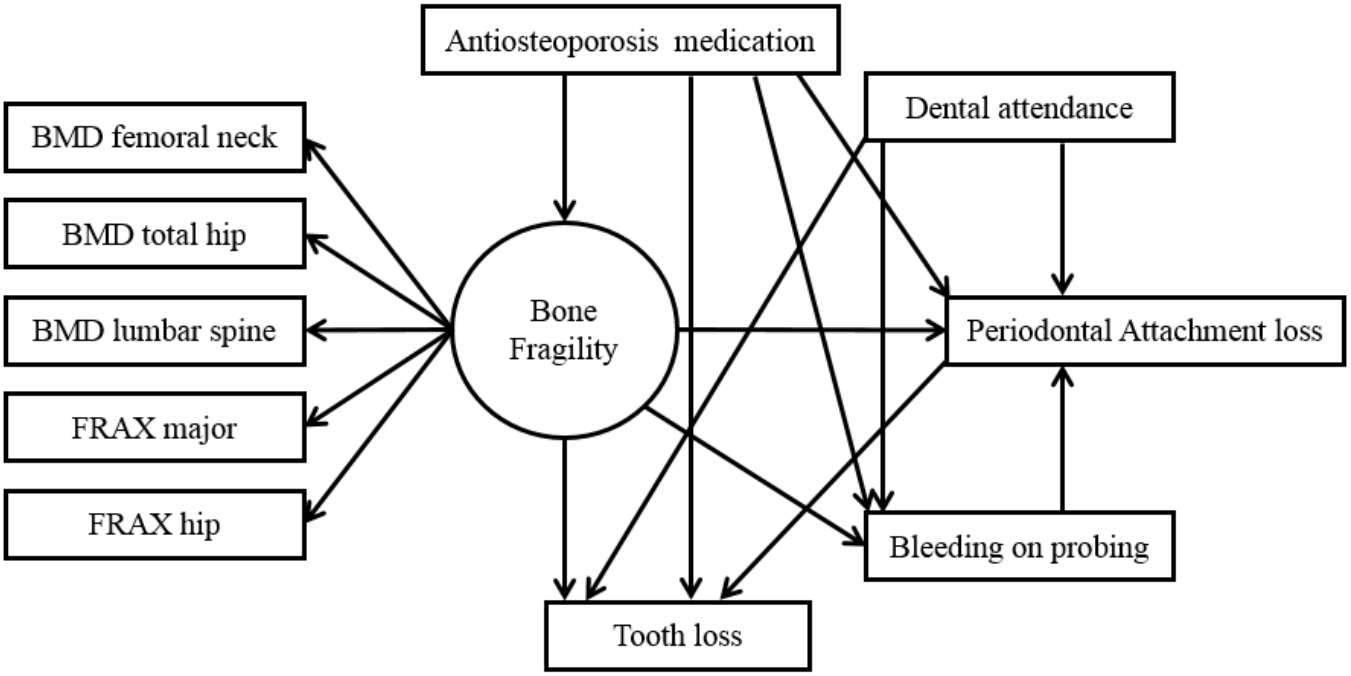
Effects of Bone Fragility and Antiresorptive Drugs on Periodontal Disease and Tooth Loss: A Longitudinal Study

D.C. Penoni, A.T.T. Leão, S.R. Torres, M.L.F. Farias, T.M. Fernandes, M. Crivelli, and M.V. Vettore

