

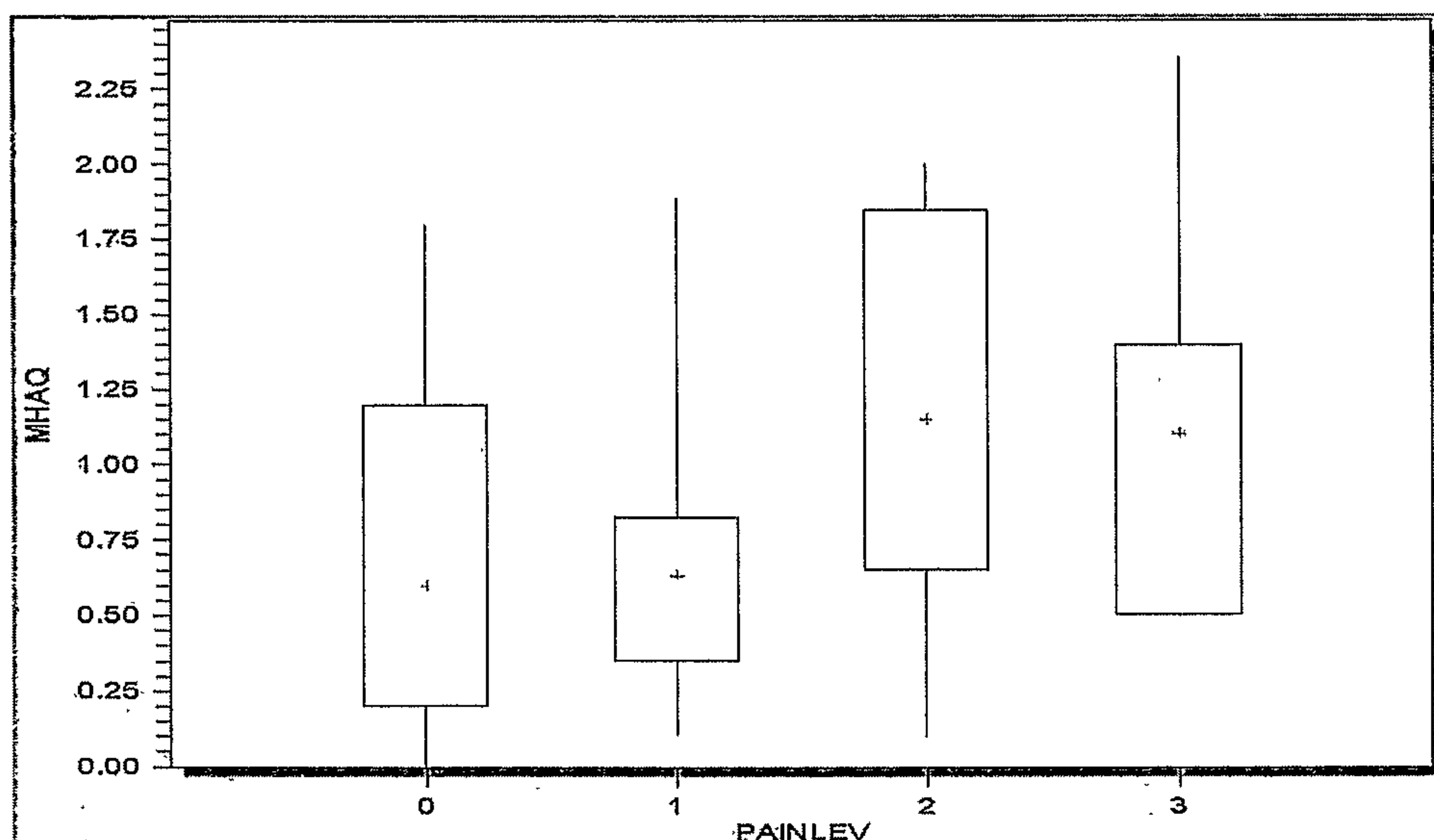


Figure 7: Box-whisker* plot of activities of daily living score (MHAQ) by pain experienced in the face, jaw, in front of the ear, or cheeks in the past six months (PAINLEV) where 0 = none, 1 = little, 2 = moderate, 3 = great pain. *Central + defines the median, box ends define the 25th & 75th percentiles, and whiskers define 10th & 90th percentiles. Spearman's rank correlation coefficient (R_s) = 0.2, p-value = 0.043

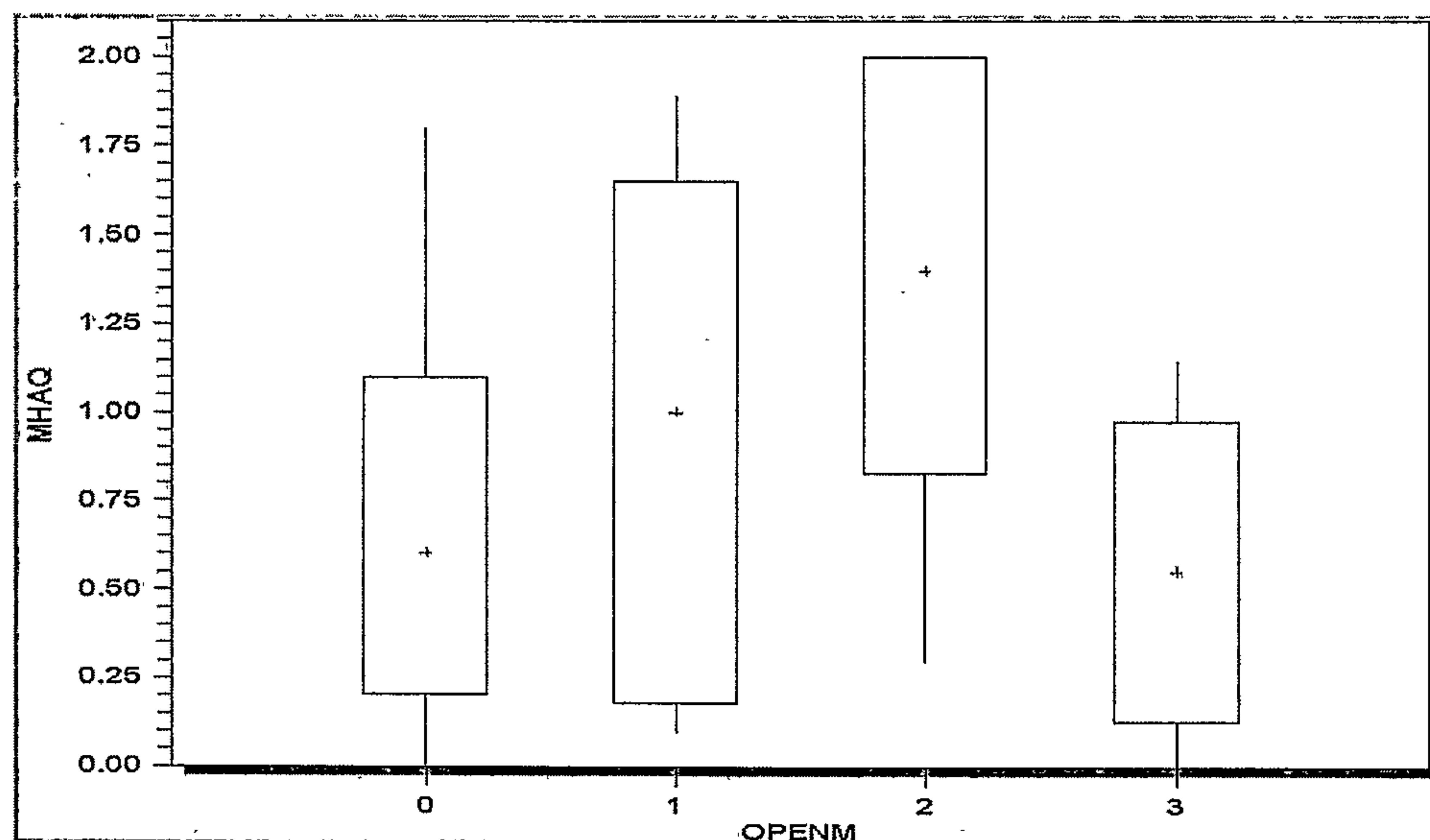


Figure 8: Box-whisker* plot of activities of daily living score (MHAQ) by difficulty experienced in opening mouth (OPENM) where 0 = none, 1 = little, 2 = moderate, 3 = great difficulty. *Central + defines the median, box ends define the 25th & 75th percentiles, and whiskers define 10th & 90th percentiles. Spearman's rank correlation coefficient (R_s) = 0.27, p-value = 0.006

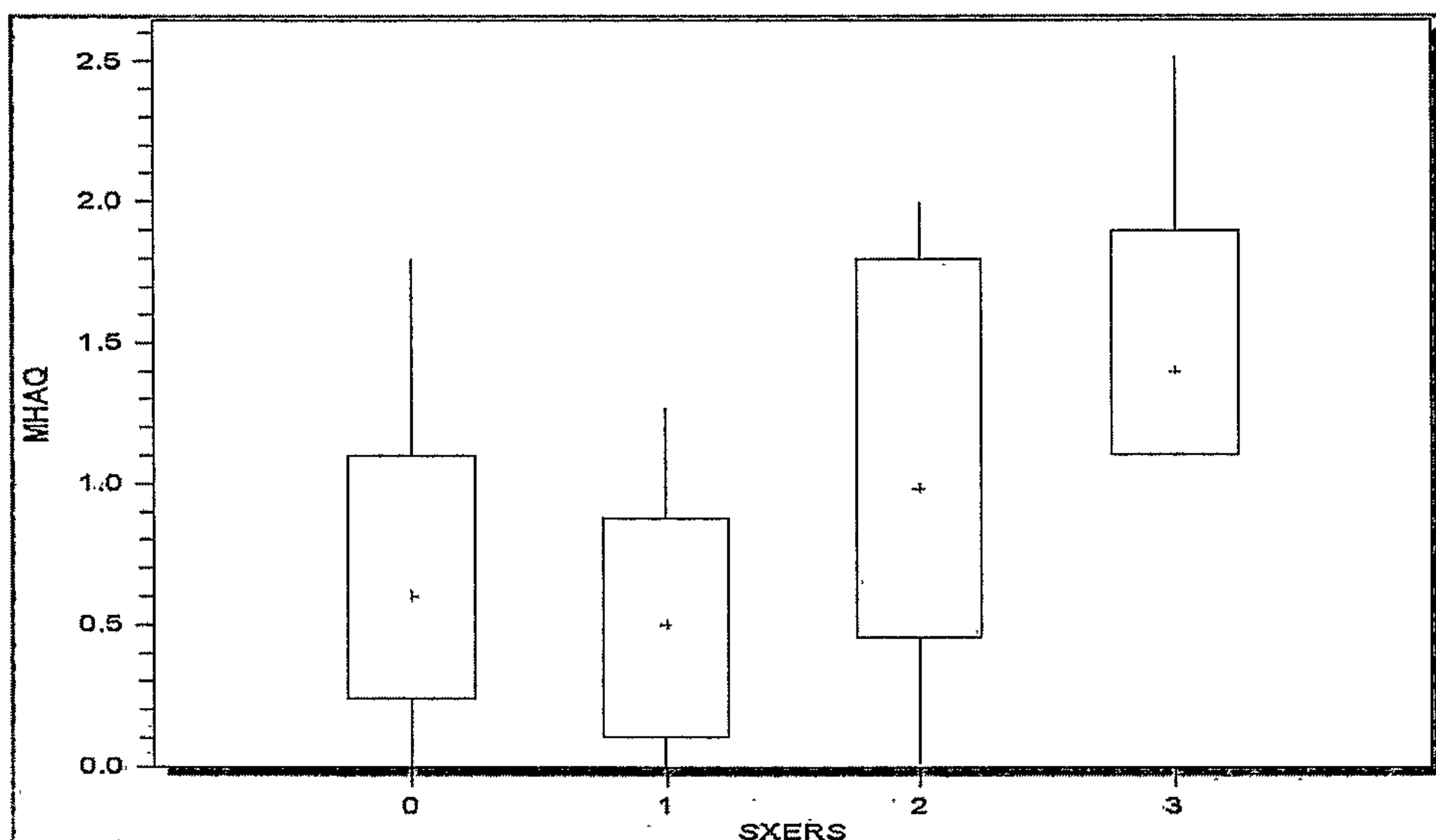


Figure 9: Box-whisker* plot of activities of daily living score (MHAQ) by number of xerostomia symptoms (SXERS). *Central + defines the median, box ends define the 25th & 75th percentiles, and whiskers define 10th & 90th percentiles. Spearman's rank correlation coefficient (R_s) = 0.24, p-value = 0.016

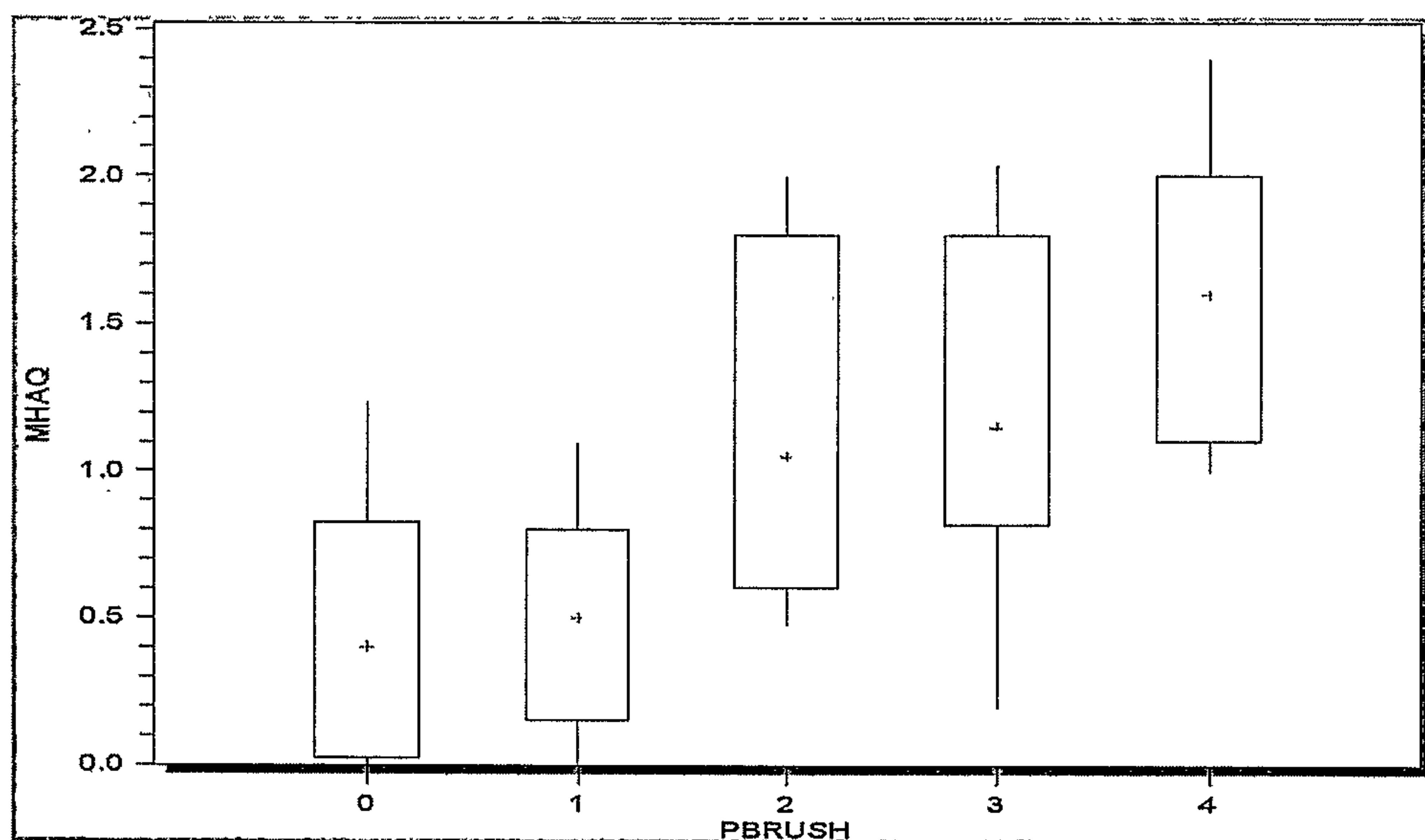


Figure 10: Box-whisker* plot of activities of daily living score (MHAQ) by difficulty experienced when tooth brushing (PBRUSH) where 0 = none, 1 = little, 2 = moderate, 3 = great, 4 = extreme. *Central + defines the median, box ends define the 25th & 75th percentiles, and whiskers define 10th & 90th percentiles. Spearman's rank correlation coefficient (R_s) = 0.56, p-value < 0.0001

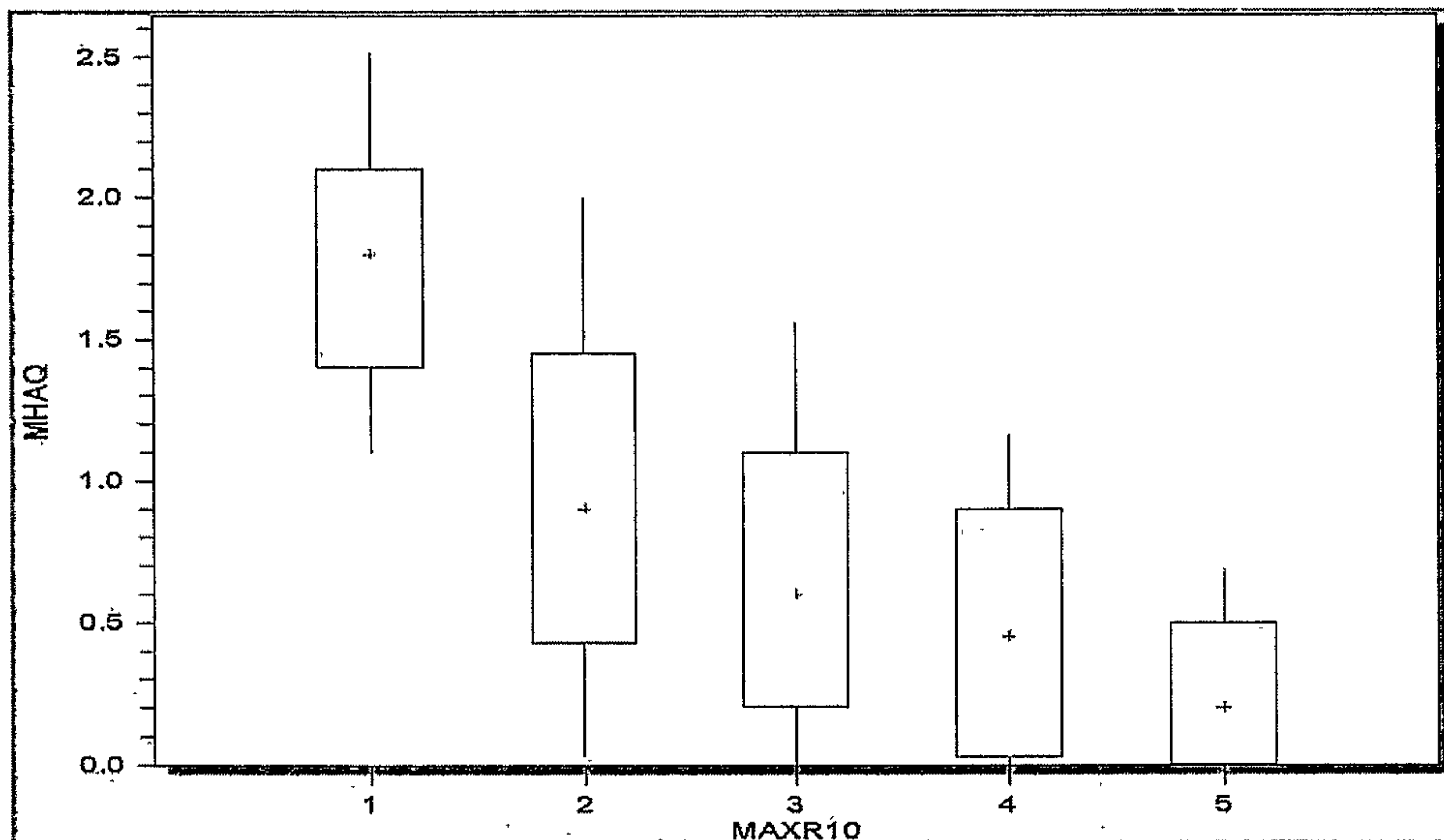


Figure 11: Box-whisker* plot of activities of daily living score (MHAQ) by maximum mouth opening in mm (MAXR10) where 1 = 20 - 29, 2 = 30 - 39, 3 = 40 - 49, 4 = 50 - 59, 5 = 60 - 69mm. *Central + defines the median, box ends define the 25th & 75th percentiles, and whiskers define 10th & 90th percentiles. Spearman's rank correlation coefficient (R_s) = -0.39, p-value < 0.0001

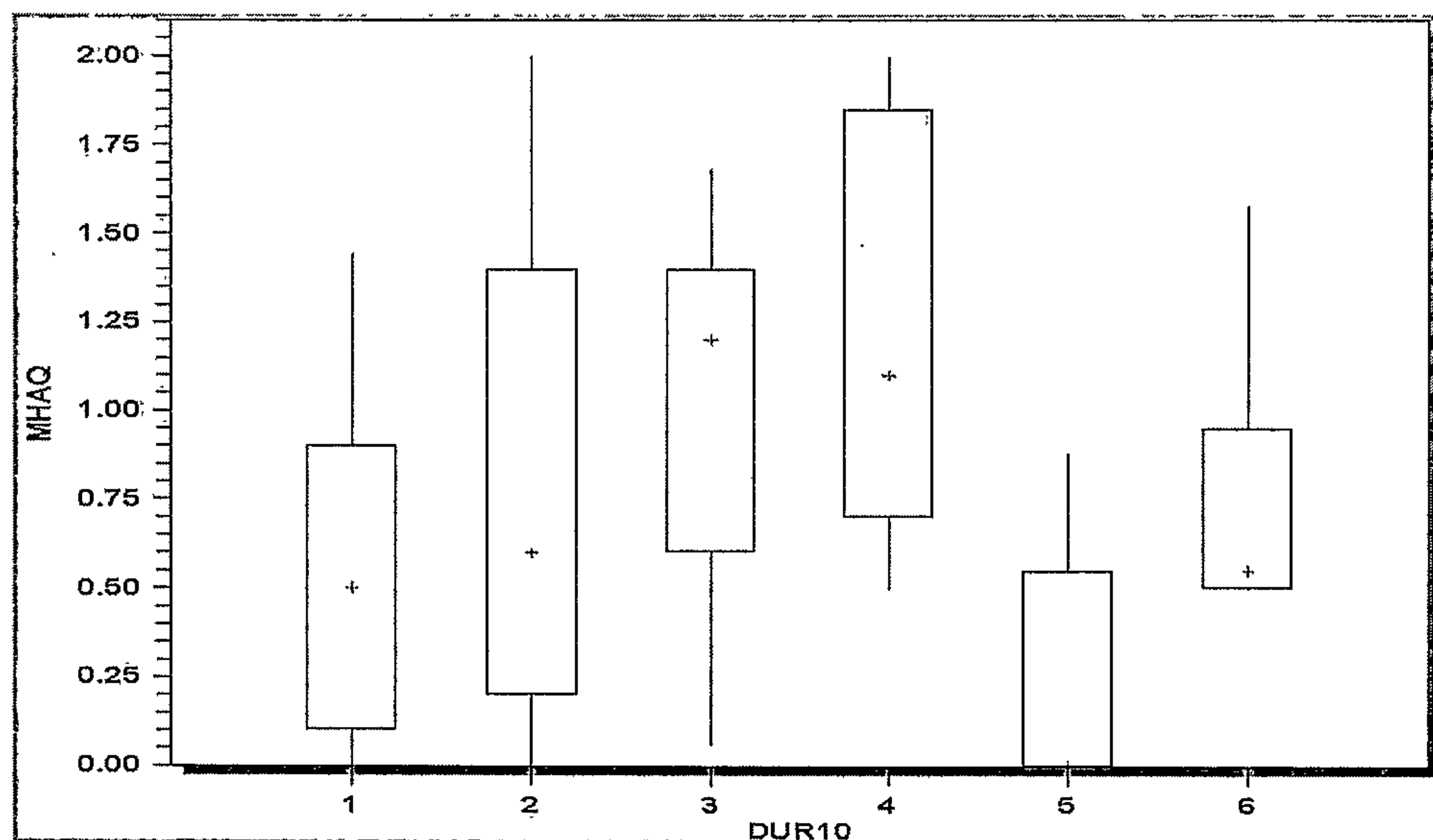


Figure 12: Box-whisker* plot of activities of daily living score (MHAQ) by duration of RA (DUR10) where 1 = 0 - 9, 2 = 10 - 19, 3 = 20 - 29, 4 = 30 - 39, 5 = 40 - 49, 6 = 50 - 59years. *Central + defines the median, box ends define the 25th & 75th percentiles, and whiskers define 10th & 90th percentiles. Spearman's rank correlation coefficient (R_s) = 0.29, p-value = 0.004