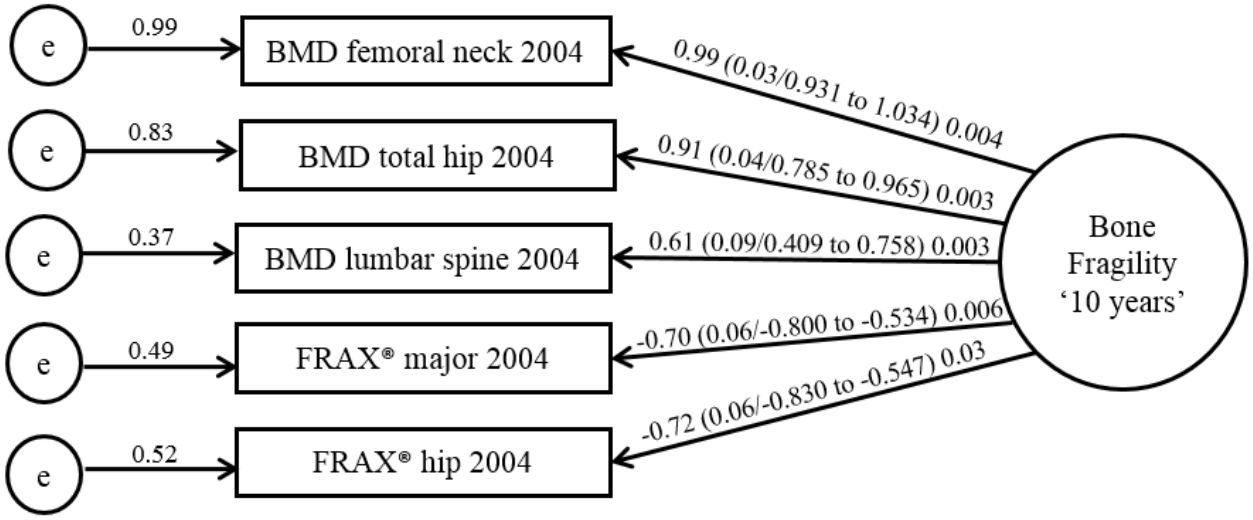
Appendix

Appendix Figure 1. Full theoretical model of the relationship between bone fragility and periodontal attachment loss.

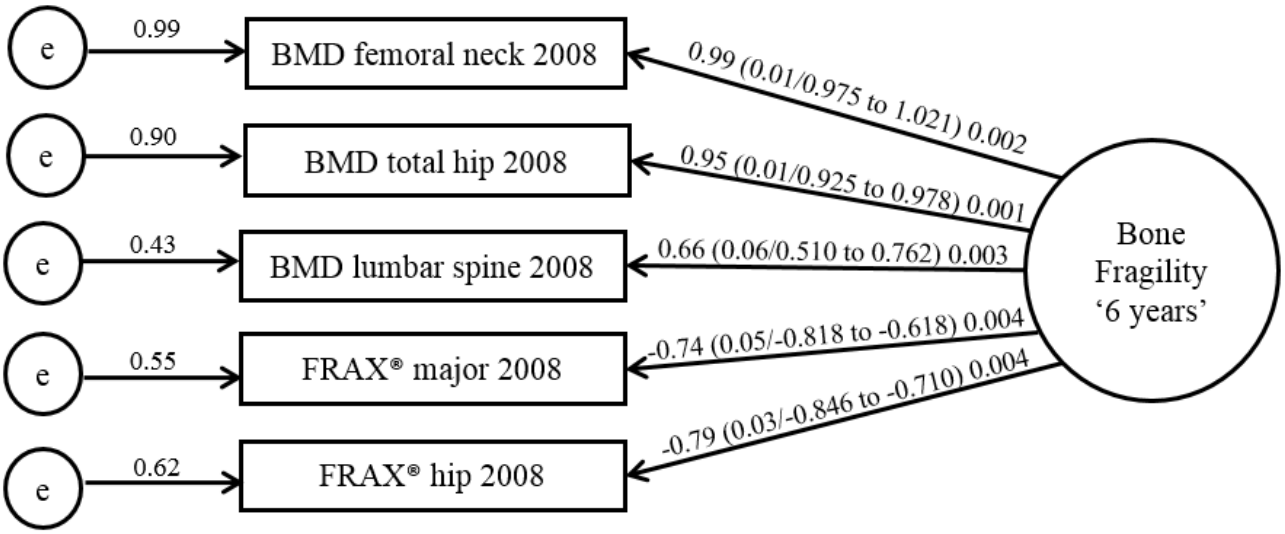


Appendix Figure 2. Confirmatory factor analysis of the factor of 5 variables (measurement model) obtained through bootstrap item loadings according to period of analysis