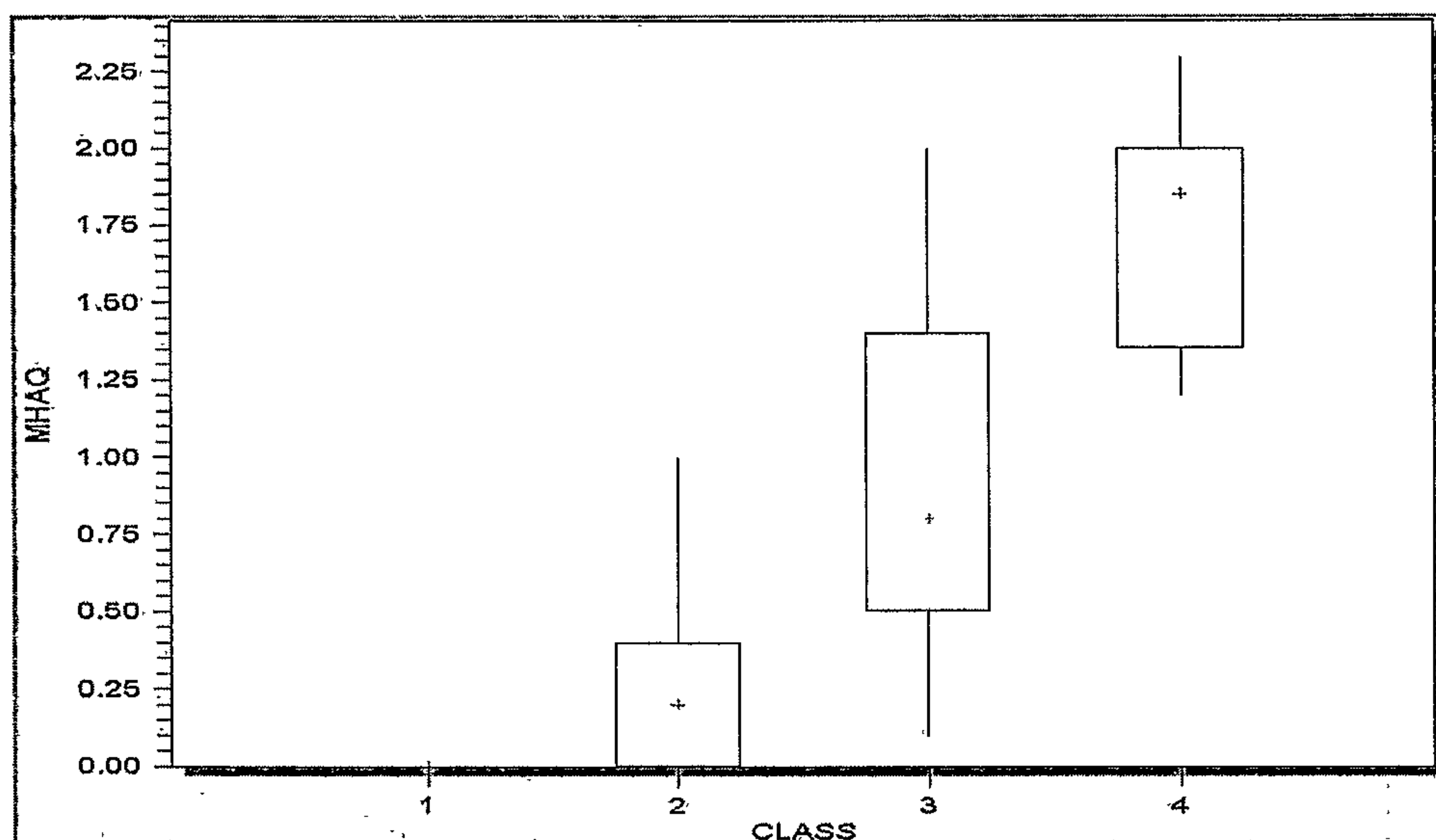


Figure 13: Box-whisker* plot of activities of daily living score (MHAQ) by class of functional disability (CLASS) where 1 = Class I, 2 = Class II, 3 = Class III, 4 = Class IV. *Central + defines the median, box ends define the 25th & 75th percentiles, and whiskers define 10th & 90th percentiles. Spearman's rank correlation coefficient (R_s) = 0.54, p -value < 0.0001

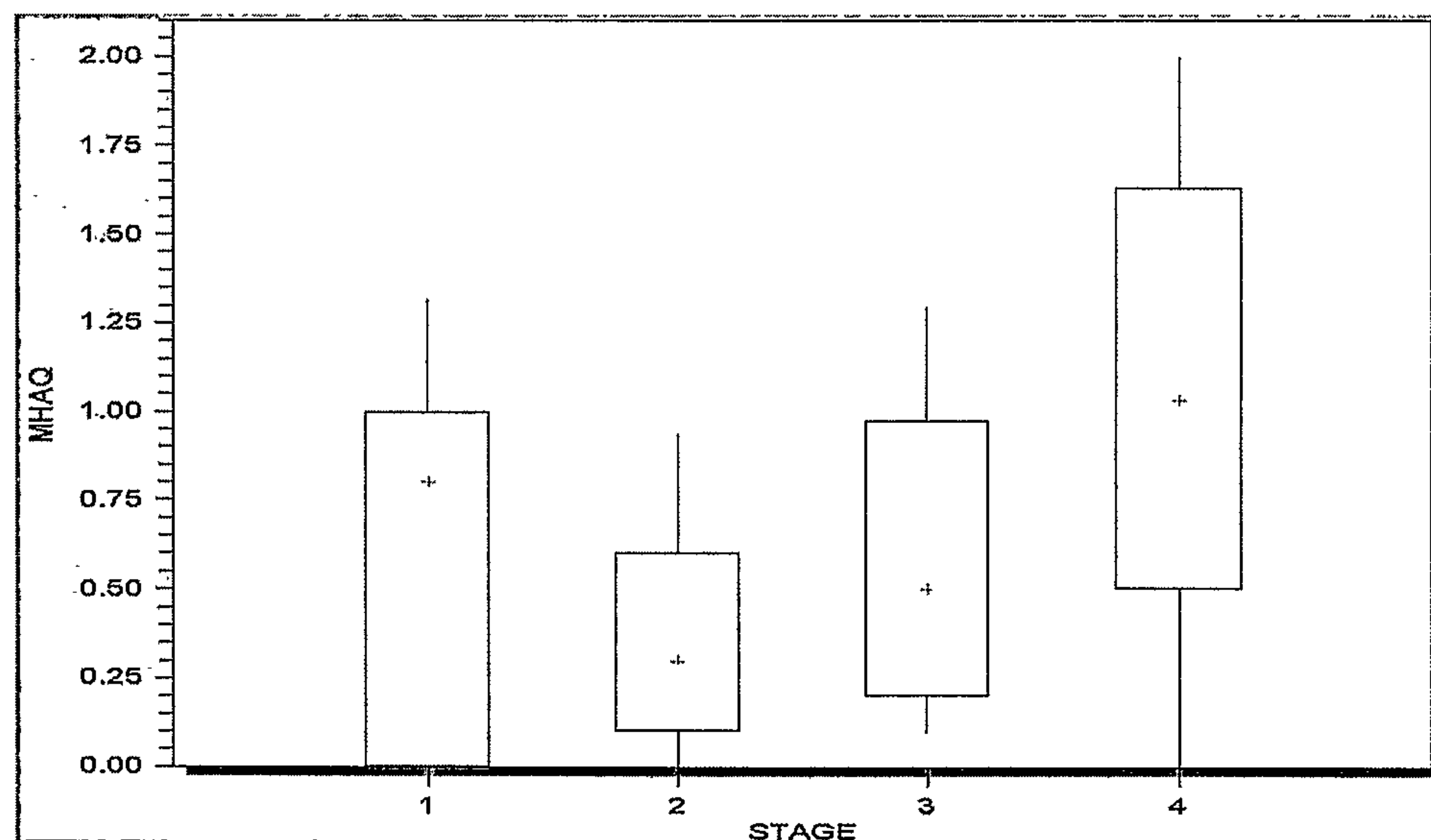


Figure 14: Box-whisker* plot of activities of daily living score (MHAQ) by stage of joint destruction (STAGE) where 1 = Stage I, 2 = Stage II, 3 = Stage III, 4 = Stage IV. *Central + defines the median, box ends define the 25th & 75th percentiles, and whiskers define 10th & 90th percentiles. Spearman's rank correlation coefficient (R_s) = 0.32, p -value = 0.001

Table 17: Distribution of activities of daily living scores and related statistics by potential continuous type explanatory variables. Potential explanatory variables were identified as those showing significant associations (p<0.05) with the outcome variables in linear regression analyses.

Outcome variable		Unit	Range
MHAQ		score	0 to 3
Activities of daily living score, based on 8 questions			

Potential explanatory variables	Unit	Regression Coefficient	R-square	Correlation Coefficient	F-Value	P-Value
<u>QSCORE</u> Oral Health Quality of Life score, based on 16 questions	score	-0.01	0.08	-0.28	8.16	0.005
<u>MAX</u> Maximum mouth opening capacity	mm	-0.04	0.25	-0.5	32.2	0

(Continued)

Potential explanatory variables	Unit	Regression Coefficient	R-square	Correlation Coefficient	F-Value	P-Value
<u>AGEONS</u> Age of RA onset	years	-0.01	0.04	-0.2	3.98	0.049
<u>DURAT</u> Years duration of RA	years	0.01	0.06	0.24	6.5	0.012

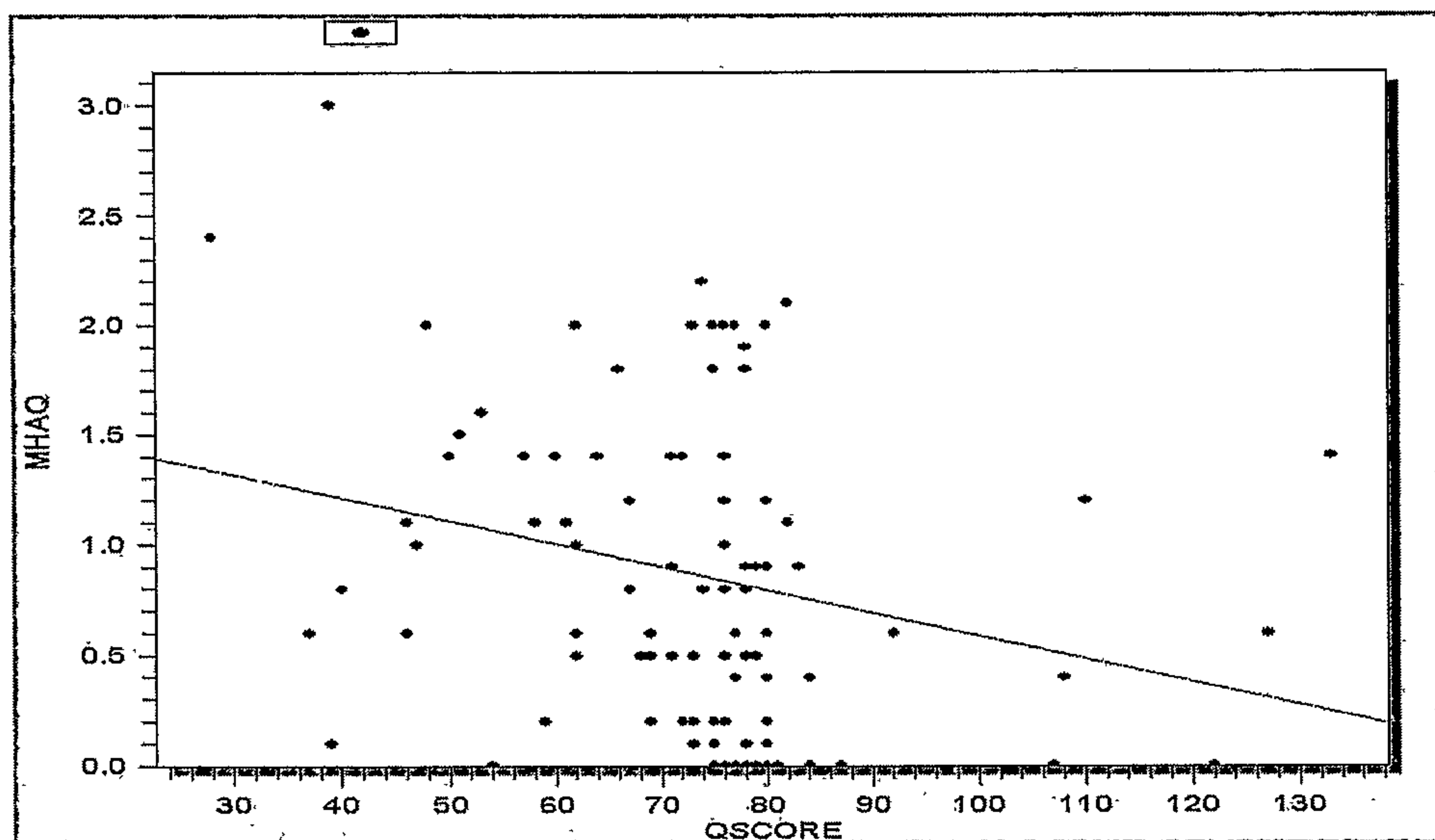


Figure 15: Scatter diagram of activities of daily living score (MHAQ) versus oral health related quality of life score (QSCORE). Correlation coefficient = -0.28, p-value = 0.005

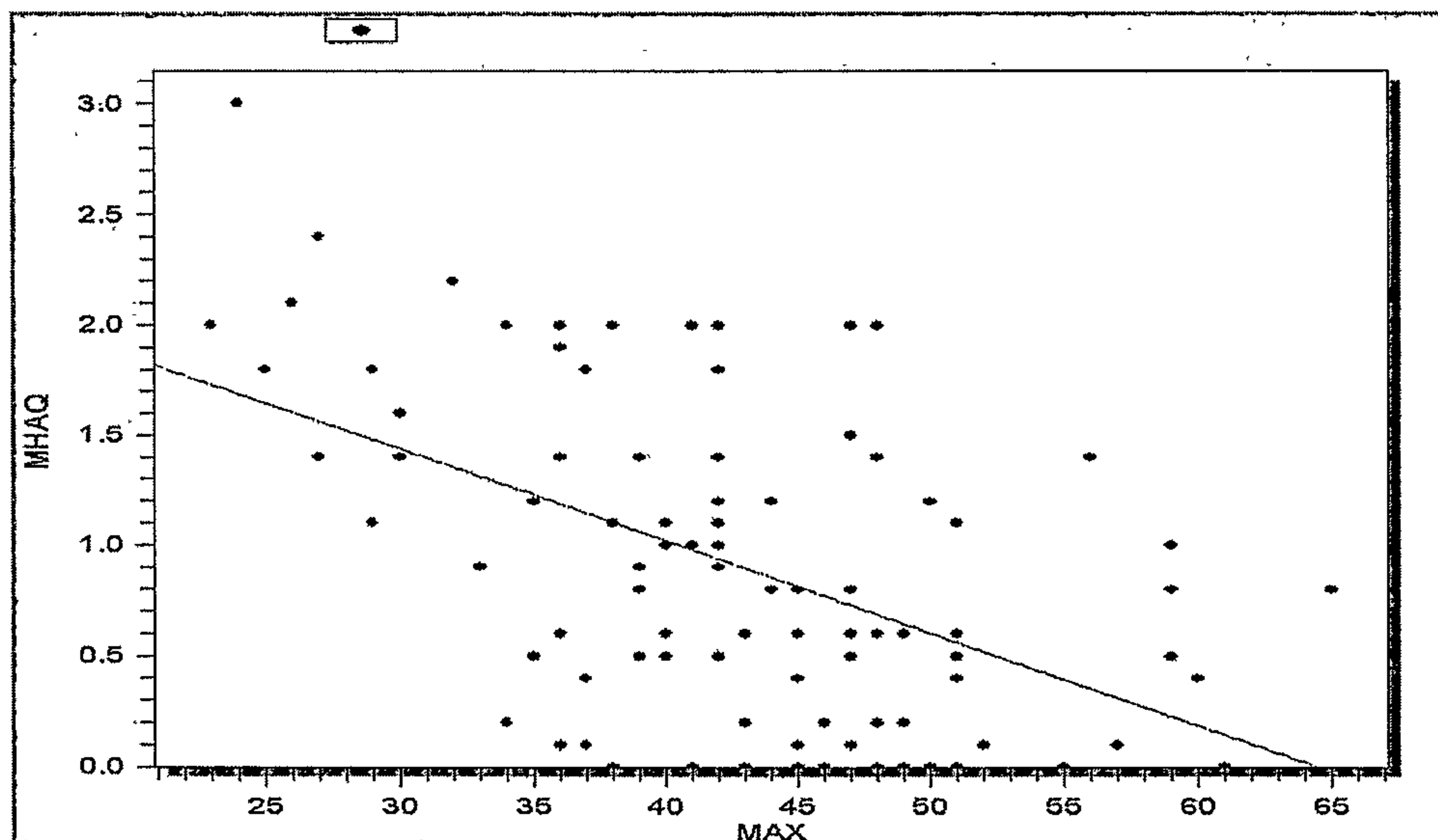


Figure 16: Scatter diagram of activities of daily living score (MHAQ) versus maximum mouth opening in mm (MAX). Correlation coefficient = -0.5, p-value = 0.000

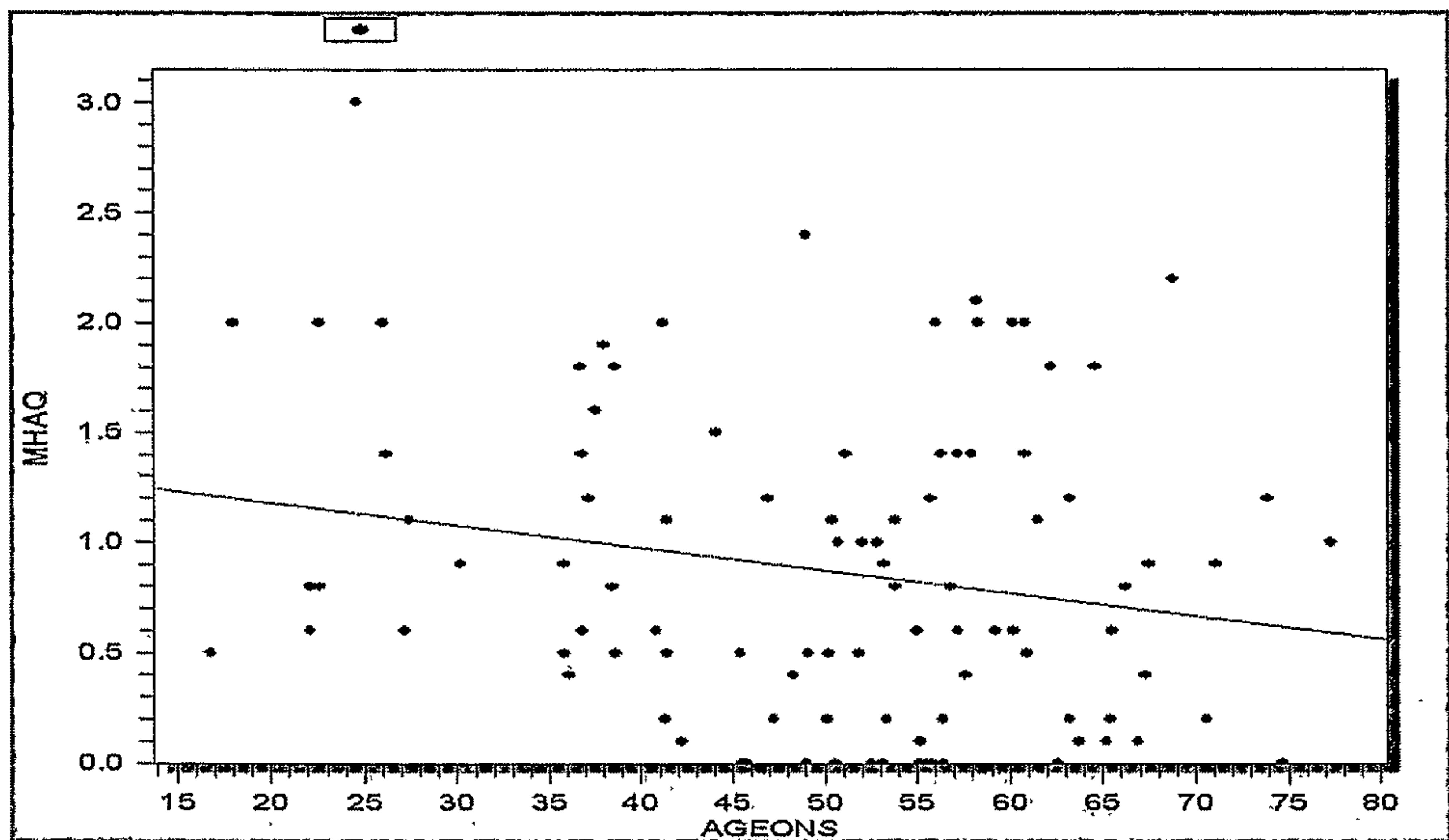


Figure 17: Scatter diagram of activities of daily living score (MHAQ) versus age of RA onset (AGEONS). Correlation coefficient = -0.2, p-value = 0.049