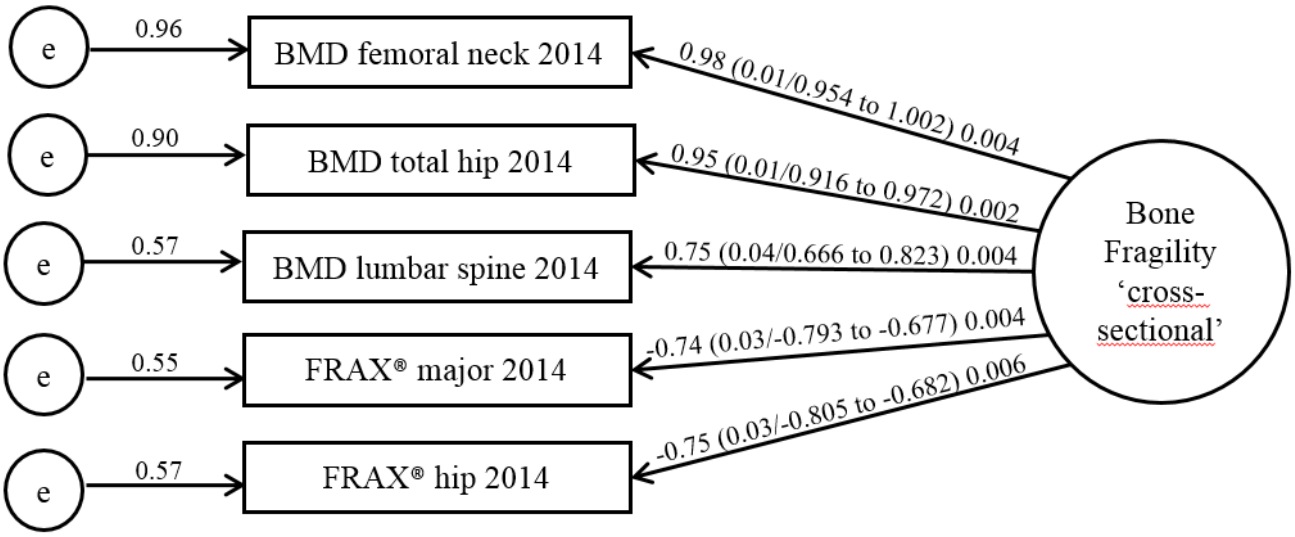
A. '10 years analysis'



B. '6 years analysis'



C. 'Cross-sectional analysis'



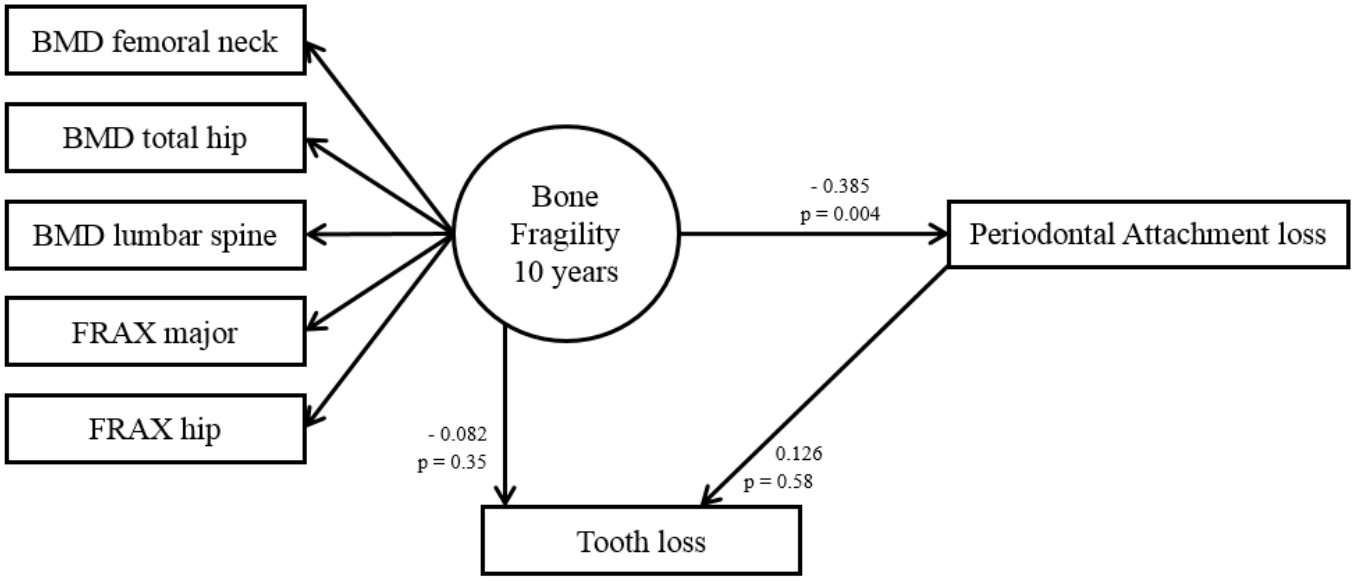
Paths in the right side: data expressed as β (standardized direct effect). In parenthesis: standard-error, lower and upper bounds, followed by p-values.

Paths in the left side: R^2 (squared multiple correlations)

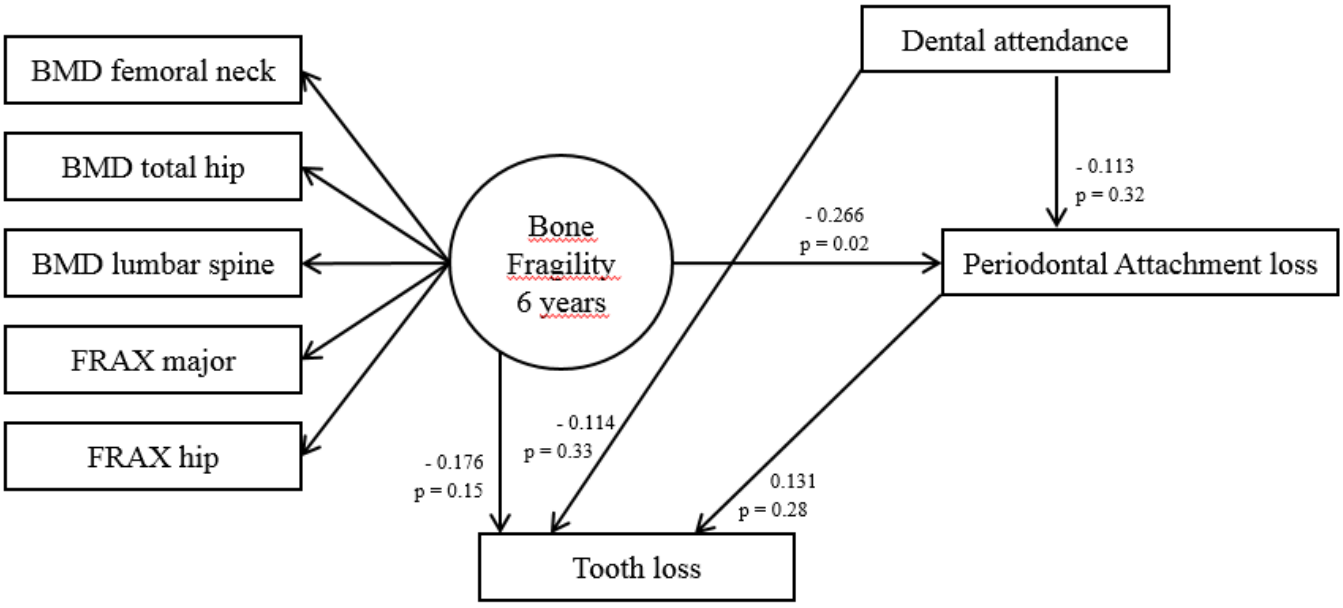
BMD: bone mineral density

Appendix Figure 3. Full models for the three periods of analysis.