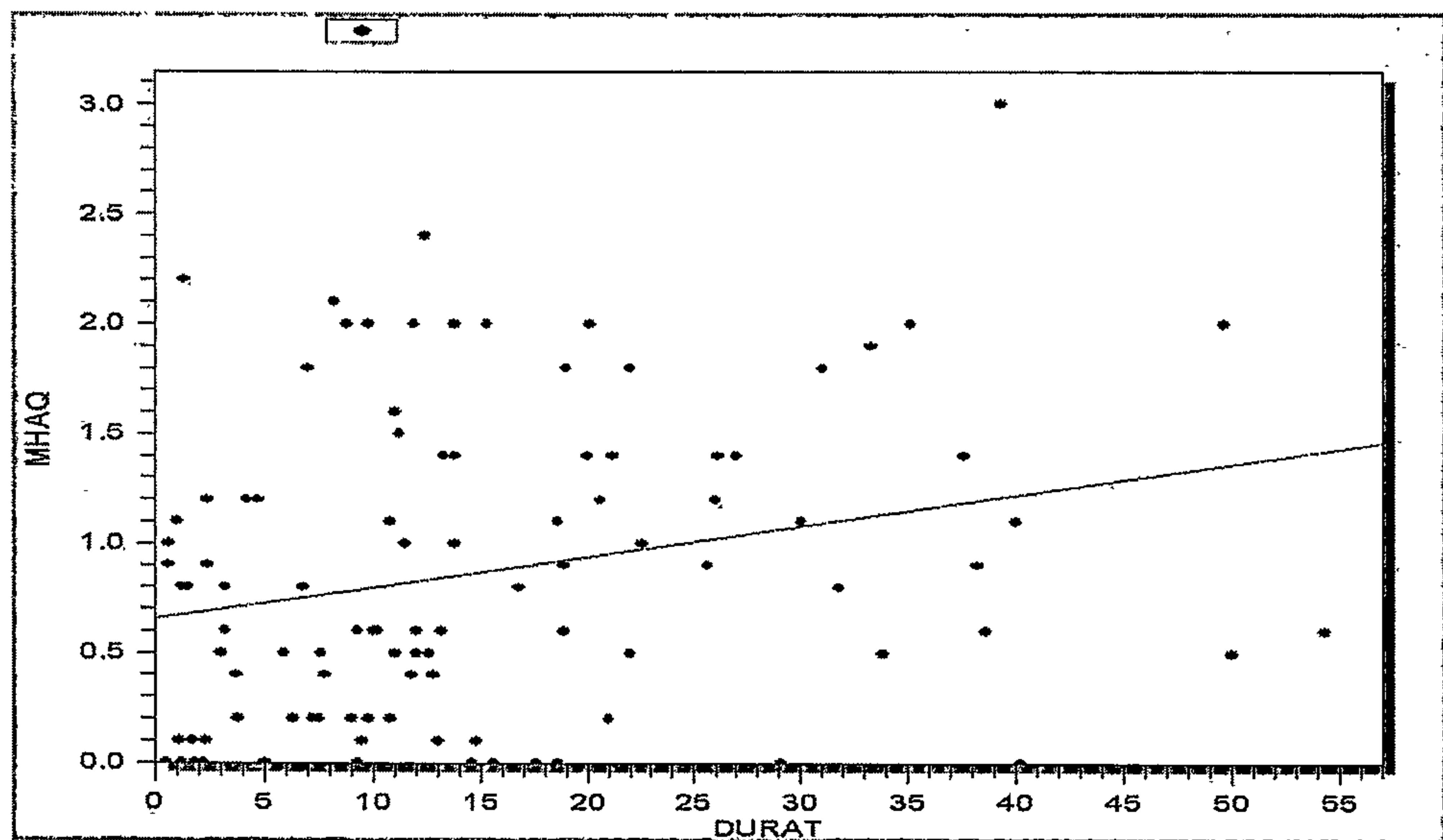


Figure18: Scatter diagram of activities of daily living score (MHAQ) versus RA duration (DURAT). Correlation coefficient = 0.24, p-value = 0.012

4.8.10 Maximum mouth opening capacity by potential *categorical type* explanatory variables

An analysis of variance of maximum mouth opening capacity (MAX) by potential categorical type explanatory variables showed that 21 out of 44 potential categorical type explanatory variables were significantly associated with MAX differences (Table 18).

MAX was strongly associated with difficulty experienced when opening mouth (OPENM); as levels of difficulty experienced when opening mouth (OPENM) increased, MAX decreased significantly ($p = 0.000$, $R_s = -0.55$). This is illustrated in Figure 20. Similarly, MAX was negatively correlated with difficulty experienced when tooth brushing (PBRUSH) ($p = 0.001$, $R_s = -0.39$). This indicates that maximum mouth opening capacity decreased with increasing difficulty experienced when tooth brushing and is illustrated in Figure 22. Furthermore, increasing class of functional disability (CLASS) was significantly associated with decreased MAX ($p = 0.042$, $R_s = -0.29$), which is illustrated in Figure 24.

4.8.11 Maximum mouth opening capacity by potential *continuous type* explanatory variables

The linear regression analysis of maximum mouth opening capacity (MAX) showed that only three out of 18 potential continuous type explanatory variables were significantly associated with MAX (Table 19); they were MHAQ (activities of daily living), QSCORE (oral health related quality of life), and F8 (the number of filled teeth).

Table 18: Distribution of maximum mouth opening capacity and related statistics by potential categorical type explanatory variables. Potential explanatory variables were identified as those showing significant associations (p<0.05) with the outcome variables in ANOVA.

Outcome variable	Unit	Range
MAX	mm	23 to 65
Maximum mouth opening capacity		

Potential explanatory variables	Category	n	MAX Mean	SD	F-Value	P-Value	Spearman's rank correlation coefficient	P-value
<u>MHAQR05</u> Activities of daily living score, based on 8 questions (Categorical)	1 0 - 0.9	59	45.5	7.2	11.4	0	-0.4	<0.0001
	2 1.0 - 1.9	29	40.2	8.37				
	3 2.0 - 3.0	12	34.8	8.67				
<u>PROBI</u> Does your jaw hurt when chewing or shortly after ?	0 No	92	43.2	8.42	4.55	0.035		
	1 Yes	8	36.6	7.48				

(Continued)

Potential explanatory variables	Category	n	MAX Mean	SD	F-Value	P-Value	Spearman's rank correlation coefficient	P-value
<u>PAINAFT</u> Have you had pain in the face, jaw, in front of the ear, or cheeks after onset of RA?	0 No 1 Yes	56 44	44.6 40.3	8.31 8.23	6.59	0.012		
<u>OPENM</u> Do you have any difficulty when opening your mouth ?	0 None 1 Little 2 Moderate 3 Great 4 Extreme	73 7 15 5 0	45.4 35.0 35.4 36.0	7.31 7.39 8.24 4.58	12.0	0	-0.55	<0.0001
<u>SWALLOW</u> Do you have difficulties swallowing any foods ?	0 No 1 Yes	89 11	43.5 35.9	8.1 9.04	8.39	0.005		
<u>DRYM</u> Does your mouth feel dry when eating a meal ?	0 No 1 Yes	72 28	43.8 39.8	7.66 9.92	4.76	0.032		

(Continued)

Potential explanatory variables	Category	n	MAX Mean	SD	F-Value	P-Value	Spearman's rank correlation coefficient	P-value
<u>SXERS</u> Score of Xerostomia (the number of answer YES to questions 6, 7, and 8)	0 1 2 3	50 23 21 6	43.4 46.7 39.6 31.8	7.69 7.43 8.95 5.6	7.05	0	-0.24	0.016
<u>PBRUSH</u> Does your arthritis make it difficult for you to brush your teeth ?	0 None 1 Little 2 Moderate 3 Great 4 Extreme	43 14 28 9 6	45.4 45.2 40.8 38.6 32.5	6.76 7.26 9.11 9.33 8.22	5.17	0.001	-0.39	<0.0001
<u>PALPT</u> Do you feel pain or pressure when I palpate your head or face?	0 No 1 Yes	62 38	44.9 39.1	8.62 7.05	12.2	0.001		
<u>TEMPYN</u> Tenderness on palpation of the tempolaris Yes / No	0 No 1 Yes	87 13	43.9 34.3	8.15 5.79	16.7	0		

(Continued)

Potential explanatory variables	Category	n	MAX Mean	SD	F-Value	P-Value	Spearman's rank correlation coefficient	P-value
<u>MASSEYN</u> Tenderness on palpation of the masseter Yes / No	0 No 1 Yes	67 33	43.9 40.2	9.12 6.51	4.47	0.037		
<u>CLICKYN</u> Clicking Yes / No	0 No 1 Yes	52 48	40.4 45.1	8.41 8	8.1	0.005		
<u>CREPYN</u> Crepitus Yes / No	0 No 1 Yes	78 22	43.6 39.4	8.35 8.4	4.41	0.038		
<u>NTR10</u> The number of remaining teeth including third molars (Categorical)	1 0 - 9 2 10 - 19 3 20 - 29 4 30 -	32 20 44 4	45.9 38.5 41.8 47.0	8.09 7.23 8.16 12.8	3.97	0.01	-0.16	0.108

(Continued)

Potential explanatory variables	Category	n	MAX Mean	SD	F-Value	P-Value	Spearman's rank correlation coefficient	P-value
<u>M8R5</u>								
The number of missing teeth including third molars (Categorical)	1 0 - 4	16	42.4	8.95	2.69	0.019	0.18	0.067
	2 5 - 9	21	42.1	8.27				
	3 10 - 14	17	41.9	7.92				
	4 15 - 19	11	37.7	8.19				
	5 20 - 24	8	37.8	5.63				
	6 25 - 29	12	48.3	10.3				
	7 30 -	15	46.3	5.78				
<u>F8R5</u>								
The number of filled teeth including third molars (Categorical)	1 0 - 4	27	46.7	8.25	4.47	0.014	-0.24	0.015
	2 5 - 14	51	41.3	8.57				
	3 15 -	22	40.9	7.3				
<u>SEX</u>								
Gender	1 Female	76	40.8	7.18	18.5	0		
	2 Male	24	48.7	9.68				

(Continued)

Potential explanatory variables	Category	n	MAX Mean	SD	F-Value	P-Value	Spearman's rank correlation coefficient	P-value
<u>AGER10</u>								
Age (Categorical)	1 20-29	1	47.0	0	3.42	0.004	0.03	0.744
	2 30-39	1	23.0	0				
	3 40-49	6	38.7	5.79				
	4 50-59	15	48.8	8.33				
	5 60-69	41	40.9	8.31				
	6 70-79	29	42.5	7.32				
	7 80-89	7	46.4	8.83				
<u>ONSETR10</u>								
Age of RA onset (Categorical)	1 10 - 39	24	39.5	9.87	3.51	0.034	0.07	0.509
	2 40 - 59	51	44.7	8.18				
	3 60 - 79	25	41.6	6.74				
<u>CLASS</u>								
Class of functional disability	1	1	41.0	0	2.83	0.042	-0.29	0.003
	2	20	46.9	6.28				
	3	72	42.0	8.42				
	4	7	37.4	11.5				
<u>TLTMJ</u>								
A symptom of TMJ Yes / No	0 No	34	47.2	8.06	17.3	0		
	1 Yes	66	40.3	7.79				

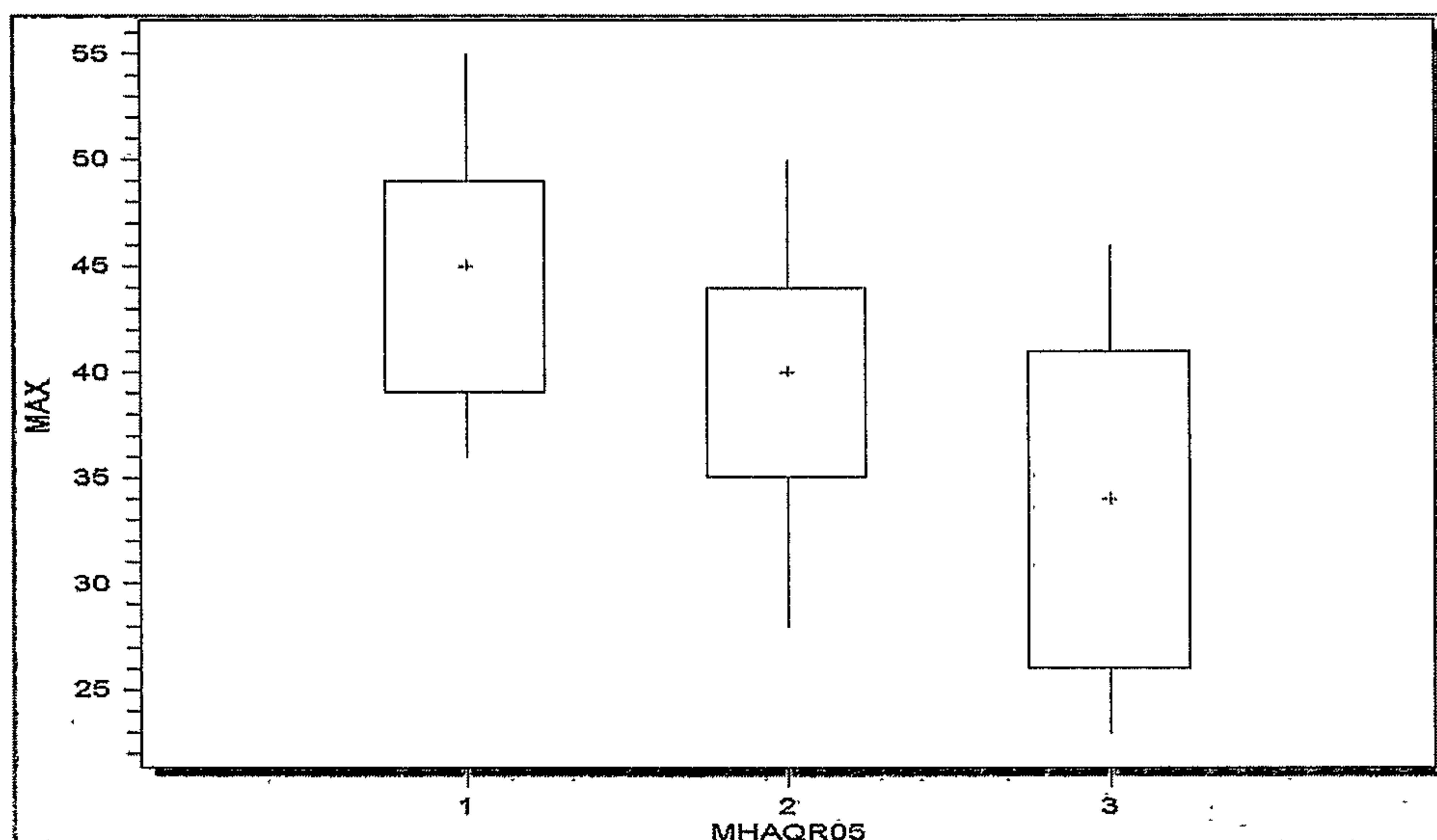


Figure 19: Box-whisker* plot of maximum mouth opening in mm (MAX) by activities of daily living score (MHAQR05) where 1 = scores 0 - 0.9, 2 = scores 1.0 - 1.9, 3 = scores 2.0 - 3.0. *Central + defines the median, box ends define the 25th & 75th percentiles, and whiskers define 10th & 90th percentiles. Spearman's rank correlation coefficient (R_s) = -0.4, p-value < 0.0001

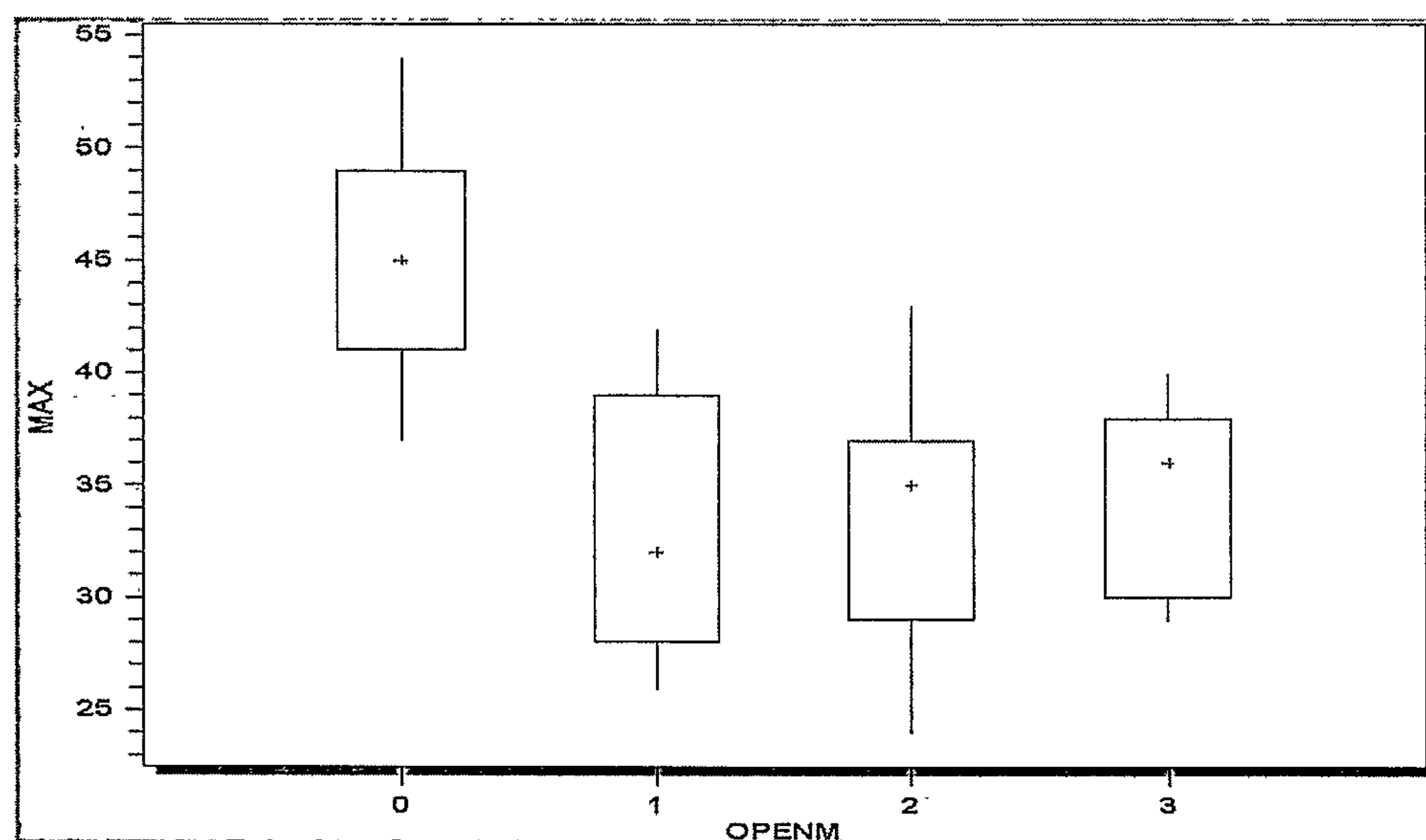


Figure 20: Box-whisker* plot of maximum mouth opening in mm (MAX) by difficulty experienced in opening mouth (OPENM) where 0 = none, 1 = little, 2 = moderate, 3 = great. *Central + defines the median, box ends define the 25th & 75th percentiles, and whiskers define 10th & 90th percentiles. Spearman's rank correlation coefficient (R_s) = -0.55, p-value < 0.0001

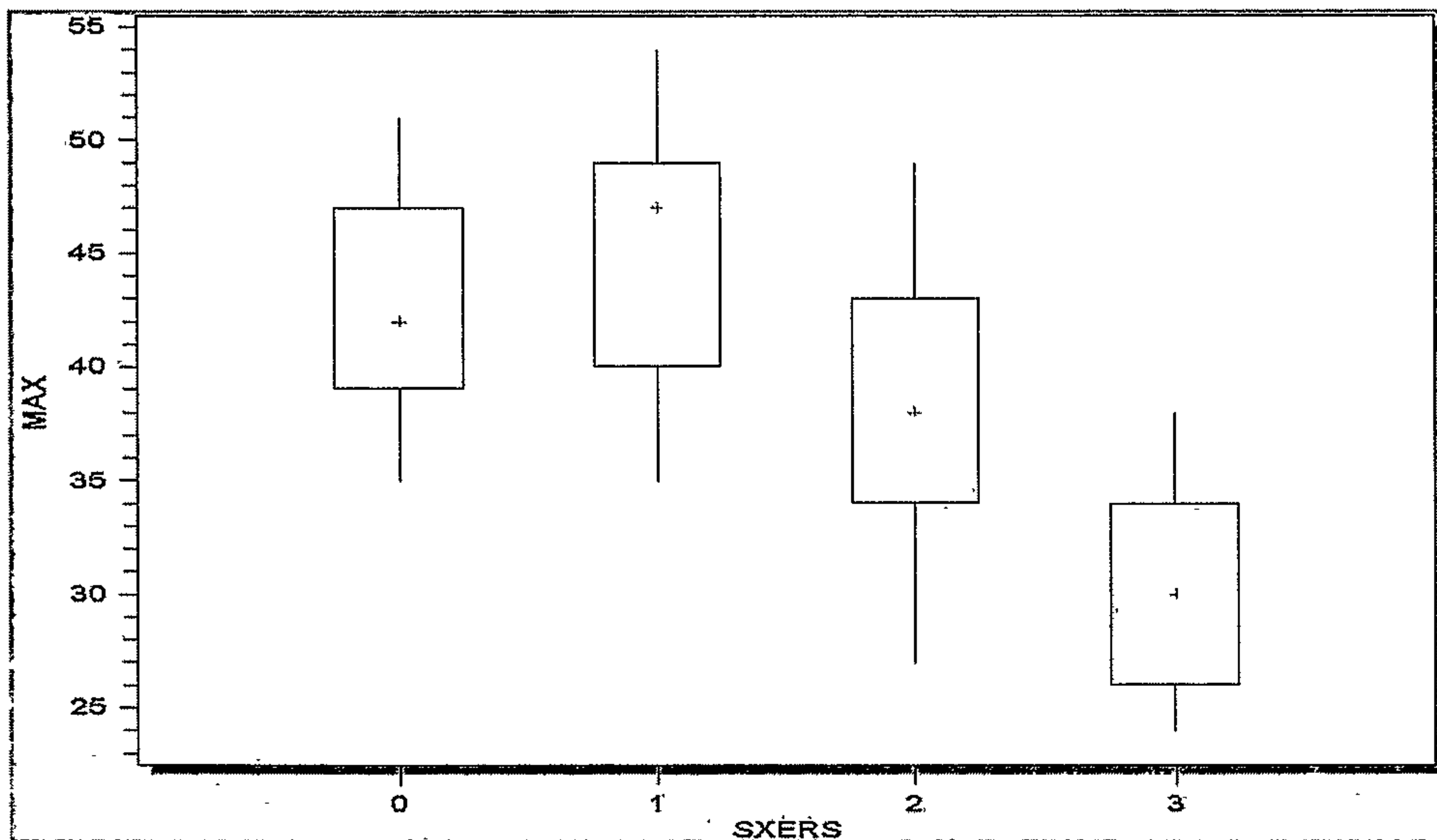


Figure 21: Box-whisker* plot of maximum mouth opening in mm (MAX) by number of xerostomia symptoms (SXERS). *Central + defines the median, box ends define the 25th & 75th percentiles, and whiskers define 10th & 90th percentiles. Spearman's rank correlation coefficient (R_s) = -0.24, p-value = 0.016