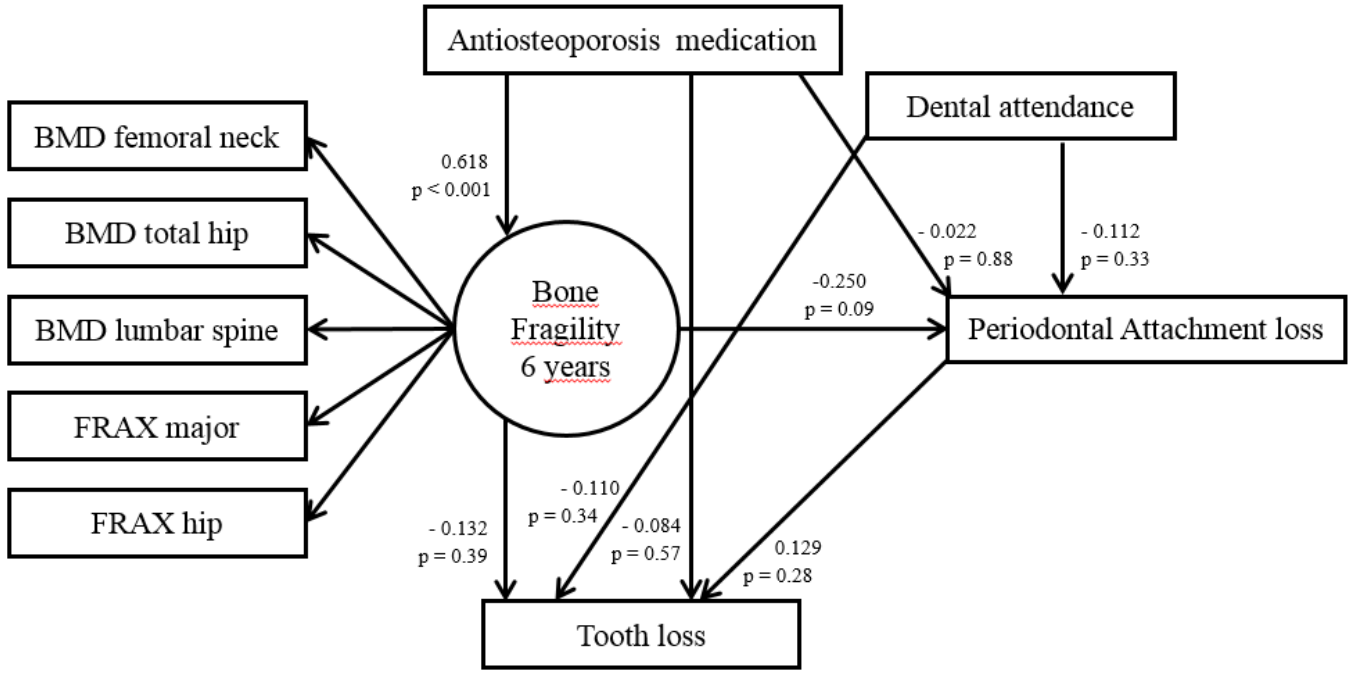
A- Ten years analysis



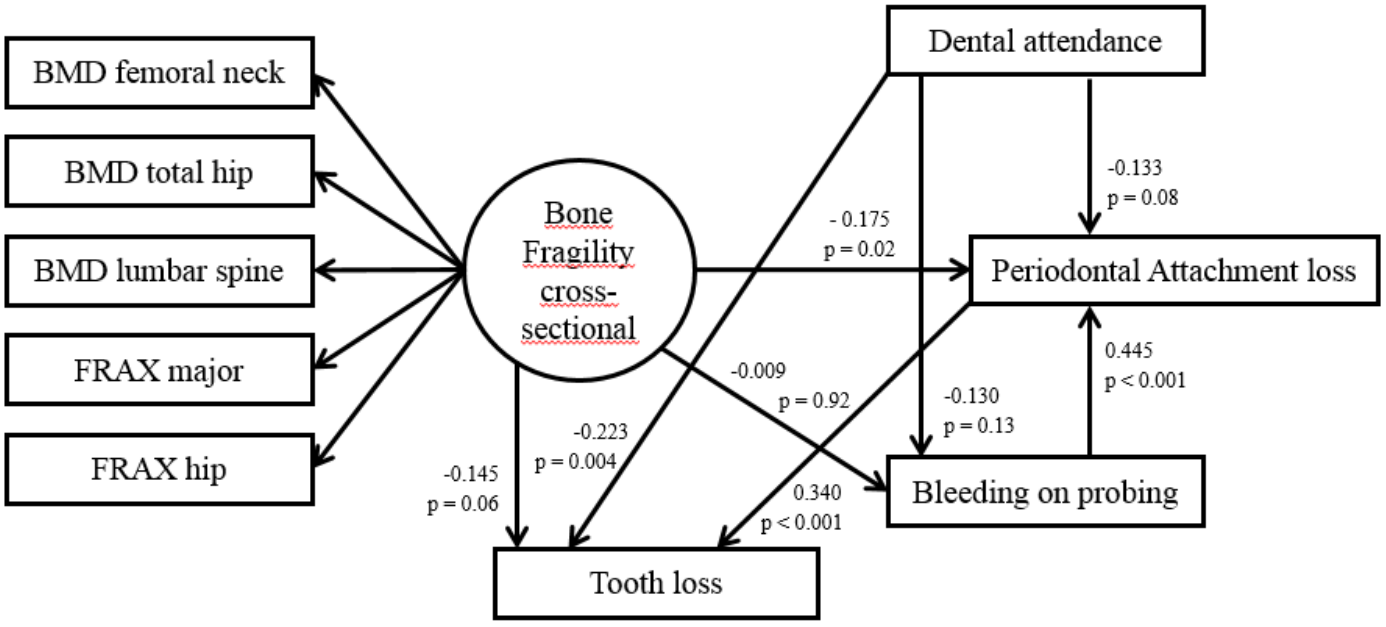
B1- Six years analysis without antiosteoporosis medication