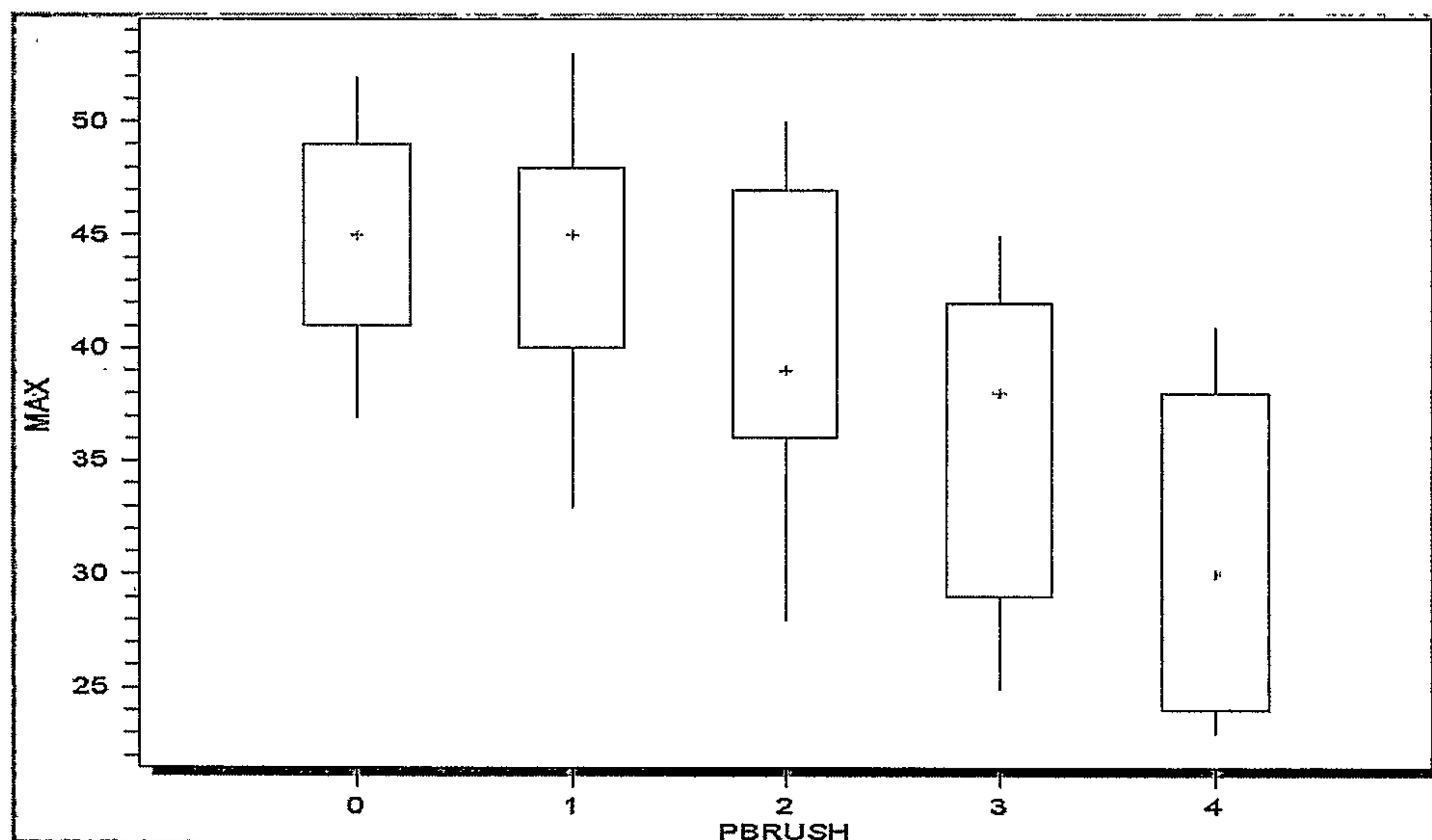


Figure 22: Box-whisker* plot of maximum mouth opening in mm (MAX) by difficulty experienced when tooth brushing (PBRUSH) where 0 = none, 1 = little, 2 = moderate, 3 = great, 4 = extreme. *Central + defines the median, box ends define the 25th & 75th percentiles, and whiskers define 10th & 90th percentiles. Spearman's rank correlation coefficient (R_s) = -0.39, p-value < 0.0001

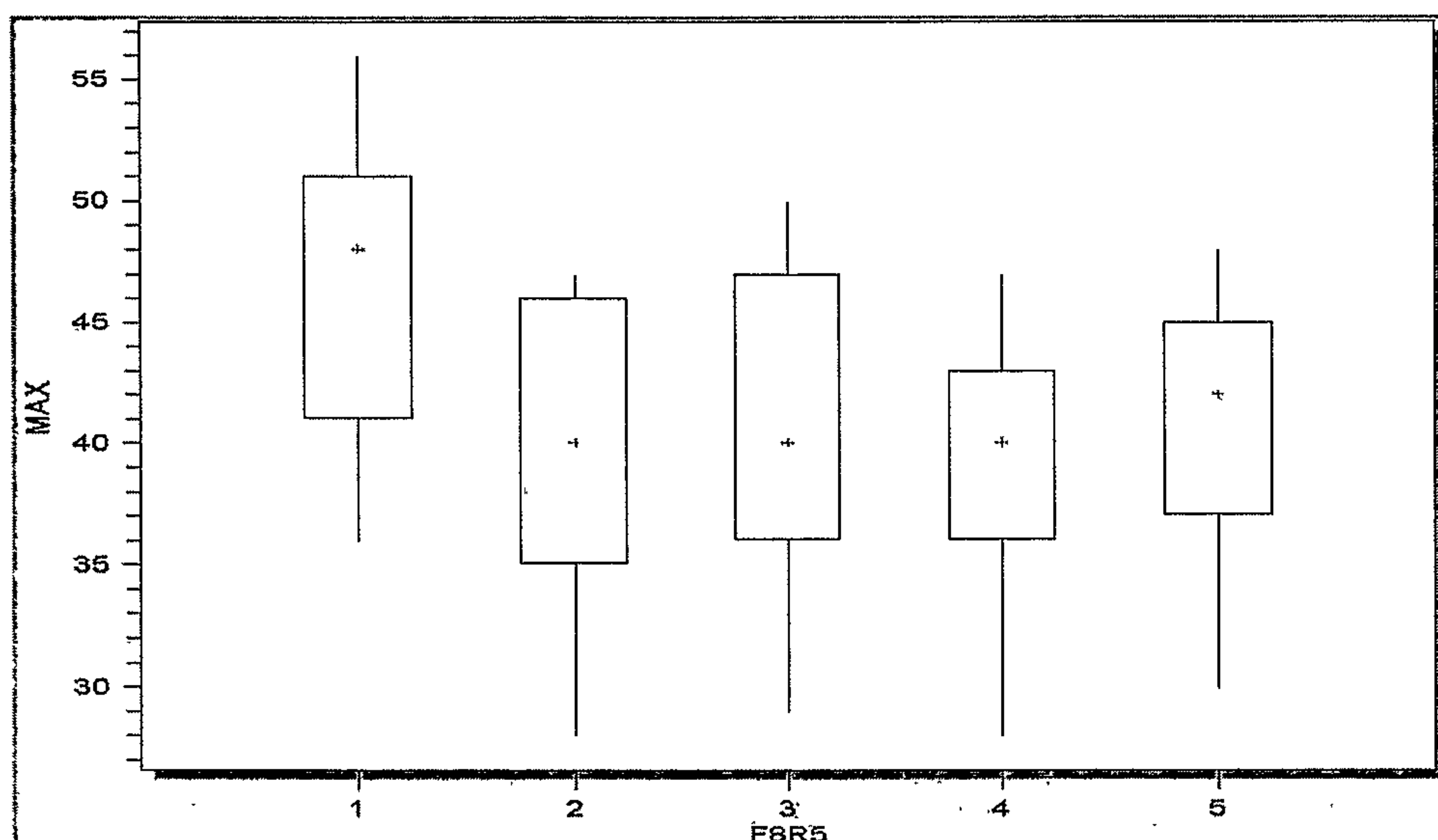


Figure 23: Box-whisker* plot of maximum mouth opening in mm (MAX) by number of filled teeth including third molars (F8R5) where 1 = 0 - 4, 2 = 5 - 9, 3 = 10 - 14, 4 = 15 - 19, 5 = >20 teeth. *Central + defines the median, box ends define the 25th & 75th percentiles, and whiskers define 10th & 90th percentiles. Spearman's rank correlation coefficient (R_s) = -0.24, p-value = 0.015

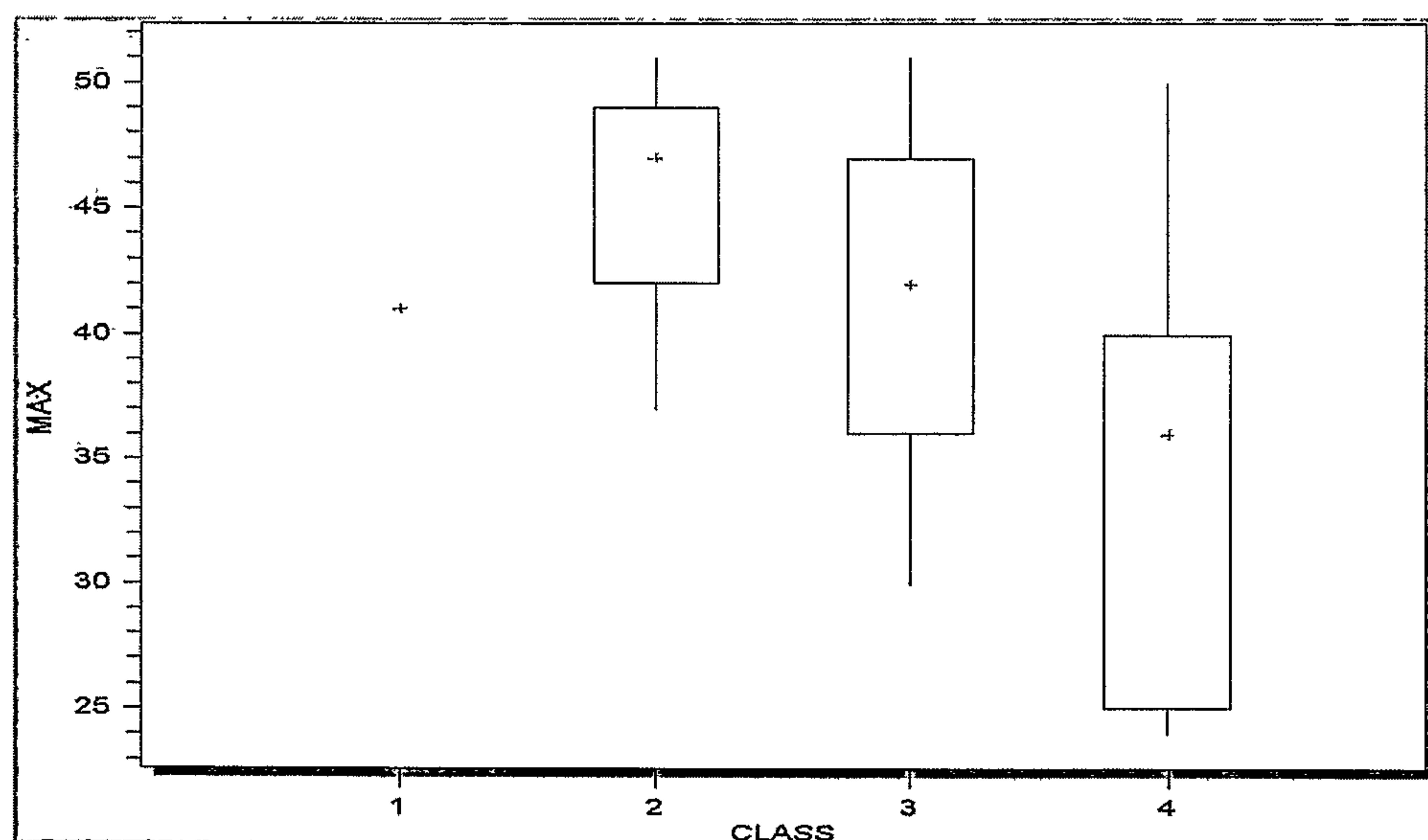


Figure 24: Box-whisker* plot of maximum mouth opening in mm (MAX) by class of functional disability (CLASS) where 1 = Class I, 2 = Class II, 3 = Class III, 4 = Class IV. *Central + defines the median, box ends define the 25th & 75th percentiles, and whiskers define 10th & 90th percentiles. Spearman's rank correlation coefficient (R_s) = -0.29, p-value = 0.003

Table 19: Distribution of maximum mouth opening capacity and related statistics by potential continuous type explanatory variables. Potential explanatory variables were identified as those showing significant associations (p<0.05) with the outcome variables in linear regression analyses.

Outcome variable	Unit	Range				
MAX Maximum mouth opening capacity	mm	23 to 65				
Potential explanatory variables	Unit	Regression Coefficient	R-square	Correlation Coefficient	F-Value	P-Value
<u>MHAQ</u> Activities of daily living score, based on 8 questions	score	-6.08	0.25	-0.5	32.2	0
<u>QSCORE</u> Oral Health Quality of Life score, based on 16 questions	score	0.12	0.06	0.24	6.55	0.012
<u>F8</u> The number of filled teeth including third molars	number of teeth	-0.31	0.05	-0.22	5.57	0.02

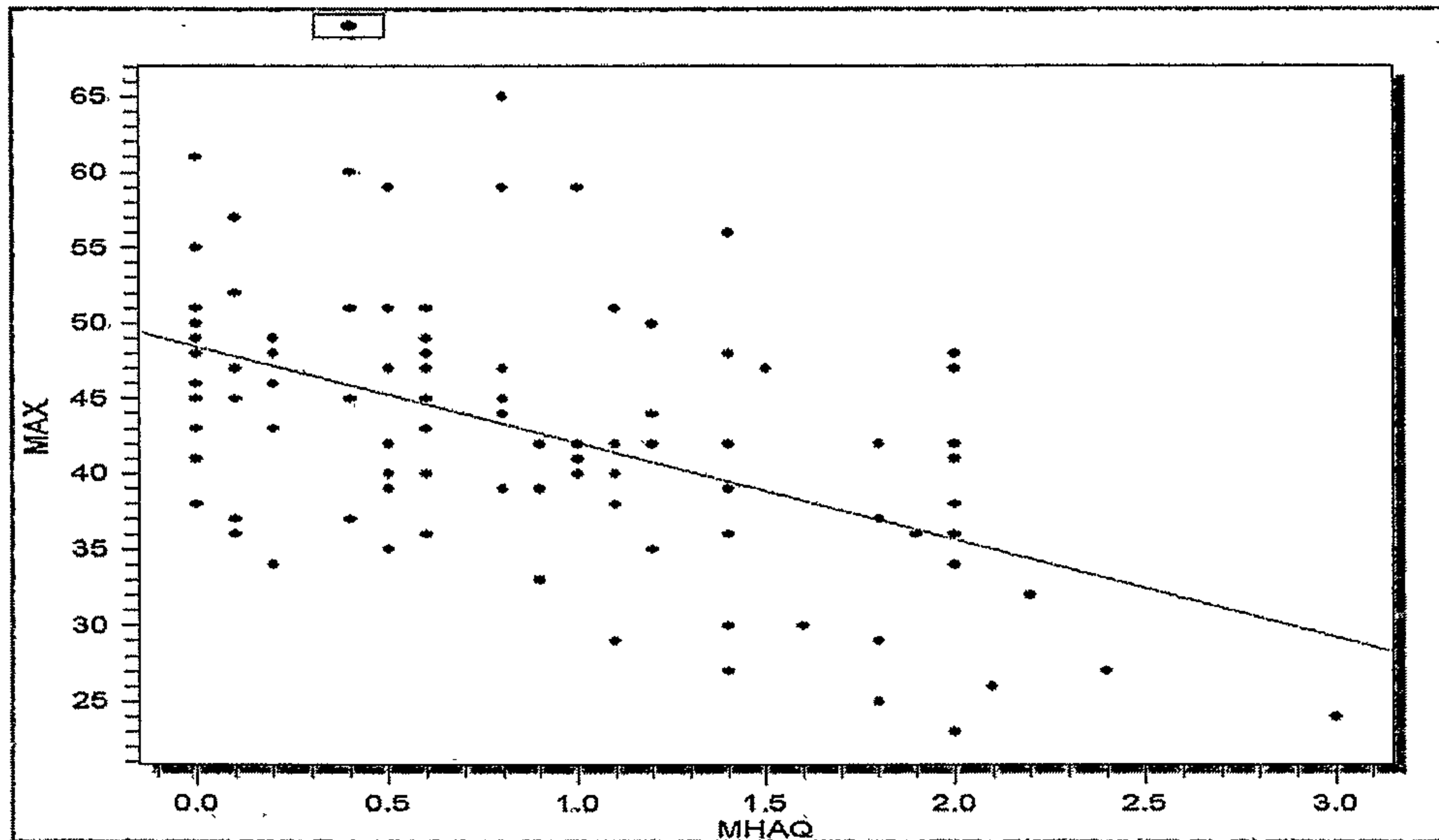


Figure 25: Scatter diagram of maximum mouth opening in mm (MAX) versus activities of daily living score (MHAQ). Correlation coefficient = -0.5, p-value = 0.000

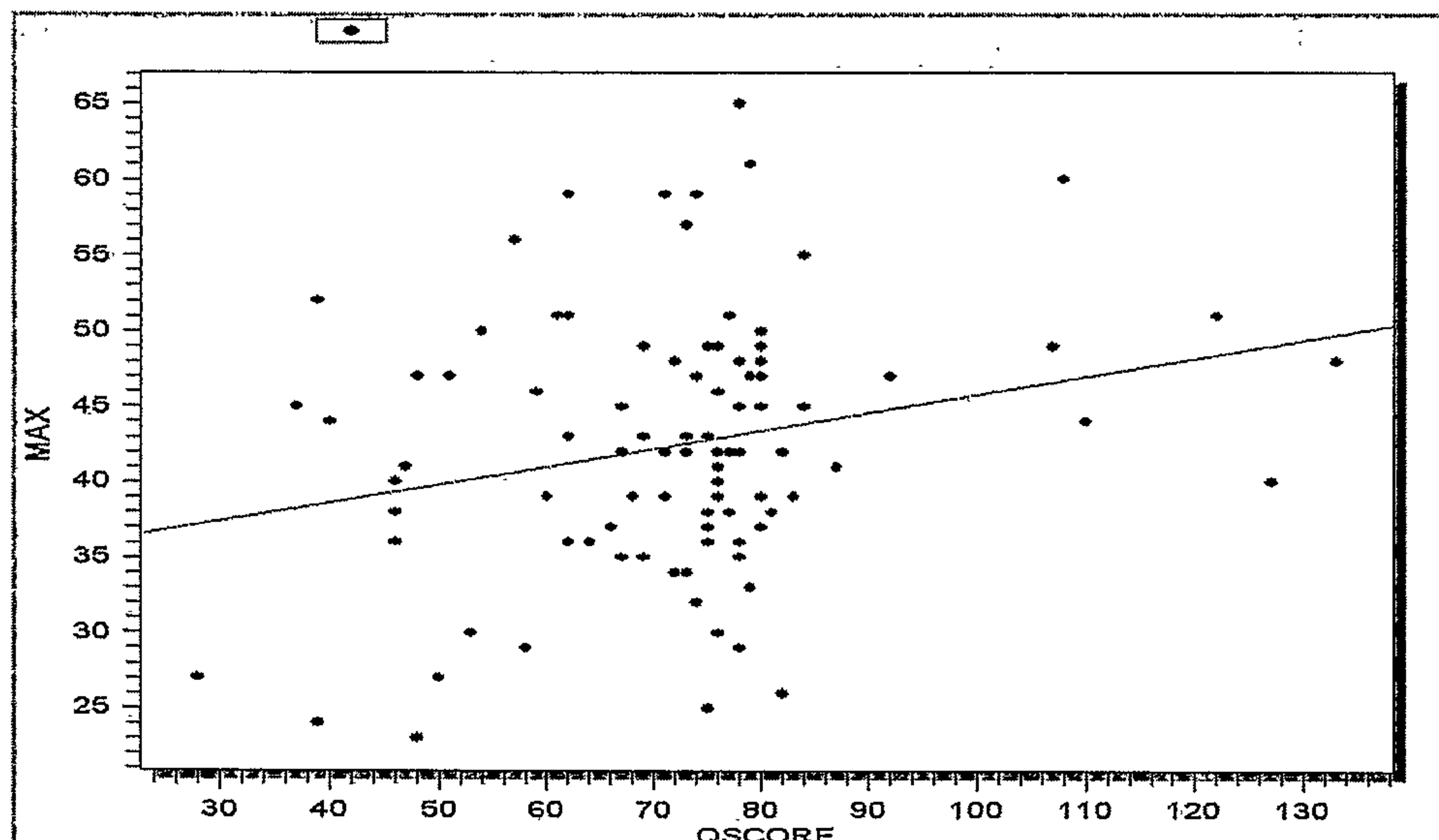


Figure 26: Scatter diagram of maximum mouth opening in mm (MAX) versus oral health related quality of life score (QSCORE). Correlation coefficient = 0.24, p-value = 0.012

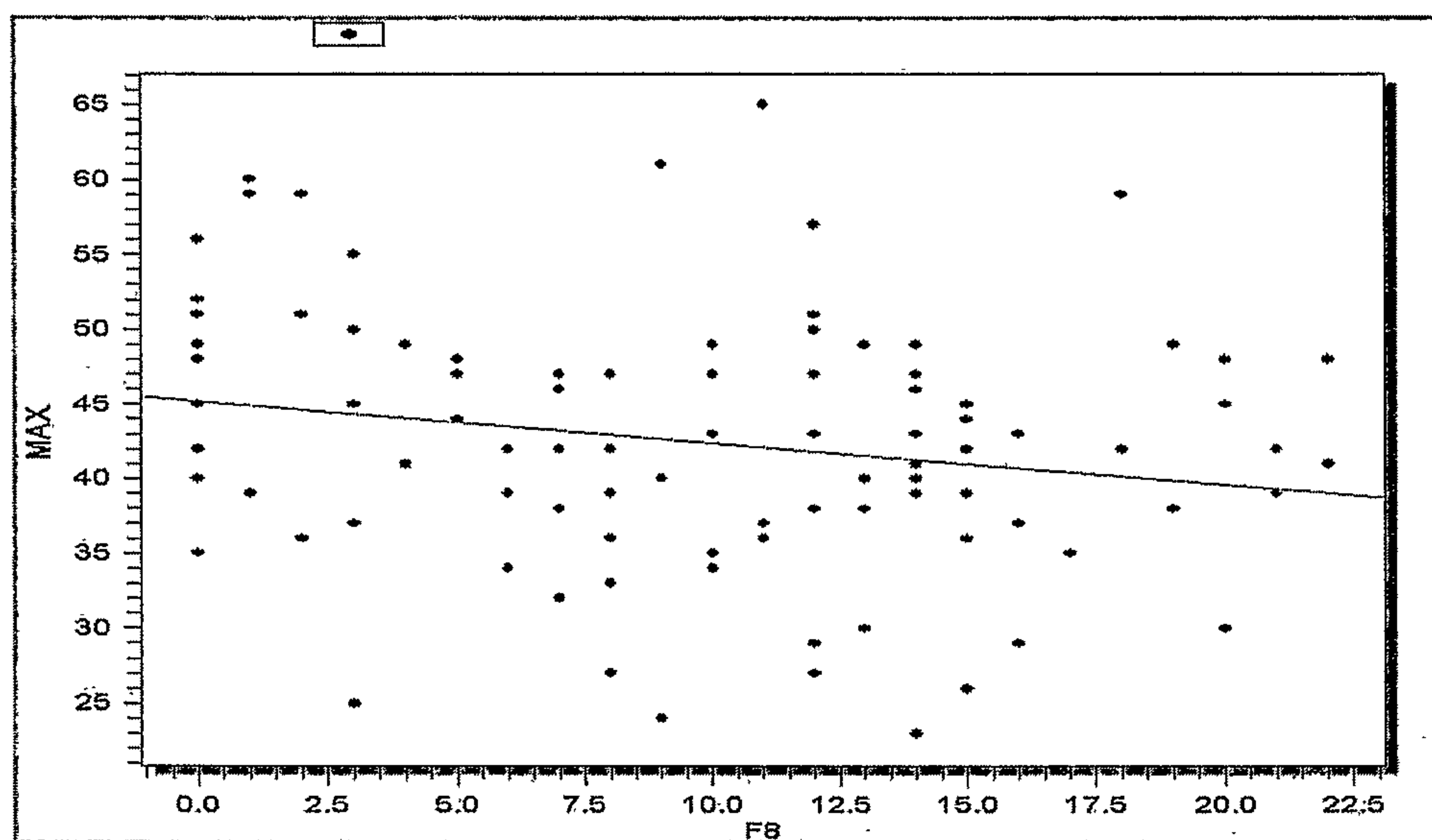


Figure 27: Scatter diagram of maximum mouth opening in mm (MAX) versus number of filled teeth including third molars (F8). Correlation coefficient = -0.22, p-value = 0.02

4.9 Risk of unfavourable oral health outcome

4.9.1 Risk of denture possession

The logistic regression analyses of variation in denture possession (DENTYN) showed that seven of 44 potential explanatory variables were significantly associated with DENTYN (Table 20).