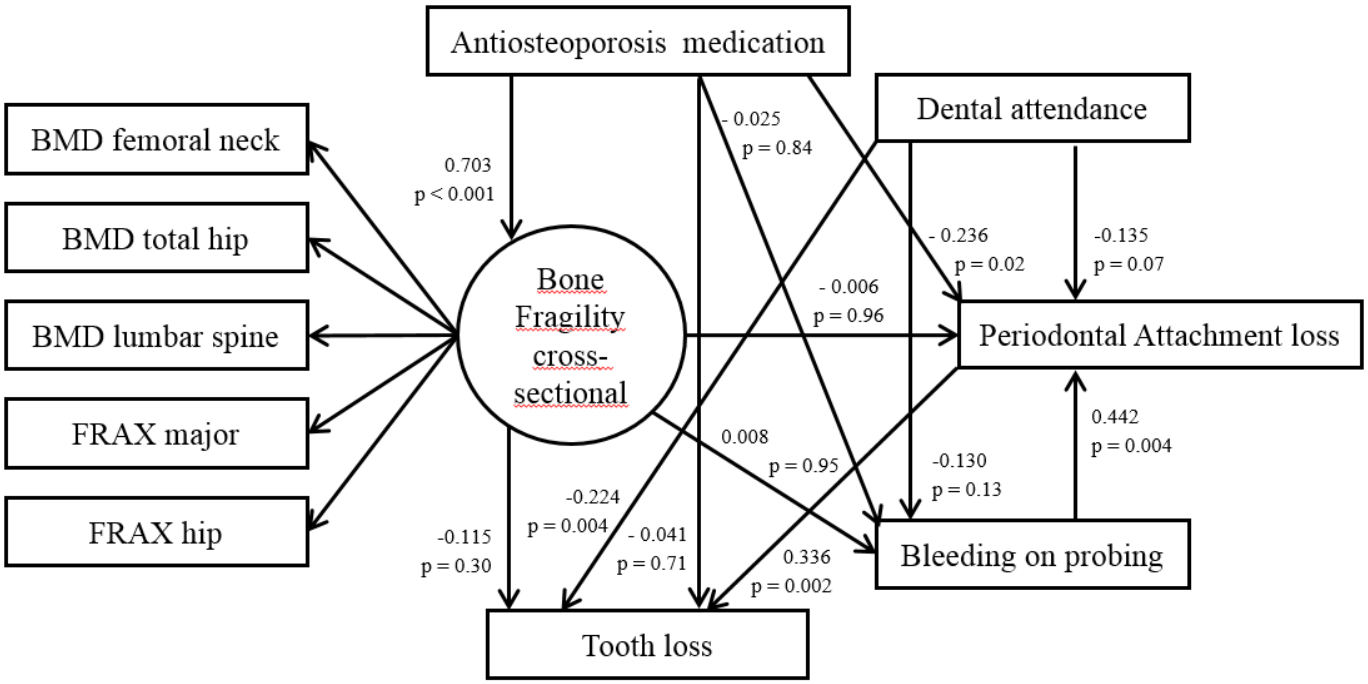
B2- Six years analysis with antiosteoporosis medication



C1- Cross-sectional analysis without antiosteoporosis medication



C2- Cross-sectional analysis with antiosteoporosis medication



Values presented in the paths are the standard direct effects (β) followed by the *p-values.*

Appendix Table 1. Fit indices for full and parsimonious models

Model	SRMR	x^2/df Ratio	GFI	CFI	RMSEA
10 years					
Full model	0.04	0.54	0.97	1.00	0.00
Parsimonious model	0.03	0.66	0.97	1.00	0.00
6 years					
Full model	0.05	1.48	0.91	0.98	0.08
Parsimonious model	0.03	1.14	0.95	0.99	0.04
Full model without bone medication	0.05	1.18	0.94	0.99	0.05
Parsimonious model without bone medication	0.03	0.71	0.97	1.00	0.00
Cross-sectional					
Full model	0.04	1.17	0.96	1.00	0.04
Parsimonious model	0.07	1.20	0.95	0.99	0.04
Full model without bone medication	0,04	1.04	0.96	1.00	0.02
Parsimonious model without bone medication	0.08	1.21	0.95	0.99	0.04

SRMR: standardised root-mean-squared residual; x^2/df: chi-square and degrees of freedom; GFI: goodness-of-fit statistics; CFI: comparative fit index; RMSEA: root-mean-square error of approximation.

A x2/df ratio < 3.0, root-mean-square error of approximation (RMSEA) values close to 0.06, comparative fit index (CFI) and goodness-of-fit statistics (GFI) of 0.90 or above and a standardised root-mean-squared residual (SRMR) <0.08 indicated an acceptable model fit.

Appendix Table 2. Direct effects of the full and parsimonious structural equation model on the relationships between the variables

	Model with medication		Model without medication	
	Full model	**Parsimonious model**	**Full model**	**Parsimonious model**
10 years				
Bone fragility - Severe CAL	-		-0.385 (0.08) 0.004*	-0.389 (0.08) 0.005*
Bone fragility - Tooth loss	-		-0.082 (0.11) 0.35	-
Severe CAL - Tooth loss	-		0.126 (0.12) 0.58	-
6 years				
Bone fragility - Severe CAL	-0.250 (0.10) 0.09	-0.257 (0.36) 0.003*	-0.266 (0.07) 0.02*	-0.259(0.07) 0.003*
Bone fragility - Tooth loss	-0.132 (0.13) 0.39	-	-0.176 (0.09) 0.15	-
Medication - Bone fragility	0.618 (0.08) <0.001*	0.615 (0.00) 0.003*	-	-
Medication - Severe CAL	-0.022 (0.11) 0.88	-	-	-
Medication - Tooth loss	-0.084 (0.13) 0.57	-	-	-
Dental attendance - Severe CAL	-0.112 (0.05) 0.33	-	-0.113 (0.05) 0.32	-
Dental attendance - Tooth loss	-0.110 (0.15) 0.34	-	-0.114 (0.15) 0.33	
Severe CAL - Tooth loss	0.129 (0.11) 0.28	-	0.131 (0.10) 0.28	-
Cross-sectional				
Bone fragility - Severe CAL	-0.006 (0.10) 0.96	-	-0.175 (0.06) 0.02*	-0.190 (0.06) 0.004*
Bone fragility – BOP	0.008 (0.14) 0.95	-	-0.009 (0.08) 0.92	-
Bone fragility - Tooth loss	-0.115 (0.09) 0.30	-	-0.145 (0.07) 0.06	
Medication - Bone fragility	0.703 (0.04) <0.001*	0.703 (0.04) 0.003*	-	-
Medication - Severe CAL	-0.236 (0.09) 0.02*	-0.251 (0.06) 0.003*	-	-
Medication – BOP	-0.025 (0.14) 0.84	-	-	-
Medication - Tooth loss	-0.041 (0.09) 0.71	-	-	-
Dental attendance - Severe CAL	-0.135 (0.09) 0.07		-0.133 (0.95) 0.08	-
Dental attendance – BOP	-0.130 (0.05) 0.13	-	-0.130 (0.53) 0.13	
Dental attendance - Tooth loss	-0.224 (0.14) 0.004*	-0.237 (0.14) 0.05*	-0.223 (0.14) 0.004*	- 0.235 (0.14) 0.05*

BOP - Severe CAL	0.442 (0.09) 0.004	0.459 (0.09) 0.003*	0.445 (0.10) <0.001*	0.461 (0.09) 0.003*
Severe CAL - Tooth loss	0.336 (0.10) 0.002	0.372 (0.10) 0.002*	0.340 (0.10) <0.001*	0.372 (0.10) 0.002*

Data presented as β bootstrapped standardized estimate (SE standard error), and *p*-values.
BOP: bleeding on probing; CAL: clinical attachment loss.
Full model of the 10-year period was composed by 'Bone Fragility', CAL and tooth loss. Full model of the 6-year included the variables of the 10-year period plus 'dental attendance'. BOP was not included in the '6 years analysis' since it reflects present periodontal inflammation. The full model of the cross-sectional analysis included the variables of the 10-year period plus dental attendance and BOP.
The SEM of the cross-sectional and 6-year periods were tested with and without 'antiosteoporosis medication'. 'Antiosteoporosis medication' corresponds to the duration of the medication intake for osteoporosis treatment (in years). Antiosteoporosis medication and pattern of dental attendance were not considered in the '10 years analysis' since women where in their first DXA assessment and skeletal evaluation.
Anticipated effect sizes were estimated as 0.13 (N = 49), 0.11 (N = 71) and 0.08 (N = 134) for cross-sectional analysis, 6 years analysis and 10 years analysis, respectively, considering a power of 80% and 0.05 level of significance ($\alpha = 0.05$) in a structural equation model directed toward a hypothesis testing for complex models with one latent variables and the respective observed variables in each model (Westland 2012).