Risk of denture possession was less among the patients who had visited a dentist regularly (OR = 0.25; 95% CI = 0.08, 0.78) and less among those who were diagnosed RA at below the age of 40 years (OR = 0.37; 95% CI = 0.14, 0.94). Also, those who had more teeth with cervical fillings were less likely to possess dentures. Most likely, this is because those who had more teeth with cervical fillings preferred to retain their teeth rather than to have them extracted. For instance, compared with those having less than four teeth with cervical fillings, those having more than 10 teeth with cervical fillings were 14 percent as likely to possess dentures (OR = 0.14; 95% CI = 0.03, 0.57). In contrast, the risk was greater among those who were older than 70 years (OR = 3.4; 95% CI = 1.3, 9.0) and greater among the in-patients compared with the out-patients (OR = 3.0; 95% CI = 1.0, 8.9).

4.9.2 Risk of dental pain when chewing

The logistic regression analyses of variation in dental pain when chewing (PROBT) showed that seven of 44 potential explanatory variables were significantly associated with PROBT (Table 21).

Risk of dental pain when chewing was least among the patients who had regularly visited a dentist compared with those who had not visited a dentist within the previous 12 months (OR = 0.22; 95% CI = 0.06, 0.78). The risk of dental pain when chewing was less among who had more than five root-filled teeth (OR = 0.40; 95% CI = 0.16, 1.0). There was marginally less risk of dental pain when chewing among those who had higher oral health quality of life scores (indicating better oral health related quality of life) (OR = 0.95; 95% CI = 0.92, 0.98) and among those who had more remaining teeth (OR = 0.95; 95% CI = 0.91, 0.99).

Table 20: Risk of denture possession. Potential explanatory variables were identified as those showing significant associations (p<0.05) with the outcome variables in logistic regression analyses. Categories shown in bold are reference categories in relation to odds

Outcome variable	Category	n						
DENTYN	0 No	36						
	1 Yes	64						
Use of denture Yes / No								
Total		100						
Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>ATTEND</u> How often have you visited a dentist in the last 12 months?	0 No	50	.					
	1 Regularly	17	0.25	(0.08, 0.78)	0.017	6.18	2	0.046
	2 When in pain	33	0.54	(0.21, 1.4)	0.2			
<u>ROOTD</u> The number of teeth with cervical fillings	1 0 - 0	67						
	2 1 - 1	14	0.17	(0.05, 0.61)	0.006	8.89	2	0.012
	3 2 - 6	19	0.92	(0.31, 2.8)	0.885			

(Continued)

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>ROOTFR5</u> The number of teeth with cervical fillings (Categorical)	1 0 - 4	75						
	2 5 - 9	14	0.27	(0.08, 0.88)	0.03	11.99	2	0.002
	3 10 -	11	0.14	(0.03, 0.57)	0.006			
<u>AGER10</u> Age (Categorical)	1 20 - 69	64						
	2 70 - 89	36	3.4	(1.3, 9.0)	0.012	6.69	1	0.01
<u>INOUT</u> In-patient/Out-patient	1 Out-patient	74						
	2 In-patient	26	3.0	(1.0, 8.9)	0.044	4.29	1	0.038
<u>ONSETR10</u> Age of RA onset (Categorical)	1 40 - 79	76						
	2 10 - 39	24	0.37	(0.14, 0.94)	0.037	4.52	1	0.033

(Continued)

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>SUMD</u>	0	1	1.3	(1.0, 1.6)	0.048	4.05	1	0.044
Sum of drugs taken	1	7						
	2	12						
(Ranks treated as continuous	3	18						
values in model)	4	21						
	5	22						
	6	9						
	7	8						
	8	1						
	9	1						

Table 21: Risk of pain when chewing. Potential explanatory variables were identified as those showing significant associations (p<0.05) with the outcome variables in logistic regression analyses. Categories shown in bold are reference categories in relation to odds ratio estimates.

Outcome variable	Category	n						
PROBT Are your teeth/gums/dentures painful when chewing ?	0 No	47						
	1 Yes	53						
	Total	100						
Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
QSCORE Oral Health Quality of Life score, based on 16 questions	Continuous	100	0.95	(0.92, 0.98)	0.002	12.31	1	0
	Unit - score							
PBRUSH Does your arthritis make it difficult for you to brush your teeth ?	0 None	43						
	1 Little	14	2.2	(0.59, 8.0)	0.244	9.47	4	0.05
	2 Moderate	28	0.41	(0.15, 1.1)	0.08			
	3 Great	9	3.0	(0.57, 16.4)	0.195			
	4 Extreme	6	1.7	(0.29, 10.5)	0.547			

(Continued)

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>ATTEND</u> How often have you visited a dentist in the last 12 months?	0 No 1 Regularly 2 When in pain	50 17 33	0.22 1.1	(0.06, 0.78) (0.45, 2.7)	0.019 0.813	7.2	2	0.027
<u>NTEETH</u> The number of remaining teeth including third molars	Continuous Unit - number of teeth	100	0.95	(0.91, 0.99)	0.011	6.77	1	0.009
<u>M8</u> The number of missing teeth including third molars	Continuous Unit - number of teeth	100	1.1	(1.0, 1.1)	0.011	6.77	1	0.009
<u>F8</u> The number of filled teeth including third molars	Continuous Unit - number of teeth	100	0.90	(0.84, 0.97)	0.004	8.98	1	0.003
<u>ROOTFR5</u> The number of teeth with cervical fillings (Categorical)	1 0 - 4 2 5 -	75 25	0.40	(0.16, 1.0)	0.053	3.87	1	0.049

4.9.3 Risk of jaw pain when chewing or shortly after

The logistic regression analyses of variation in jaw pain when chewing or shortly after (PROBJ) showed that nine of 44 potential explanatory variables were significantly associated with PROBJ (Table 22).

Risk of jaw pain when chewing or shortly after was significantly related to pain severity experienced in the face or jaw in the past six months (OR = 6.0; 95% CI = 2.4, 14.7). In this analysis, the pain severity ranks were treated as continuous measurements. In this case, the interpretation of the odds ratio is that of a multiplicative factor by which the odds of jaw pain when chewing increases per unit rank increase in pain severity, that is, compared with those who did not have pain in the face or jaw in the past six months, patients who had experienced a little pain in the face or jaw in the past six months were 6.0 times more likely to have jaw pain when chewing, whereas patients who had experienced moderate pain in the face or jaw in the past six months were 36 times (that is 6.0^2) more likely to have jaw pain when chewing.

Other notable findings in Table 22 were that the risk of jaw pain when chewing was significantly associated with levels of difficulty experienced when opening mouth (OR = 2.3; 95% CI = 1.2, 4.3). Furthermore, the patients having tenderness on palpation of the TMJ were 6.7 times more likely to have jaw pain when chewing (OR = 6.7; 95% CI = 1.5, 30.3) and those who having crepitus in the TMJ were 7.4 times more likely to have jaw pain when chewing (OR = 7.4; 95% CI = 1.6, 33.8).

4.9.4 Risk of pain in the face, jaw, in front of the ear, or cheeks in the past six months

In the logistic regression analyses of variation in pain in the face, jaw, in front of the ear, or cheeks in the past six months (PAINLEV), it was shown that nine of 44 potential explanatory variables were significantly associated with PAINLEV (Table 23).

Risk of PAINLEV was significantly related to levels of difficulty experienced when opening mouth (OPENM) (OR = 2.4; 95% CI = 1.5, 4.0) and was significantly associated with severity of functional disability (CLASS) (OR = 2.7; 95% CI = 1.0, 7.2). The patients who had tenderness on palpation of the TMJ were 5.9 times more likely to have PAINLEV

(OR = 5.9; 95% CI = 1.9, 18.4) and those who had crepitus in the TMJ were 3.8 times more likely to have PAINLEV (OR = 3.8; 95% CI = 1.4, 10.6).

4.9.5 Risk of pain in the face, jaw, in front of the ear, or cheeks after onset of RA

The logistic regression analyses of variation in pain in the face, jaw, in front of the ear, or cheeks after onset of RA (PAINAFT) showed that 13 of 44 potential explanatory variables were significantly associated with PAINAFT (Table 24).

Risk of PAINAFT was greater among the patients who had greater difficulty when opening the mouth (OPENM) (OR = 2.5; 95% CI = 1.5, 4.3), greater among those who had crepitus in the TMJ (OR = 6.4; 95% CI = 2.1, 19.3), and greater among those who were classified as having more severe functional disability (OR = 2.8; 95% CI = 1.2, 6.7). Those who had tenderness on palpation of the TMJ was 12.6 times more likely to have pain in the face or jaw after RA onset (OR = 12.6; 95% CI = 2.7, 59.2). On the other hand, risk was marginally less among those who had better quality of life (OR = 0.95) and less among those who had greater maximum mouth opening capacity (OR = 0.94).

4.9.6 Risk of experiencing difficulty when opening mouth

The logistic regression analyses of variation in difficulties experienced when opening mouth (OPENM) showed that 19 of 44 potential explanatory variables were significantly associated with OPENM (Table 25).

Risk of OPENM was greater among those who had jaw pain when chewing (OR = 5.3; 95% CI = 1.2, 24.0), greater among those who had experienced pain in the face or jaw after RA onset (OR = 5.8; 95% CI = 2.2, 15.7), and much greater those who had tenderness on palpation of the TMJ (OR = 8.6; 95% CI = 2.4, 31.2). Risk was less among the males (OR = 0.08; 95% CI = 0.01, 0.65).

Table 22: Risk of jaw pain when chewing or shortly after. Potential explanatory variables were identified as those showing significant associations (p<0.05) with the outcome variables in logistic regression analyses. Categories shown in bold are reference categories in relation to odds ratio estimates.

Outcome variable	Category	n						
PROBJ Does your jaw hurt when chewing or shortly after ?	0 No	92						
	1 Yes	8						
	Total	100						
Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>QSCORE</u> Oral Health Quality of Life score, based on 16 questions	Continuous	100	0.95	(0.90, 0.99)	0.019	5.37	1	0.02
	Unit - score							
<u>PAINLEV</u> Have you had pain in the face, jaw, in front of the ear, or cheeks in the past 6 months ? (Ranks treated as continuous values in model)	0 None	76	6.0	(2.4, 14.7)	0	33.21	1	0
	1 Little	11						
	2 Moderate	9						
	3 Great	4						
	4 Extreme	0						

(Continued)

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>OPENM</u> Do you have any difficulty when opening your mouth ? (Ranks treated as continuous values in model)	0 None 1 Little 2 Moderate 3 Great 4 Extreme	73 7 15 5 0	2.3	(1.2, 4.3)	0.014	7.48	1	0.006
<u>MAX</u> Maximum mouth opening capacity	Continuous Unit - mm	100	0.91	(0.83, 1.0)	0.04	4.44	1	0.035
<u>PALPT</u> Do you feel pain or pressure when I palpate your head or face?	0 No 1 Yes	62 38	5.6	(1.1, 29.5)	0.041	5.05	1	0.025
<u>TMJYN</u> Tenderness on palpation of the TMJ Yes / No	0 No 1 Yes	84 16	6.7	(1.5, 30.3)	0.014	7.48	1	0.006
(Continued)								

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>TEMPYN</u>								
Tenderness on palpation of the temporalis Yes / No	0 No 1 Yes	87 13	4.9	(1.0, 23.8)	0.047	4.62	1	0.032
<u>MASSEYN</u>								
Tenderness on palpation of the masseter Yes / No	0 No 1 Yes	67 33	7.2	(1.4, 38.0)	0.02	6.94	1	0.008
<u>CREPYN</u>								
Crepitus Yes / No	0 No 1 Yes	78 22	7.4	(1.6, 33.8)	0.01	8.31	1	0.004

Table 23: Risk of pain in the face, jaw, in front of the ear, or cheeks in the past six months. Potential explanatory variables were identified as those showing significant associations (p<0.05) with the outcome variables in logistic regression analyses. Categories shown in bold are reference categories in relation to odds ratio estimates.

Outcome variable	Category	n						
PAINLEV Have you had pain in the face, jaw, in front of the ear, or cheeks in the past 6 months ?	0 None	76						
	1 Yes	24						
	Total	100						
Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
MHAQ Activities of daily living score, based on 8 questions	Continuous Unit - score	100	1.9	(0.98, 3.7)	0.056	3.81	1	0.051
QSCORE Oral Health Quality of Life score, based on 16 questions	Continuous Unit - score	100	0.94	(0.91, 0.97)	0.001	12.53	1	0

(Continued)

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>OPENM</u> Do you have any difficulty when opening your mouth ? (Ranks treated as continuous values in model)	0 None 1 Little 2 Moderate 3 Great 4 Extreme	73 7 15 5 0	2.4	(1.5, 4.0)	0	15.54	1	0
<u>PALPT</u> Do you feel pain or pressure when I palpate your head or face?	0 No 1 Yes	62 38	3.0	(1.2, 7.8)	0.021	5.54	1	0.019
<u>TMJYN</u> Tenderness on palpation of the TMJ Yes / No	0 No 1 Yes	84 16	5.9	(1.9, 18.4)	0.002	10.86	1	0.001
<u>MASSEYN</u> Tenderness on palpation of the masseter Yes / No	0 No 1 Yes	67 33	3.3	(1.3, 8.6)	0.014	6.4	1	0.011

(Continued)

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>CREPYN</u>								
	0 No	78						
Crepitus Yes / No	1 Yes	22	3.8	(1.4, 10.6)	0.01	7.12	1	0.008
<u>CLASS</u>								
	1	1	2.7	(1.0, 7.2)	0.051	4.04	1	0.045
Class of functional disability	2	20						
(Ranks treated as continuous	3	72						
values in model)	4	7						
<u>ROJS</u>								
	1 None	6	3.3	(1.4, 8.2)	0.008	7.35	1	0.007
Region of swollen joints	2 Either	61						
(Ranks treated as continuous	3 Both	33						
values in model)								

Table 24: Risk of pain in the face, jaw, in front of the ear, or cheeks after onset of RA. Potential explanatory variables were identified as those showing significant associations (p<0.05) with the outcome variables in logistic regression analyses. Categories shown in bold are reference categories in relation to odds ratio estimates.

Outcome variable	Category	n						
PAINAFT Have you had pain in the face, jaw, in front of the ear, or cheeks after onset of RA?	0 No	56						
	1 Yes	44						
	Total	100						
Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
MHAQ Activities of daily living score, based on 8 questions	Continuous Unit - score	100	1.9	(1.1, 3.5)	0.034	4.7	1	0.03
QSCORE Oral Health Quality of Life score, based on 16 questions	Continuous Unit - score	100	0.96	(0.94, 0.99)	0.01	7.5	1	0.006
(Continued)								

(Continued)

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>OPENM</u> Do you have any difficulty when opening your mouth ? (Ranks treated as continuous values in model)	0 None 1 Little 2 Moderate 3 Great 4 Extreme	73 7 15 5 0	2.5	(1.5, 4.3)	0.001	14	1	0
<u>MAX</u> Maximum mouth opening capacity	Continuous Unit - mm	100	0.94	(0.89, 0.99)	0.015	6.3	1	0.012
<u>PALPT</u> Do you feel pain or pressure when I palpate your head or face?	0 No 1 Yes	62 38	3.0	(1.3, 6.9)	0.01	6.79	1	0.009
<u>TMJYN</u> Tenderness on palpation of the TMJ Yes / No	0 No 1 Yes	84 16	12.6	(2.7, 59.2)	0.001	14.63	1	0

(Continued)

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>TEMPYN</u>								
Tenderness on palpation of the tempolaris Yes / No	0 No 1 Yes	87 13	3.3	(0.95, 11.7)	0.059	3.86	1	0.049
<u>MASSEYN</u>								
Tenderness on palpation of the masseter Yes / No	0 No 1 Yes	67 33	2.8	(1.2, 6.5)	0.021	5.51	1	0.019
<u>CREPYN</u>								
Crepitus Yes / No	0 No 1 Yes	78 22	6.4	(2.1, 19.3)	0.001	12.67	1	0
<u>AGE</u>								
Age	Continuous Unit - years	100	0.96	(0.92, 1.0)	0.041	4.47	1	0.034

(Continued)

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>CLASS</u>								
Class of functional disability (Ranks treated as continuous values in model)	1	1	2.8	(1.2, 6.7)	0.018	6.15	1	0.013
	2	20						
	3	72						
	4	7						
<u>NOJSR5</u>								
Number of swollen joints (Categorical)	1 0 - 4	70						
	2 5 -	30	2.5	(1.1, 6.1)	0.037	4.45	1	0.035
<u>ROIS</u>								
Region of swollen joints (Ranks treated as continuous values in model)	1 None	6	2.3	(1.1, 4.8)	0.032	4.79	1	0.029
	2 Either	61						
	3 Both	33						

Table 25: Risk of experiencing difficulty in opening mouth. Potential explanatory variables were identified as those showing significant associations (p<0.05) with the outcome variables in logistic regression analyses. Categories shown in bold are reference categories in relation to odds ratio estimates.

Outcome variable	Category	n						
OPENM Do you have any difficulty when opening your mouth ?	0 None	73						
	1 Yes	27						
	Total	100						
Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
MHAQ Activities of daily living score, based on 8 questions	Continuous Unit - score	100	2.6	(1.4, 5.1)	0.005	8.85	1	0.003
QSCORE Oral Health Quality of Life score, based on 16 questions	Continuous Unit - score	100	0.96	(0.93, 0.99)	0.007	7.88	1	0.005
PROBI Does your jaw hurt when chewing or shortly after ?	0 No 1 Yes	92 8	5.3	(1.2, 24.0)	0.03	5.56	1	0.018

(Continued)

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>PAINLEV</u> Have you had pain in the face, jaw, in front of the ear, or cheeks in the past 6 months ? (Ranks treated as continuous values in model)	0 None 1 Little 2 Moderate 3 Great 4 Extreme	76 11 9 4 0	3.5	(1.9, 6.6)	0	21.97	1	0
<u>PAINAFT</u> Have you had pain in the face, jaw, in front of the ear, or cheeks after onset of RA?	0 No 1 Yes	56 44	5.8	(2.2, 15.7)	0	13.58	1	0
<u>DRYM</u> Does your mouth feel dry when eating a meal ?	0 No 1 Yes	72 28	4.5	(1.8, 11.8)	0.002	10.44	1	0.001
<u>SIP</u> Do you sip liquids to aid in swallowing dry foods?	0 No 1 Yes	56 44	3.6	(1.4, 9.2)	0.007	7.71	1	0.005

(Continued)

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>SXERS</u> Score of Xerostomia (the number of answer YES to questions 6, 7, and 8) (Ranks treated as continuous values in model)	0 1 2 3	50 23 21 6	2.2	(1.4, 3.6)	0.001	11.73	1	0.001
<u>MAX</u> Maximum mouth opening capacity	Continuous Unit - mm	100	0.82	(0.75, 0.89)	0	27.24	1	0
<u>PALPT</u> Do you feel pain or pressure when I palpate your head or face?	0 No 1 Yes	62 38	2.7	(1.1, 6.7)	0.03	4.84	1	0.028
<u>TMJYN</u> Tenderness on palpation of the TMJ Yes / No	0 No 1 Yes	84 16	3.4	(1.1, 10.3)	0.029	5.11	1	0.024
<u>TEMPYN</u> Tenderness on palpation of the tempolaris Yes / No	0 No 1 Yes	87 13	8.6	(2.4, 31.2)	0.001	13.52	1	0

(Continued)

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>CREPYN</u>								
Crepitus Yes / No	0 No 1 Yes	78 22	3.0	(1.1, 8.1)	0.031	4.87	1	0.027
<u>NTR10</u>								
The number of remaining teeth including third molars (Categorical)	1 10 - 2 0 - 9	68 32	0.28	(0.09, 0.89)	0.032	5.02	1	0.025
<u>D8</u>								
The number of decayed teeth including third molars	Continuous Unit - number of teeth	100	1.4	(1.0, 2.0)	0.052	4.3	1	0.038
<u>M8R5</u>								
The number of missing teeth including third molars (Categorical)	1 0 - 9 2 10 - 19 3 20 -	37 28 35	1.8 0.30	(0.63, 5.0) (0.09, 1.1)	0.275 0.064	8.02	2	0.018
(Continued)								

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>F8R5</u>								
The number of filled teeth including third molars (Categorical)	1 0 - 9	49						
	2 10 -	51	3.0	(1.2, 7.8)	0.021	5.55	1	0.018
<u>SEX</u>								
Gender	1 Female	76						
	2 Male	24	0.08	(0.01, 0.65)	0.018	8.35	1	0.004
<u>CLASS</u>								
Class of functional disability	1 1 - 2	21						
	2 3 - 4	79	4.4	(0.95, 20.4)	0.058	4.12	1	0.042

4.9.7 Risk of experiencing difficulty when swallowing foods

In the logistic regression analyses of variation in difficulties experienced when swallowing foods (SWALLOW), it was shown that 11 potential explanatory variables were significantly associated with SWALLOW (Table 26).

Risk of experiencing difficulty when swallowing foods was greater among those who had dry mouth when eating a meal (OR = 3.7; 95% CI = 1.0, 13.2), greater among those who had greater difficulty in performing activities of daily living (OR = 3.0; 95% CI = 1.2, 7.3), and greater among those who were classified as having more severe functional disability (OR = 4.6; 95% CI = 1.2, 18.2).

4.9.8 Risk of dry mouth when eating

In the logistic regression analyses of variation in dry mouth when eating (DRYM), it was shown that 10 of 44 potential explanatory variables were significantly associated with DRYM (Table 27).

Risk of DRYM was much greater among those who had needs to sip liquids to aid in swallowing (OR = 23.3; 95% CI = 6.3, 85.9) and greater among those who had greater difficulty in performing activities of daily living (OR = 2.7; 95% CI = 1.4, 5.4).

4.9.9 Risk of need to sip to aid swallowing

In the logistic regression analyses of variation in need to sip to aid swallowing (SIP), it was shown that seven of 44 potential explanatory variables were significantly associated with SIP (Table 28).

Those who had maximum mouth opening capacity of less than 40 mm, which is considered restricted, were 3.3 times more likely to have needs to sip to aid swallowing compared with those who had maximum mouth opening capacity of more than 40 mm. Also, those who experienced difficulty when opening mouth were more likely to need to sip to aid swallowing (OR = 1.7; 95% CI = 1.1, 2.7).

Table 26: Risk of experiencing difficulty when swallowing foods. Potential explanatory variables were identified as those showing significant associations ($p<0.05$) with the outcome variables in logistic regression analyses. Categories shown in bold are reference categories in relation to odds ratio estimates.

Outcome variable	Category	n						
SWALLOW Do you have difficulties swallowing any foods ?	0 No	89						
	1 Yes	11						
	Total	100						
Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>MHAQ</u> Activities of daily living score, based on 8 questions	Continuous	100	3.0	(1.2, 7.3)	0.018	6.36	1	0.012
	Unit - score							
<u>PAINLEV</u> Have you had pain in the face, jaw, in front of the ear, or cheeks in the past 6 months ? (Ranks treated as continuous values in model)	0 None	76	1.9	(1.0, 3.5)	0.043	4.65	1	0.031
	1 Little	11						
	2 Moderate	9						
	3 Great	4						
	4 Extreme	0						

(Continued)

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>DRYM</u> Does your mouth feel dry when eating a meal ?	0 No 1 Yes	72 28	3.7	(1.0, 13.2)	0.047	4.32	1	0.038
<u>SIP</u> Do you sip liquids to aid in swallowing dry foods?	0 No 1 Yes	56 44	3.9	(0.98, 15.8)	0.054	4.14	1	0.042
<u>SXERS</u> Score of Xerostomia (the number of answer YES to questions 6, 7, and 8) (Ranks treated as continuous values in model)	0 1 2 3	50 23 21 6	8.2	(2.7, 25.2)	0	27.93	1	0
<u>PBRUSH</u> Does your arthritis make it difficult for you to brush your teeth ?	0 None 1 Little 2 Moderate 3 Great 4 Extreme	43 14 28 9 6	8.2 1.6 2.6 10.3	(1.3, 51.2) (0.21, 11.9) (0.21, 31.8) (1.1, 93.7)	0.024 0.659 0.464 0.039	9.67	4	0.046

(Continued)

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>TEMPYN</u>								
Tenderness on palpation of the temporalis Yes / No	0 No 1 Yes	87 13	5.1	(1.2, 20.8)	0.024	5.97	1	0.015
<u>CLICKYN</u>								
Clicking Yes / No	0 No 1 Yes	52 48	0.21	(0.04, 1.0)	0.052	4.4	1	0.036
<u>CREPYN</u>								
Crepitus Yes / No	0 No 1 Yes	78 22	3.5	(0.96, 12.9)	0.057	3.96	1	0.047
<u>AGEONS</u>								
Age of RA onset	Continuous Unit - years	100	0.95	(0.91, 0.99)	0.029	5.17	1	0.023
<u>CLASS</u>								
Class of functional disability (Ranks treated as continuous values in model)	1 2 3 4	1 20 72 7	4.6	(1.2, 18.2)	0.03	4.73	1	0.03

Table 27: Risk of dry mouth when eating. Potential explanatory variables were identified as those showing significant associations (p<0.05) with the outcome variables in logistic regression analyses. Categories shown in bold are reference categories in relation to odds ratio estimates.

Outcome variable	Category	n						
DRYM								
	0 No	72						
	1 Yes	28						
Total		100						
Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
MHAQ Activities of daily living score, based on 8 questions	Continuous	100	2.7	(1.4, 5.4)	0.003	9.67	1	0.002
	Unit - score							
PAINLEV Have you had pain in the face, jaw, in front of the ear, or cheeks in the past 6 months ? (Ranks treated as continuous values in model)	0 None	76	1.7	(1.0, 2.8)	0.048	4.24	1	0.04
	1 Little	11						
	2 Moderate	9						
	3 Great	4						
	4 Extreme	0						

(Continued)

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>OPENM</u> Do you have any difficulty when opening your mouth ? (Ranks treated as continuous values in model)	0 None 1 Little 2 Moderate 3 Great 4 Extreme	73 7 15 5 0	1.8	(1.1, 2.7)	0.015	6.36	1	0.012
<u>SWALLOW</u> Do you have difficulties swallowing any foods ?	0 No 1 Yes	89 11	3.7	(1.0, 13.2)	0.047	4.32	1	0.038
<u>SIP</u> Do you sip liquids to aid in swallowing dry foods?	0 No 1 Yes	56 44	23.3	(6.3, 85.9)	0	32.37	1	0
<u>SXERS</u> Score of Xerostomia (the number of answer YES to questions 6, 7, and 8) (Ranks treated as continuous values in model)	0 1 2 3	50 23 21 6	72.9	(12.4, 430.8)	0	68.86	1	0

(Continued)

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>MAX</u> Maximum mouth opening capacity	Continuous Unit - mm	100	0.94	(0.89, 1.0)	0.036	4.63	1	0.031
<u>TEMPYN</u> Tenderness on palpation of the temporalis Yes / No	0 No 1 Yes	87 13	5.4	(1.6, 18.2)	0.007	8.34	1	0.004
<u>CRP</u> C-reactive protein	Continuous Unit - mg/dl	100	0.74	(0.55, 1.0)	0.049	4.2	1	0.04
<u>SUMD</u> Sum of drugs taken (Ranks treated as continuous values in model)	0 1 2 3 4 5 6 7 8 9	1 7 12 18 21 22 9 8 1 1	1.4	(1.1, 1.8)	0.019	5.87	1	0.015

Table 28: Risk of need to sip to aid swallowing. Potential explanatory variables were identified as those showing significant associations (p<0.05) with the outcome variables in logistic regression analyses. Categories shown in bold are reference categories in relation to odds ratio estimates.

Outcome variable	Category	n					
SIP							
	0 No	56					
	1 Yes	44					
Do you sip liquids to aid in swallowing dry foods?							
Total		100					
Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF
							Overall P-value
<u>MHAQ</u>							
Activities of daily living score, based on 8 questions	Continuous	100	1.8	(0.99, 3.2)	0.053	3.86	1
	Unit - score						0.049
<u>OPENM</u>							
Do you have any difficulty when opening your mouth ?	0 None	73	1.7	(1.1, 2.7)	0.019	5.91	1
(Ranks treated as continuous values in model)	1 Little	7					0.015
	2 Moderate	15					
	3 Great	5					
	4 Extreme	0					

(Continued)

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>SWALLOW</u> Do you have difficulties swallowing any foods ?	0 No 1 Yes	89 11	3.9	(0.98, 15.8)	0.054	4.14	1	0.042
<u>DRYM</u> Does your mouth feel dry when eating a meal ?	0 No 1 Yes	72 28	23.3	(6.3, 85.9)	0	32.37	1	0
<u>ATTEND</u> How often have you visited a dentist in the last 12 months?	0 No 1 Regularly 2 When in pain	50 17 33	0.46 2.3	(0.13, 1.6) (0.94, 5.7)	0.227 0.068	6.91	2	0.032
<u>MAXRIO</u> Maximum mouth opening capacity (mm)	1 40 - 69 2 20 - 39	65 35	3.3	(1.4, 7.8)	0.006	7.77	1	0.005
<u>TEMPYN</u> Tenderness on palpation of the tempolaris Yes / No	0 No 1 Yes	87 13	3.3	(0.95, 11.7)	0.059	3.86	1	0.049

4.9.10 Risk of experiencing difficulty when tooth brushing

The logistic regression analyses of variation in difficulty experienced when tooth brushing (PBRUSH) showed that 17 of 44 potential explanatory variables were significantly associated with PBRUSH (Table 29).

Risk of experiencing tooth brushing difficulty was greater among those who had TMJ symptoms (OR = 4.8; 95% CI = 2.0, 11.7) and greater among those who had greater pain in the face or jaw in the past six months (OR = 4.9; 95% CI = 1.7, 14.5). Also, this risk was strongly associated with difficulty in performing activities of daily living (OR = 5.7; 95% CI = 2.5, 13.0) and was similarly related to levels of functional disability (OR = 8.7; 95% CI = 2.8, 26.5). Furthermore, those who were diagnosed with RA at younger than 40 years of age were 2.9 times more likely to have difficulty when tooth brushing compared with those who were diagnosed with RA at older than 40 years of age.

4.9.11 Risk of experiencing tenderness on palpation of the head or face

The logistic regression analyses of variation in experiencing tenderness on palpation of the head or face (PALPT) showed that 10 of 44 potential explanatory variables were significantly associated with PALPT (Table 30).

Risk of PALPT was greater among those who had greater difficulty in performing activities of daily living (OR = 2.9; 95% CI = 1.5, 5.5) and greater among those who were classified as more severe functional disability (OR = 2.5; 95% CI = 1.1, 6.0). Furthermore, those who had quality of life scores of 20 – 49 (poorer quality of life) were 8.8 times more likely to have tenderness on palpation of the head or face compared with those who had quality of life scores of 80 – 139 (better quality of life). Risk of PALPT was less among the males (OR = 0.25; 95% CI = 0.08, 0.79).

Table 29: Risk of experiencing difficulty when tooth brushing . Potential explanatory variables were identified as those showing significant associations (p<0.05) with the outcome variables in logistic regression analyses. Categories shown in bold are reference categories in relation to odds ratio estimates.

Outcome variable	Category	n						
PBRUSH Does your arthritis make it difficult for you to brush your teeth ?	0 None	43						
	1 Yes	57						
	Total	100						
Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>MHAQ</u> Activities of daily living score, based on 8 questions	Continuous Unit - score	100	5.7	(2.5, 13.0)	0	21.14	1	0
<u>QSCORE</u> Oral Health Quality of Life score, based on 16 questions	Continuous Unit - score	100	0.97	(0.94, 0.99)	0.018	6.31	1	0.012

(Continued)

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>PAINLEV</u> Have you had pain in the face, jaw, in front of the ear, or cheeks in the past 6 months ? (Ranks treated as continuous values in model)	0 None 1 Little 2 Moderate 3 Great 4 Extreme	76 11 9 4 0	4.9	(1.7, 14.5)	0.004	13.19	1	0
<u>PAINAFT</u> Have you had pain in the face, jaw, in front of the ear, or cheeks after onset of RA?	0 No 1 Yes	56 44	3.3	(1.4, 7.7)	0.006	7.93	1	0.005
<u>OPENM</u> Do you have any difficulty when opening your mouth ? (Ranks treated as continuous values in model)	0 None 1 Little 2 Moderate 3 Great 4 Extreme	73 7 15 5 0	1.9	(1.1, 3.2)	0.018	6.2	1	0.013
<u>MAX</u> Maximum mouth opening capacity	Continuous Unit - mm	100	0.93	(0.88, 0.98)	0.008	7.69	1	0.006

(Continued)

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>PALPT</u>								
Do you feel pain or pressure when I palpate your head or face?	0 No 1 Yes	62 38	6.1	(2.3, 16.1)	0	15.11	1	0
<u>MASSEYN</u>								
Tenderness on palpation of the masseter Yes / No	0 No 1 Yes	67 33	7.3	(2.5, 21.3)	0	15.58	1	0
<u>CREPYN</u>								
Crepitus Yes / No	0 No 1 Yes	78 22	4.5	(1.4, 14.5)	0.012	7.09	1	0.008
<u>M8R5</u>								
The number of missing teeth including third molars (Categorical)	1 0 - 4 2 5 - 29 3 30 -	16 69 15	0.28 0.15	(0.07, 1.1) (0.03, 0.78)	0.065 0.024	5.71	2	0.057
(Continued)								

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>F8R5</u> The number of filled teeth including third molars (Categorical)	1 0 - 9 2 10 -	49 51	2.3	(1.0, 5.1)	0.048	3.97	1	0.046
<u>ONSETR10</u> Age of RA onset (Categorical)	1 40 - 79 2 10 - 39	76 24	2.9	(1.0, 8.0)	0.046	4.17	1	0.041
<u>CLASS</u> Class of functional disability (Ranks treated as continuous values in model)	1 2 3 4	1 20 72 7	8.7	(2.8, 26.5)	0	18.93	1	0
<u>R0JS</u> Region of swollen joints	0 None 1 Lower 2 Upper 3 Both	6 18 43 33	2.5 7.7 13.3	(0.24, 26.5) (0.82, 71.3) (1.4, 130.3)	0.447 0.074 0.026	11.64	3	0.009

(Continued)

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>SUMD</u>								
	1 0 - 2	20						
Sum of drugs taken	2 3 - 4	39	2.2	(0.71, 6.6)	0.174	7.26	2	0.026
	3 5 - 9	41	4.5	(1.4, 14.0)	0.01			
<u>F8</u>								
The number of filled teeth including third molars	Continuous	100	1.1	(1.0, 1.2)	0.023	5.36	1	0.021
	Unit - number of teeth							
<u>TLTMI</u>								
A symptom of TMJ Yes / No	0 No	34						
(Ranks treated as continuous values in model)	1 Yes	66	4.8	(2.0, 11.7)	0	12.77	1	0

Table 30: Risk of experiencing pain on palpation of head or face. Potential explanatory variables were identified as those showing significant associations ($p<0.05$) with the outcome variables in logistic regression analyses. Categories shown in bold are reference categories in relation to odds ratio estimates.

Outcome variable	Category	n						
PALPT Do you feel pain or pressure when I palpate your head or face?	0 No	62						
	1 Yes	38						
	Total	100						
Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>MHAQ</u> Activities of daily living score, based on 8 questions	Continuous	100	2.9	(1.5, 5.5)	0.001	11.32	1	0.001
	Unit - score							
<u>QSR30</u> Oral Health Quality of Life score, based on 16 questions (Categorical)	1 80 - 139	24						
	2 50 - 79	65	3.6	(1.1, 11.6)	0.036	8.05	2	0.018
	3 20 - 49	11	8.8	(1.7, 44.7)	0.009			

(Continued)

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>PROBJ</u> Does your jaw hurt when chewing or shortly after ?	0 No 1 Yes	92 8	5.6	(1.1, 29.5)	0.041	5.05	1	0.025
<u>PAINLEV</u> Have you had pain in the face, jaw, in front of the ear, or cheeks in the past 6 months ? (Ranks treated as continuous values in model)	0 None 1 Little 2 Moderate 3 Great 4 Extreme	76 11 9 4 0	2.3	(1.3, 4.0)	0.004	9.89	1	0.002
<u>PAINAFT</u> Have you had pain in the face, jaw, in front of the ear, or cheeks after onset of RA?	0 No 1 Yes	56 44	3.0	(1.3, 6.9)	0.01	6.79	1	0.009
<u>OPENM</u> Do you have any difficulty when opening your mouth ? (Ranks treated as continuous values in model)	0 None 1 Little 2 Moderate 3 Great 4 Extreme	73 7 15 5 0	1.7	(1.1, 2.7)	0.016	6.31	1	0.012

(Continued)

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>MAX</u> Maximum mouth opening capacity	Continuous Unit - mm	100	0.91	(0.86, 0.97)	0.002	11.04	1	0.001
<u>SEX</u> Gender	1 Female 2 Male	76 24	0.25	(0.08, 0.79)	0.019	6.1	1	0.014
<u>CLASS</u> Class of functional disability (Ranks treated as continuous values in model)	1 2 3 4	1 20 72 7	2.5	(1.1, 6.0)	0.035	4.8	1	0.029
<u>RQJS</u> Region of swollen joints (Ranks treated as continuous values in model)	1 None 2 Either 3 Both	6 61 33	2.2	(1.0, 4.7)	0.039	4.41	1	0.036

4.9.12 Risk of experiencing jaw crepitus on mouth opening

In the logistic regression analyses of variation in experiencing jaw crepitus on mouth opening (CREPYN), it was shown that 15 of 44 potential explanatory variables were significantly associated with CREPYN (Table 31).

The most substantial findings in Table 31 were that the risk of CREPYN was greater among those who had greater difficulty in performing activities of daily living (OR = 2.9; 95% CI = 1.4, 5.9) and much greater among those who were classified as more severe RA stage (OR = 16.4; 95% CI = 2.2, 120.7). Also, those who had jaw pain when chewing were 7.4 times more likely to have experienced crepitus. Furthermore, those who had experienced pain in the face or jaw since RA onset were 6.4 times more likely to have experienced crepitus.

4.9.13 Risk of experiencing TMJ symptoms

The logistic regression analyses of variation in TMJ symptoms (TLTMJ) showed that eight of 44 potential explanatory variables were significantly associated with TLTMJ (Table 32).

Risk of TLTMJ was greater among who had greater difficulty in performing activities of daily living (OR = 2.9; 95% CI = 1.4, 6.0). Also, those who had more remaining teeth were more likely to have experienced TMJ symptoms. For instance, compared with those having 0 – 9 remaining teeth, those having 10 – 19 remaining teeth were 4.5 times more likely to have experienced TMJ symptoms (OR = 4.5; 95% CI = 1.2, 16.6) . On the other hand, risk was less among those who had greater maximum mouth opening capacity (OR = 0.89; 95% CI = 0.84, 0.95) and marginally less among those who had better oral health related quality of life (OR = 0.97; 95% CI = 0.95, 1.0).

4.10 Reliability of measurements

Eight of the 100 patients were reassessed after three weeks. Intra-examiner reliability regarding DMFT was high (Kappa = 0.96) (*see Appendix K*).

Table 31: Risk of experiencing jaw crepitus on mouth opening. Potential explanatory variables were identified as those showing significant associations ($p<0.05$) with the outcome variables in logistic regression analyses. Categories shown in bold are reference categories in relation to odds ratio estimates.

Outcome variable	Category	n						
CREPYN Crepitus Yes / No	0 No	78						
	1 Yes	22						
Total		100						
Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
MHAQ Activities of daily living score, based on 8 questions	Continuous Unit - score	100	2.9	(1.4, 5.9)	0.004	9.47	1	0.002
QSCORE Oral Health Quality of Life score, based on 16 questions	Continuous Unit - score	100	0.96	(0.93, 0.99)	0.014	6.26	1	0.012
(Continued)								

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>PROBJ</u> Does your jaw hurt when chewing or shortly after ?	0 No 1 Yes	92 8	7.4	(1.6, 33.8)	0.01	8.31	1	0.004
<u>PAINLEV</u> Have you had pain in the face, jaw, in front of the ear, or cheeks in the past 6 months ? (Ranks treated as continuous values in model)	0 None 1 Little 2 Moderate 3 Great 4 Extreme	76 11 9 4 0	2.4	(1.4, 4.2)	0.001	12.64	1	0
<u>PAINAFT</u> Have you had pain in the face, jaw, in front of the ear, or cheeks after onset of RA?	0 No 1 Yes	56 44	6.4	(2.1, 19.3)	0.001	12.67	1	0
<u>OPENM</u> Do you have any difficulty when opening your mouth ? (Ranks treated as continuous values in model)	0 None 1 Little 2 Moderate 3 Great 4 Extreme	73 7 15 5 0	1.7	(1.1, 2.7)	0.031	5.03	1	0.025

(Continued)

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>SWALLOW</u>								
Do you have difficulties swallowing any foods ?	0 No	89						
	1 Yes	11	3.5	(0.96, 12.9)	0.057	3.96	1	0.047
<u>SXERS</u>								
Score of Xerostomia (the number of answer YES to questions 6, 7, and 8)	0	50						
	1	23	0.60	(0.15, 2.4)	0.474	8.21	3	0.042
	2	21	1.3	(0.37, 4.2)	0.72			
	3	6	8.0	(1.3, 50.0)	0.026			
<u>MAX</u>								
Maximum mouth opening capacity	Continuous	100	0.94	(0.89, 1.0)	0.042	4.31	1	0.038
	Unit - mm							
<u>CLICKYN</u>								
Clicking Yes / No	0 No	52						
	1 Yes	48	0.07	(0.02, 0.32)	0.001	17.11	1	0

(Continued)

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>DMFT8</u>	Continuous	100	1.0	(0.93, 1.1)	0.999	0	1	0
DMFT based on 32 teeth								
<u>AGEONS</u>	Continuous	100	0.94	(0.91, 0.98)	0.002	10.81	1	0.001
Age of RA onset								
<u>DURAT</u>	Continuous	100	1.1	(1.0, 1.1)	0.007	8.34	1	0.004
Years duration of RA								
<u>CLASS</u>	1	1	2.7	(0.96, 7.4)	0.059	3.75	1	0.053
Class of functional disability (Ranks treated as continuous values in model)	2	20						
	3	72						
	4	7						

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>STAGE</u>	1	8	16.4	(2.2, 120.7)	0.006	15.09	1	0
Stage of joint destruction	2	13						
	3	25						
(Ranks treated as continuous values in model)	4	54						

Table 32: Risk of experiencing TMJ symptoms. Potential explanatory variables were identified as those showing significant associations (p<0.05) with the outcome variables in logistic regression analyses. Categories shown in bold are reference categories in relation to odds ratio estimates.

Outcome variable	Category	n						
TLTMJ	0 No	34						
	1 Yes	66						
Total			100					
Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>MHAQ</u> Activities of daily living score, based on 8 questions	Continuous Unit - score	100	2.9	(1.4, 6.0)	0.004	8.89	1	0.003
<u>QSCORE</u> Oral Health Quality of Life score, based on 16 questions	Continuous Unit - score	100	0.97	(0.95, 1.0)	0.038	4.75	1	0.029

(Continued)

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>PBRUSH</u> Does your arthritis make it difficult for you to brush your teeth ? (Ranks treated as continuous values in model)	0 None 1 Little 2 Moderate 3 Great 4 Extreme	43 14 28 9 6	2.0	(1.3, 3.1)	0.001	11.54	1	0.001
<u>MAX</u> Maximum mouth opening capacity	Continuous Unit - mm	100	0.89	(0.84, 0.95)	0	14.99	1	0
<u>NTR10</u> The number of remaining teeth including third molars (Categorical)	1 0 - 9 2 10 - 19 3 20 - 29 4 30 -	32 20 44 4	4.5 3.4 1.1	(1.2, 16.6) (1.3, 9.0) (0.14, 9.1)	0.022 0.014 0.906	9.01	3	0.029
<u>M8R5</u> The number of missing teeth including third molars (Categorical)	1 0 - 9 2 10 - 19 3 20 -	37 28 35	2.0 0.40	(0.59, 6.4) (0.15, 1.1)	0.276 0.063	8.29	2	0.016

(Continued)

Potential explanatory variables	Category	n	Odds Ratio	95% CI	P-value	Chi-square	DF	Overall P-value
<u>F8R5</u>								
The number of filled teeth including third molars (Categorical)	1 0 - 4	27						
	2 5 - 14	51	3.7	(1.4, 9.8)	0.01	7.68	2	0.021
	3 15 -	22	3.3	(1.0, 11.1)	0.051			
<u>CLASS</u>								
Class of functional disability (Ranks treated as continuous values in model)	1	1	2.2	(0.97, 4.8)	0.06	3.72	1	0.054
	2	20						
	3	72						
	4	7						

5. Discussion

5.1 Oral status

The oral status findings in the present study are comparable with other studies. The prevalence of edentulousness of the RA sample in the present study was 13 percent, which is similar to that found in the RA group studied by Laurell *et al.* (1989). However, the mean number of remaining teeth including third molars in the present study was 16.4 (Table 7), which is fewer than figures reported in the previous studies (Laurell *et al.*, 1989; Arneberg *et al.*, 1992). This might be related to the findings: (1) that nearly 60 percent of the RA patients claimed to experience difficulty in tooth brushing due to RA (Table 6), which is much higher than (24 percent) reported by Tegelberg and Kopp (1987b); (2) that only 45 percent brushed their teeth with fluoride toothpaste (Table 6), which is lower than that found in the Japanese population survey by the Niigata Dental Health Division (1999) and differs remarkably from the previous report of Norwegian RA patients where all RA subjects except one reported daily use of fluoride toothpaste (Arneberg *et al.*, 1992); and (3) that nearly 50 percent reported not having a dental visit in the past 12 months (Table 6), which is in accordance with that reported by Pokrajac-Zirojevic *et al.* (2002) among Australian RA patients selected from the National Health survey.

We further investigated the problem of difficulty in tooth brushing. It was found to be associated with: (1) oral health related quality of life; (2) activities of daily living; (3) dental pain when chewing; (4) TMJ symptoms including TMJ pain, difficulty in mouth opening, tenderness on palpation of masticatory muscles, and crepitus; and (5) RA factors such as age of RA onset and functional disability (Table 29). However, the association between difficulty in tooth brushing and oral status was not found in our study.

In a comparison between an RA group and a non-RA control, Laurell *et al.* (1989) and Arneberg *et al.* (1992) reported that there was no significant difference in the mean number of remaining teeth between the two groups. In contrast, Mercado *et al.* (2001) and Gleissner *et al.* (2003) found that the mean number of missing teeth in the RA sample was significantly higher than those in a control group.

Data on the number of decayed teeth in RA patients is scarce and variable. In the present study, having more than two decayed teeth was observed in about 10 percent of the RA patients (Table 7). In a questionnaire survey, Arneberg *et al.* (1992) stated that about 20 percent reported an annual incidence of more than two decayed teeth.

We found that 32 percent of patients had more than one mobile tooth either showing 2 mm horizontal mobility or > 2 mm horizontal and/or vertical mobility. A relationship between RA and periodontal disease has been highlighted in recent studies. Arneberg *et al.* (1992) reported that periodontal problems were prevalent in about one fifth of Norwegian RA patients, recorded as “loose tooth due to gum disease” (9 percent) and “lost tooth due to gum disease” (9 percent). In an Australian study, it was found that patients with RA were more at risk of severe periodontitis (Mercado *et al.*, 2000; Mercado *et al.*, 2001). On the other hand, Sjostrom *et al.* (1989b) stated that better periodontal conditions in the RA patients were observed compared with the non-RA control group. Their explanation was that the better periodontal conditions observed could be associated with the effect of the long-term use of non-steroid anti-inflammatory drugs (NSAIDs), which suppress inflammation. In the present study, 79 percent of the RA patients were on NSAID medication, but the effect of NSAIDS on the number of mobile teeth was not clearly found.

No association between oral status and oral health related to quality of life was found in our study. Similarly, there appeared to be no association between oral status and activities of daily living. However, RA severity and RA duration seemed to be related to oral status. For instance, longer RA duration was found to be associated with less number of remaining teeth (Table 9). It was also found that higher serum concentrations of CRP were associated with fewer decayed teeth (Table 10). Those who were classified as Stage III severity had a tendency to have more mobile teeth and more teeth with cervical caries compared with those who were classified as Stage I or II (less severe RA) (Tables 12 and 13).

Furthermore, it was shown that oral status would be related to oral health, since fewer remaining teeth were found to be associated with dental pain when chewing (Table 9) and more decayed teeth and more teeth with cervical caries was also found to be associated with difficulty in mouth opening (Tables 10 and 13). In our study, those with more decayed teeth were more likely to have mobile teeth and cervical caries (Table 10). We also found a negative association between mobile teeth and number of remaining teeth (Table 12). A negative association between oral status and age was also found in our study; numbers of remaining teeth and DMF teeth were fewer among those who were older. In contrast, Risheim *et al.* (1992) reported that number of remaining teeth was not significantly correlated with age.

5.2 Oral health

Most studies demonstrate that dry mouth symptoms are frequently observed in RA patients and are associated with a reduction in salivary flow. Risheim *et al.* (1992) reported that

root caries in rheumatic subjects with dry mouth was likely to increase with age due to declining resting salivary flow rate and increasing oral sugar clearance time. However, in the present study, root caries was not found to be associated with age, but was associated with number of decayed teeth, number of mobile teeth, difficulty in mouth opening, serum concentrations of CRP, and RA severity. Geterud *et al.* (1991) also stated that xerostomia in RA patients was significantly associated with low stimulated saliva flow. In a recent USA study by Russell and Reisine (1998), a reduction in salivary flow, which was associated with xerostomia symptoms, was found in approximately half of RA patients. Half of the RA patients in the present study reported to have xerostomia symptoms according to Russell and Reisine's criteria (1998), which is in agreement with their finding. We also found that dry mouth was associated with more severe difficulty in performing activities of daily living (OR = 2.7; 95% CI = 1.4, 5.4), which is consistent with finding by Russell and Reisine (1998).

Swallowing problems in RA patients was found in our study; 44 percent claimed a need to sip liquids to aid in swallowing foods and 11 percent reported difficulty in swallowing, which is consistent with that found by Russell and Reisine (1998). Swallowing problems were found to be associated with more severe difficulty in performing activities of daily living (OR = 3.0; 95% CI = 1.2, 7.3), which was also found by Russell and Reisine (1998). Geterud *et al.* (1991) reported that swallowing problems occurred in 28 percent of the RA patients. They also found that swallowing problems had significant association with RA severity, but not with age, RA duration, xerostomia, or decreased stimulated salivary flow. We found that swallowing problems were associated with more severe functional disability due to RA (OR = 4.6; 95% CI = 1.2, 18.2), early RA onset (OR = 0.95; 95% CI = 0.91, 0.99), and dry mouth symptoms (OR = 3.7; 95% CI = 1.0, 13.2). It was also observed that

the risk of swallowing problems were greater among those who had greater difficulty in performing activities of daily living (OR = 3.0; 95% CI = 1.2, 7.3).

5.3 TMJ status/health

Overall, TMJ symptoms were found in 66 percent of RA patients in this study. Most studies also indicate that TMJ involvement is frequent in RA patients. Mizutani *et al.* (1985) reported that TMJ symptoms were observed in 62.4 percent of RA patients. In another study by Yokoyama *et al.* (1988), it was reported that TMJ symptoms occurred in 63.8 percent of RA patients. Yokoe *et al.* (2002) also found that clinical TMJ symptoms occurred in 42.7 percent of RA patients. In the Finnish study by Syrjanen (1985), clinical TMJ symptoms were reported in 34 percent of the RA group. Tegelberg and Kopp (1987b) stated that the prevalence of subjective TMJ symptoms in Swedish RA patients, was found to be 35 percent. They also reported that few RA patients complained that TMJ symptoms disturbed their daily activities. However, our findings showed that TMJ symptoms were significantly associated with greater difficulty in performing activities of daily living and poorer oral health related quality of life (Tables 14, 16, and 32). Another noteworthy finding was that TMJ symptoms were associated with greater difficulty in tooth brushing and more severe functional disability due to RA (Table 32).

Maximum mouth opening capacity of less than 40 mm, which is considered as restricted, was observed in 35 percent of RA patients; this is almost identical to the figure reported by Laurell *et al.* (1989a). Tegelberg and Kopp (1987a) found that nearly half of the RA patients in their study had less than 40 mm maximum mouth opening capacity. In another study by Ettala-Ylitolo *et al.* (1987), it was reported that an opening capacity of less than 40 mm was diagnosed in about 30 percent of RA patients. We also found that maximum

mouth opening capacity was associated with both difficulty in performing activities of daily living and more severe functional disability due to RA. Furthermore, since TMJ symptoms were found to be associated with TMJ pain, difficulty in mouth opening, jaw pain when chewing, and tenderness on palpation of the head or face, there are some evidences to conclude that reduced maximum mouth opening capacity is an indication of the presence of TMJ symptoms. In previous studies, Tegelberg and Kopp (1987a) and Yokoyama *et al.* (1988) reported that maximum mouth opening capacity was associated with TMJ pain. On the other hand, Larheim *et al.* (1983) stated that maximum mouth opening capacity seemed to be an uncertain parameter in the estimation of joint function since some patients with satisfactory maximum mouth opening capacity (> 40 mm) had restricted condylar translation.

Our study also found that maximum mouth opening capacity differed significantly between males and females, which corresponds with that found by Tegelberg and Kopp (1987a). On the other hand, our finding that maximum mouth opening capacity was negatively associated with number of remaining teeth is inconsistent with Tegelberg's finding that maximum mouth opening capacity was positively correlated with number of remaining teeth.

Tenderness on palpation of masticatory muscles was found to be the most common clinical finding (38 percent), followed by crepitus (22 percent), and tenderness of the TMJ (16 percent). However, it was found that TMJ pain was the most frequently (44 percent) reported symptom (as per questionnaire), followed by difficulty in mouth opening (27 percent), and jaw pain when chewing (8 percent). Mizutani *et al.* (1985) reported that crepitus was the most common clinical finding, followed by TMJ pain, and limitation in

mouth opening. In another study by Yokoe *et al.* (2002), it was found that crepitus in the TMJ was the most frequent clinical finding, followed by pain on palpation of the TMJ, and difficulties in mouth opening.

The prevalence of TMJ symptoms has been reported in other studies. According to Mizutani *et al.* (1985), few patients (8 percent) reported acute TMJ symptoms, which is in agreement with our finding (4 percent). Ettala-Ylitolo *et al.* (1987) found that crepitus was reported in 21.7 percent of the RA group, which is almost identical to our finding. They also reported that tenderness on palpation of masticatory muscles occurred in 53 percent and was not significantly different from that in a non-RA control group. This is a higher prevalence than our finding of 39 percent. In Sweden, it was reported by Laurell *et al.* (1989) that TMJ pain during chewing or mouth opening was found in 18 percent of RA subjects and tenderness on palpation of the TMJ was reported by 23 percent, which is similar to that found in our study. They also found that the prevalence of crepitus was 30 percent. Tegelberg and Kopp (1987a) found that crepitus of the TMJ occurred in 75 percent of the RA-group, which is much higher than our finding. On the other hand, our finding that there was no remarkable sex difference in TMJ crepitus corresponds with that found by them. In their other study (Tegelberg, Kopp, 1987b), pain in the TMJ during mouth opening or chewing was found in 54 percent of the RA group and difficulties in mouth opening were found in 62 percent, which is also higher than our finding. In a more recent study by Yokoe *et al.* (2002), it was found that for most patients the duration of TMJ symptoms was less than one month. This is in accord with our finding that more than half of the patients who reported TMJ pain also reported that their TMJ symptoms had lasted for less than one month.

It was of interest to notice that problems in TMJ health (including dental and jaw pain when chewing, TMJ pain experienced, difficulty in mouth opening, tenderness on palpation of both masticatory muscles and the TMJ, and crepitus) were significantly associated with oral health related quality of life scores (Tables 14, 22 - 25, and 30 - 31). Furthermore, most TMJ symptoms were found to be associated with reduced activities of daily living (Tables 16, 23 - 25, and 30 - 31). Only one other study (Voog *et al.*, 2003) has reported that TMJ pain in the RA patients was associated with limited activities of daily living, which is in accordance with our findings. On the other hand, the relationships among TMJ symptoms, occlusion, and RA severity have been investigated in most studies. Larheim *et al.* (1983) reported that type of dentition was unlikely to be associated with the prevalence of TMJ pain. In contrast, Tegelberg and Kopp (1987a) demonstrated that loss of occlusal support was associated with TMJ disorders. Mizutani *et al.* (1985) stated that the high prevalence of TMJ involvement seemed to be associated with early RA onset and long RA duration. In our study, crepitus was found to be associated with early RA onset and long RA duration (Table 31). It is also noteworthy that decreased functional disability, which is used to measure RA severity, was found to be associated with most TMJ symptoms. It is therefore assumed that TMJ symptoms are related to RA severity. This is also suggested by previous investigations by Tegelberg and Kopp (1987b) and Ettala-Ylitolo *et al.* (1987). On the other hand, the latter stated that no relationship was found between RA severity and occlusal disturbances.

In other study by Tegelberg and Kopp (1987b), TMJ pain was found to be more frequent in females than in males. Although this association was not found in our study, difficulty in opening mouth and tenderness on palpation of the head or face was found to be more frequent in females than in males (Tables 25 and 30). Tegelberg and Kopp (1987b) also

reported that TMJ pain was negatively correlated with age, which is supported by our finding (Table 24).

Regarding associations among TMJ symptoms, Tegelberg and Kopp (1987b) stated that TMJ pain was positively correlated with difficulties in mouth opening and TMJ sounds. They also found that difficulty in mouth opening was also positively correlated with TMJ sounds. In our study, we checked these associations, and found that those who had difficulty in mouth opening were nearly three times more likely to have TMJ pain and those who had crepitus were four times more likely to have TMJ pain. It was further found that those who had crepitus were three times more likely to have difficulty in mouth opening.

5.4 Oral health related to quality of life

We found that approximately 70 percent of the patients were categorized as having oral health related quality of life scores below the sample mean of 72.6 (Table 4). This indicates that patients, in this sample, were likely to have a poor oral health related quality of life. We further investigated oral health related quality of life associations, and found that it was associated with activities of daily living (ADL); RA patients classified as severe on the ADL scale were more likely to have a poorer oral health related quality of life compared with those classified as mild or moderate. This corresponds with finding from the most recent study by Iwamoto *et al.* (2003). However, in our linear regression analysis, it was found that only eight percent of the variability in quality of life was explained by activities of daily living.

Regarding the relationship between oral health related quality of life and demographic and RA factors, oral health related quality of life seemed to be associated with age, age of RA onset, and number of swollen joints (Table 14).

5.5 Conclusion

The major points arising from this study are that:

1. Oral health and TMJ health was associated with oral status.
2. Oral health related quality of life was associated with oral health and TMJ status/health.
3. Oral health related quality of life was associated with activities of daily living.
4. Activities of daily living were associated with demographic factors, RA factors, oral health, and TMJ status/health.
5. RA factors were associated with TMJ status/health, ability to maintain good oral hygiene, oral status, and oral health related quality of life.
6. Oral status was not associated with oral health related quality of life or activities of daily living.

It was concluded that, RA impacted unfavourably on the TMJ and on ability to maintain good oral hygiene which together then impact unfavourably on oral status, oral health, and oral health related quality of life.

Whereas oral health is associated with both oral health related quality of life and oral status, oral status is apparently not associated with oral health related quality of life. Hence, an intervention to improve oral status might appear to be futile – an intervention might improve oral status, yet not relate to oral health related quality of life. This argument is

flawed because oral health is determined partly by oral status factors and partly by other factors, whereas oral health related quality of life is related solely to health factors – it is not derived (in this index) from any oral status factors.

Oral health is a consequence of oral status. In the pursuit of oral health, oral status problems must also be addressed – oral health is an intermediary step between oral status and oral health related quality of life.

Rheumatoid arthritis patients present with many oral problems that stem from preventable oral diseases. The suffering of arthritis patients could be substantially reduced through the implementation of oral health promotion programs.

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Appendices

Appendix A: Map of Niigata, Japan

Appendix B: Ethics approval

Appendix C: The recruitment letter

Appendix D: Information statement

Appendix E: Consent form

Appendix F: Questionnaires

Appendix G: Clinical examination forms

Appendix H: The American Rheumatism Association (ARA)

1987 revised criteria

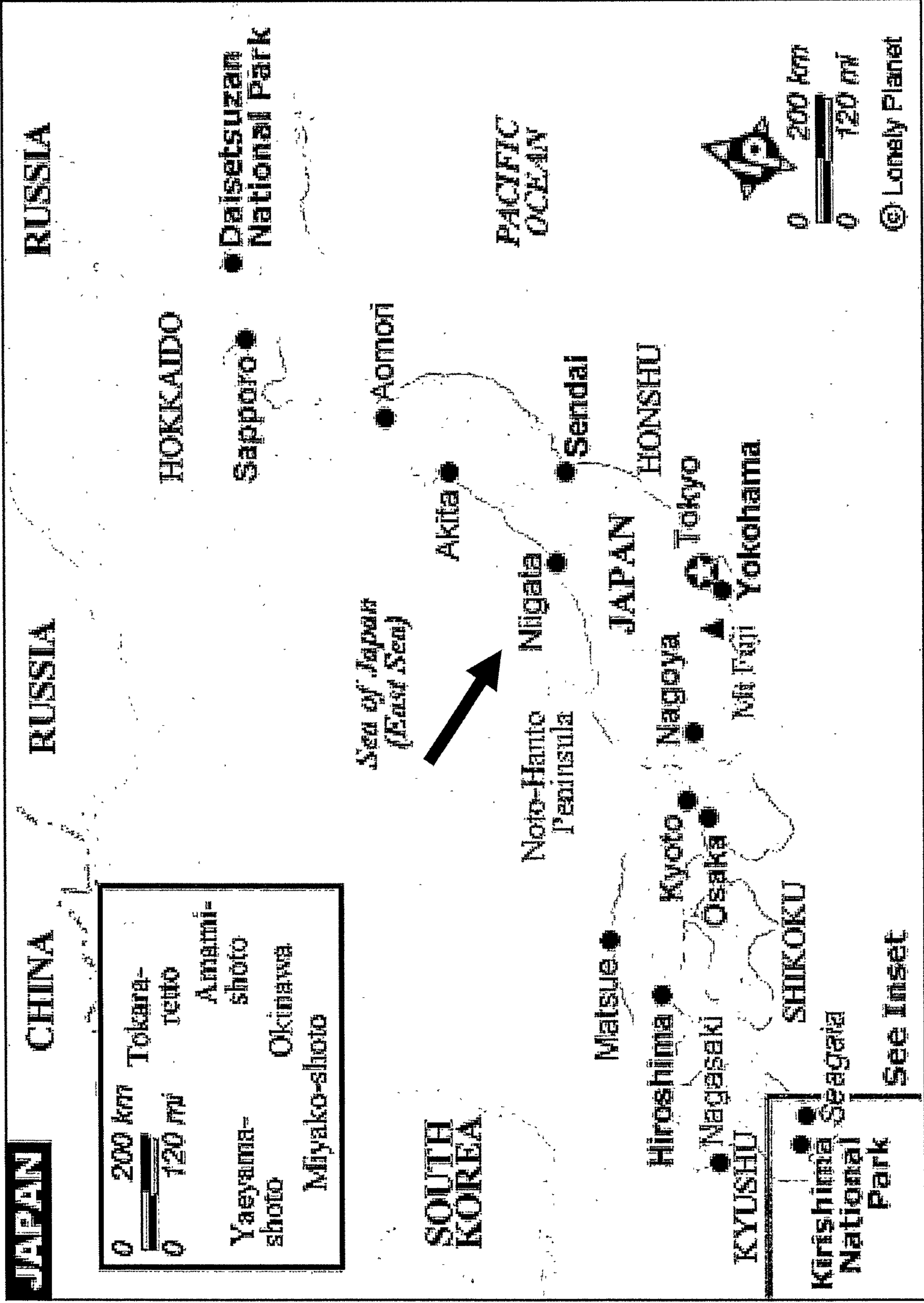
Appendix I: Steinbrocker's criteria

Appendix J: The American College of Rheumatology 1991

revised criteria

Appendix K: Kappa value calculation tables

Appendix A: Map of Niigata, Japan



Appendix B: Ethics approval



The University of Sydney

NSW 2006 Australia

Human Research Ethics Committee
<http://www.usyd.edu.au/ethics/human/>

Chairman:

Associate Professor Stewart Kellie
Telephone: (02) 9845 2141
Facsimile: (02) 9845 2171
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Manager:

Mrs Gail Briody
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Human Secretariat

Telephone: (02) 9036 9309
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Facsimile: (02) 9036 9310
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18 March 2004

Associate Professor R W Evans
Community Oral Health and Epidemiology
Westmead Centre for Oral Health
Faculty of Dentistry
Building C24

Dear Professor Evans

Thank you for your correspondence dated 15 March 2004 addressing comments made to you by the Committee. After considering the additional information, the Executive Subcommittee at its meeting on 17 March 2004 approved your protocol on the study below. Please note that subject to annual monitoring returns, the approved protocol is valid for five years.

Title:	<i>The oral health problems of rheumatoid arthritis patients</i>
Ref No:	7305
Approval Period:	<i>March 2004 – March 2005</i>
Authorised Personnel:	<i>Associate Professor R W Evans</i> <i>Dr A Murasawa</i>

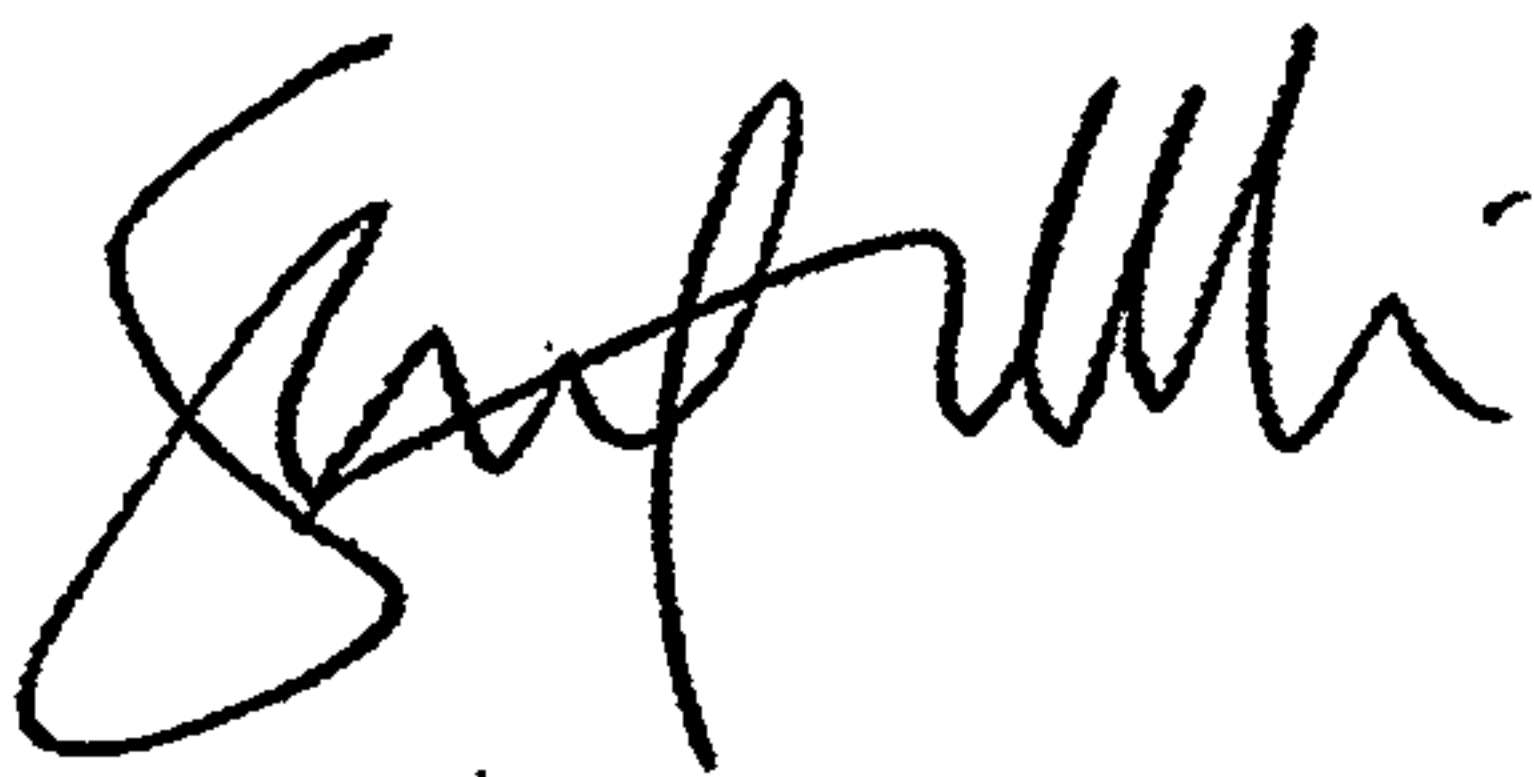
The additional information will be filed with your application.

In order to comply with the *National Statement on Ethical Conduct in Research Involving Humans*, and in line with the Human Research Ethics Committee requirements the Chief Investigator's responsibility is to ensure that:

- (1) The individual researcher's protocol complies with the final and Committee approved protocol.
- (2) Modifications to the protocol cannot proceed until such approval is obtained in writing.
- (3) The confidentiality and anonymity of all research subjects is maintained at all times, except as required by law.

- (4) All research subjects are provided with a Participant Information Sheet and Consent Form, unless otherwise agreed by the Committee.
- (5) The Participant Information Sheet and Consent Form are to be on University of Sydney letterhead and include the full title of the research project and telephone contacts for the researchers, unless otherwise agreed by the Committee.
- (6) The following statement must appear on the bottom of the Participant Information Sheet. *Any person with concerns or complaints about the conduct of a research study can contact the Manager of Ethics Administration, University of Sydney, on (02) 9351 4811.*
- (7) The standard University policy concerning storage of data and tapes should be followed. While temporary storage of data or tapes at the researcher's home or an off-campus site is acceptable during the active transcription phase of the project, permanent storage should be at a secure, University controlled site for a minimum of five years.
- (8) A progress report should be provided by the end of each year. Failure to do so will lead to withdrawal of the approval of the research protocol and re-application to the Committee must occur before recommencing.
- (9) A report and a copy of any published material should be provided at the completion of the Project.

Yours sincerely



Associate Professor Stewart Kellie
Chairman, Human Research Ethics Committee

Encl. Dear Patient Letter
Information Statement to Patients
Patient (or Guardian) Consent Form
Modified Stanford Health Assessment Questionnaire (m-HAQ)
Questionnaire regarding oral health status and performance of oral daily hygiene

cc: ✓ Dr A Murasawa, Community Oral Health & Epidemiology, Westmead Centre for Oral Health,
Faculty of Dentistry, Building C24

3 March 2004

Dear Wendell Evans

Associated Professor and Principal Investigator, The University of Sydney

Dear Akira Murasawa

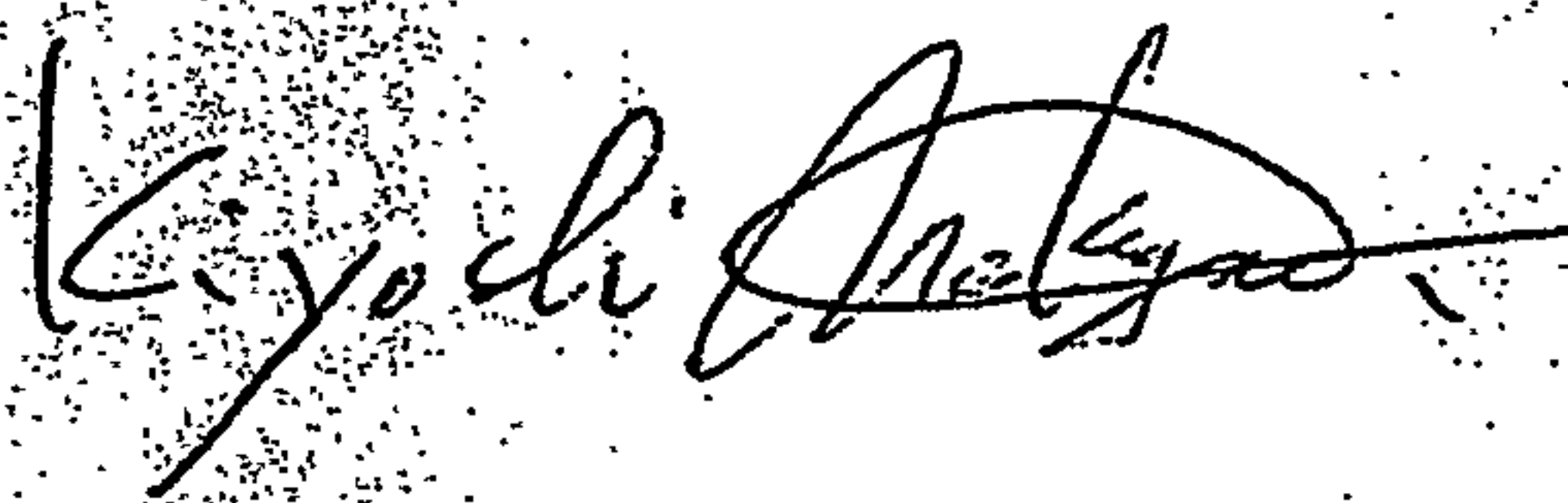
Director, Rheumatic Center, Niigata Prefectural Senami Hospital

The consent of an oral health survey of rheumatoid arthritis patients
in Niigata Prefectural Senami Hospital

We have consented to the oral health survey of rheumatoid arthritis patients in
Niigata Prefectural Senami Hospital

Kiyoshi Nakazono MD.

Chairman of The Ethics Committee, Niigata Prefectural Senami Hospital



平成16年3月3日

ウェンデル エヴァンス教授殿

シドニー大学

村澤 章 院長殿

新潟県立瀬波病院

瀬波病院治験審査委員会 委員長

中園 清

中園 清

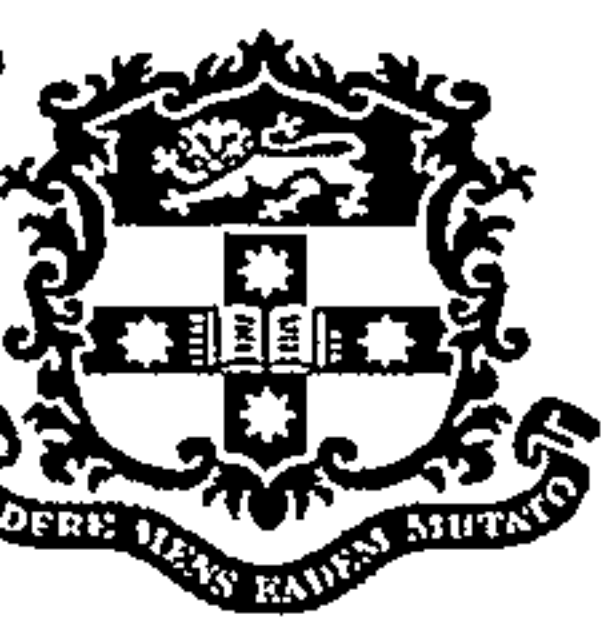
2月25日の当院治験審査委員会において、「瀬波病院における関節リウマチ患者さんのお口の健康調査」について審議いたしましたが、下記の3点について計画書を当院の治験審査委員会に提出していただくのを条件に承認されました。つきましては下記の3点について計画書を作成し、治験審査委員会事務局（薬剤部）まで御提出いただきますようお願いいたします。

記

- ① 調査を行う場所は？
- ② 看護師を含めたスタッフが必要か？
- ③ 調査の際、当院の器材が必要となるか？

以上

Appendix C: The recruitment letter



The University of Sydney

**Faculty of Dentistry
College of Health Sciences**

Wendell Evans, MDS DDSc
Associate Professor
Community Oral Health and Epidemiology

Westmead Centre for Oral Health
Westmead Hospital
Australia NSW 2145

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3 February 2004

Dear Patient,

Oral Health Survey of Rheumatoid Arthritis Patients in Senami Hospital

A survey is being conducted among rheumatoid arthritis patients attending Dr Akira Murasawa's clinic. Both out-patients and in-patients will be included.

You are invited to take part in this survey. It is not compulsory.

If you would like to take part in this survey, please inform the nurse assisting Dr Murasawa. She will introduce you to Dr Ayako Murasawa who is conducting this survey.

Thank you for your consideration.

Yours faithfully,

Principal Investigator
Associate Professor Wendell Evans
University of Sydney, Australia

Co-investigator
Dr Ayako Murasawa
University of Sydney, Australia



The University of Sydney

シドニー大学

歯学部

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患者の皆さんへ

瀬波病院におけるリュウマチ患者さんのお口の健康調査

このお口の健康調査は、瀬波病院の村澤先生の患者さん対象に行われます。外来患者さんと入院患者さんが対象になります。

そこで、この調査に参加していただきたく、お知らせしています。この調査は患者さんに強制して行うものではありません。

この調査に参加していただけるご意思のおありの方は、村澤先生担当の看護婦さんにお知らせください。

また、このお口の調査は、20分くらいで終わります。
より多くの患者の皆さんのご参加をお待ちしています。ご協力ありがとうございます。

オーストラリア シドニー大学
口腔保健歯科疫学分野教授
MDS DDS c
ウェンデル エヴァンス

オーストラリア シドニー大学
歯科医師
村澤綾子

Appendix D: Information statement



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INFORMATION STATEMENT TO PATIENTS

Oral Health Survey of Rheumatoid Arthritis Patients in Senami Hospital

An oral health survey of rheumatoid arthritis patients in Senami Hospital will be conducted by Dr Ayako Murasawa, the daughter of Dr Akira Murasawa, from the Dental School at the University of Sydney, Australia. This study is towards the Master of Dental Science degree. Approval to conduct this survey has been granted by the Director, Senami Hospital and The University of Sydney. The purpose of the survey is to determine the oral health status of arthritis patients and to determine whether or not they are troubled by oral problems. This study will assist planning for more effective oral health services and research into the oral health needs of rheumatoid arthritis patients.

What is involved

With your permission, Dr Murasawa will examine your teeth and gums according to World Health Organisation criteria. This oral examination, using a dental mirror, will assess the condition of your teeth, gums, and dentures. No x-rays will be taken. You will also be asked to answer some questions concerning your daily activities and oral health problems. Finally, you will be advised of any need to arrange of dental care. The examination will take place and the questions will be asked in a private room and will take approximately 30 minutes to complete.

Confidentiality

Only the Dr Murasawa and her supervisor (Associate Professor Wendell Evans) will have access to the oral examination and questionnaire information. This information will be put in a computer for analysis and the examination and questionnaire forms will be destroyed. Your name *will not* be put in the computer.

The survey results will be published and a report will be sent to Senami Hospital. The report will not include names or other information that could identify you.

Your participation and consent

Your participation will make an important contribution to knowledge about oral health rheumatoid arthritis patients.

We would be grateful if you would read and complete the **CONSENT FORM**. You will keep the completed **CONSENT FORM** on the back of this **INFORMATION STATEMENT** for your reference and Dr Murasawa will retain a second copy.

Any person with concerns or complaints about the conduct of a research study can contact the Manager for Ethics Administration, University of Sydney on (+612) 9351 4811.



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患者さんへのお知らせ

瀬波病院におけるリュウマチ患者さんのお口の健康調査

この瀬波病院におけるリュウマチ患者さんのお口の健康調査は、オーストラリア、シドニー大学歯学部村澤綾子歯科医師、村澤章医師の娘、によって行われるものです。この調査は、歯科サイエンスのマスターコースの一環として行われます。また、瀬波病院とシドニー大学の協力のもと、行われます。この調査の目的は、リュウマチ患者さんがお口の健康状態にお困りになっていること（お口の乾燥、お口が開けづらい、虫歯、お口の中の痛みなど）があるかどうかについて調査すること、にあります。また、この調査は、リュウマチ患者さんがどのようにお口の健康を求められているかにおける調査と、お口の健康をよりよく維持するための歯科保健事業を促進するために行われます。

調査の内容

1. アンケート

お口の健康状態と患者さんの日常生活活動に関するアンケートを行います。

2. お口の健康チェック

患者さんの歯と歯ぐきの健康状態を、歯科用ミラーだけを使って、チェックします。

X-線写真は撮りません。

最後に、歯のケアが必要かどうか、患者さんにお知らせします。

アンケートとお口の健康チェックは、個室で行われ、おおよそ30分くらいかかります。

この調査によって得られた情報の管理

- この調査によって得られた情報は、コンピューターに保管され、内密に管理されます。その際、患者さんのお名前はコンピューターには、書き込まれません。
- また、この調査の結果は、データー処理後、瀬波病院に送られます。その際、患者さんのお名前は含まれません。

患者さんの調査へのご参加と同意書

- 患者さんの調査へのご参加は、リュウマチ患者さんのお口の健康を知ることに対して大きく貢献するものであり、より多くの患者さんのご参加を期待しております。
- 調査の際、オーストラリアの厳密な情報管理のため、この患者さんのお知らせの裏の同意書（患者さん保管用）と別の紙の同意書（歯科医師保管用）に簡単にご署名をお願いいたします。

患者の皆さんのご協力、どうぞよろしくお願いいたします。

この調査へのご質問や、お問い合わせのある方は、シドニー大学、倫理委員会（+612）93514811 までお願いいたします。

Appendix E: Consent form



The University of Sydney

Wendell Evans, MDS DDSc
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Oral Health Survey of Rheumatoid Arthritis Patients in Senami Hospital

Dear Patient,

Thank you for agreeing to participate in oral health survey of rheumatoid arthritis patients in Senami Hospital
Please complete **CONSENT** below. All information you provide will be **STRICTLY CONFIDENTIAL**.

Wendell Evans and Ayako Murasawa

ORAL HEALTH SURVEY

PATIENT (OR GUARDIAN) CONSENT FORM

FIRST NAME: SURNAME:

- 1. I (Please PRINT name) agree to participate in the dental survey as described in the INFORMATION STATEMENT on the back of this consent form.
- 2. I acknowledge that I have read this INFORMATION STATEMENT which describes the purpose of the survey and the nature of the dental examination.
- 3. Before signing this CONSENT FORM, I have been given the opportunity to ask any questions and I have received satisfactory answers. My participation is voluntary and my consent is freely given.
- 4. I understand that I can withdraw from the survey at any time without prejudice to my continuing care at Senami Hospital.
- 5. I agree that research results based on the survey information obtained may be published provided that I will not be identified.
- 6. I understand that if I have any questions relating to my participation in this research, I may contact Professor Wendell Evans on telephone (+612) 9845 7537 who will be happy to answer them.
- 7. I acknowledge that I have a copy of the *INFORMATION STATEMENT* and a signed copy of the *CONSENT FORM*.

Signature of patient or guardian: Date:

PLEASE KEEP THIS COPY OF THE CONSENT FORM FOR YOUR RECORDS



The University of Sydney

シドニー大学

口腔保健歯科疫学分野教授

MDS DDS c

ウェンデル エヴァンス

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瀬波病院におけるリュウマチ患者さんのお口の健康調査

患者さんの皆さんへ

瀬波病院におけるリュウマチ患者さんのお口の健康調査にご参加の同意をしていただき、ありがとうございます。下の同意書にご署名をお願いします。この調査の情報は、厳密に管理されます。

ウェンデル エヴァンス

村澤綾子

お口の健康調査

患者さん（またはご家族の方）の同意書

お名前:

1. 私は、（お名前のご署名）..... この同意書の裏に書かれた調査に参加することに同意します。
2. 私は、この調査の目的とお口の調査の内容に関する“患者さんのお知らせ”を読んだことを認めます。
3. 私は、この同意書に署名する前に、この調査に参加するかどうかの選択を与えられました。私の参加は、任意のものです。
4. 私は、いつでもこの調査から退くことができることを理解します。
5. 私は、自分の名前が公表されないことを条件に、この調査によって得られた情報が結果として公表されることに同意します。
6. 私は、もしこの調査の参加に関して質問がある場合、ウェンデル エヴァンス教授 TEL (+612) 9845 7537 に問い合わせができることを理解します。
7. 私は、この署名された同意書と“患者さんへのお知らせ”を保管することを認めます。

患者さん（またはご家族）のご署名:

署名日: 月.....日 2004

記録としてこの同意書を保管してください。

Appendix F: Questionnaires (English version)

OHQoL-UK

This questionnaire for assessing **the impact of Oral health on quality of life (QOL)** comprises questions relating to 16 items.

In relation to each item, there is a **main question** and then a **subsidiary question**.

Physical factors

1(a) What effects does the condition of your teeth, gums, mouth, and/or denture have on your **appearance** ?

Answer: Good, None, Bad

1(b) How good/bad ?

Answer: None, Little, Moderate, Great, Extreme

2(a) What effects does the condition of your teeth, gums, mouth, and/or denture have on your **eating/enjoyment of food** ?

Answer: Good, None, Bad

2(b) How good/bad ?

Answer: None, Little, Moderate, Great, Extreme

3(a) What effects does the condition of your teeth, gums, mouth, and/or denture have on your **speech** ?

Answer: Good, None, Bad

3(b) How good/bad ?

Answer: None, Little, Moderate, Great, Extreme

4(a) What effects does the condition of your teeth, gums, mouth, and/or denture have on your **general health** ?

Answer: Good, None, Bad

4(b) How good/bad ?

Answer: None, Little, Moderate, Great, Extreme

5(a) What effects does the condition of your teeth, gums, mouth, and/or denture have on your **comfort** ?

Answer: Good, None, Bad

5(b) How good/bad ?

Answer: None, Little, Moderate, Great, Extreme

6(a) What effects does the condition of your teeth, gums, mouth, and/or denture have on your **breath odour** ?

Answer: Good, None, Bad

6(b) How good/bad ?

Answer: None, Little, Moderate, Great, Extreme

Social factors

7(a) What effects does the condition of your teeth, gums, mouth, and/or denture have on your **social life** ?

Answer: Good, None, Bad

7(b) How good/bad ?

Answer: None, Little, Moderate, Great, Extreme

8(a) What effects does the condition of your teeth, gums, mouth, and/or denture have on your ***romantic relationship*** ?

Answer: Good, None, Bad

8(b) How good/bad ?

Answer: None, Little, Moderate, Great, Extreme

9(a) What effects does the condition of your teeth, gums, mouth, and/or denture have on your ***smiling or laughing*** ?

Answer: Good, None, Bad

9(b) How good/bad ?

Answer: None, Little, Moderate, Great, Extreme

10(a) What effects does the condition of your teeth, gums, mouth, and/or denture have on your ***work/ability to do usual jobs*** ?

Answer: Good, None, Bad

10(b) How good/bad ?

Answer: None, Little, Moderate, Great, Extreme

11(a) What effects does the condition of your teeth, gums, mouth, and/or denture have on your ***finances***?

Answer: Good, None, Bad

11(b) How good/bad ?

Answer: None, Little, Moderate, Great, Extreme

Psychological factors

12(a) What effects does the condition of your teeth, gums, mouth, and/or denture have on your **confidence** ?

Answer: Good, None, Bad

12(b) How good/bad ?

Answer: None, Little, Moderate, Great, Extreme

13(a) What effects does the condition of your teeth, gums, mouth, and/or denture have on your **sleep/ability to relax** ?

Answer: Good, None, Bad

13(b) How good/bad ?

Answer: None, Little, Moderate, Great, Extreme

14(a) What effects does the condition of your teeth, gums, mouth, and/or denture have on your **carefree manner** ?

Answer: Good, None, Bad

14(b) How good/bad ?

Answer: None, Little, Moderate, Great, Extreme

15(a) What effects does the condition of your teeth, gums, mouth, and/or denture have on your **mood** ?

Answer: Good, None, Bad

15(b) How good/bad ?

Answer: None, Little, Moderate, Great, Extreme

16(a) What effects does the condition of your teeth, gums, mouth, and/or denture have on your ***personality*** ?

Answer: Good, None, Bad

16(b) How good/bad ?

Answer: None, Little, Moderate, Great, Extreme

Modified Stanford Health Assessment questionnaire (m-HAQ)

1. Dressing and grooming

Are you able to dress yourself, including tying shoelaces and doing buttons ?

- 0. Without any difficulty
- 1. With some difficulty
- 2. With much difficulty
- 3. Unable to do

2. Arising

Can you get in and out of bed ?

(0, 1, 2, 3)

3. Eating

Can you lift a full cup or glass to your mouth ?

(0, 1, 2, 3)

4. Walking

Can you walk outdoors on flat ground ?

(0, 1, 2, 3)

5. Hygiene

Can you wash and dry our entire body ?

(0, 1, 2, 3)

6. Reaching

Can you bend down to pick up clothing from the floor ?

(0, 1, 2, 3)

7. Gripping

Can you turn faucets on and off ?

(0, 1, 2, 3)

8. Other activities

Can you get in and out of a car ?

(0, 1, 2, 3)

Questionnaire regarding oral health status and performance of oral daily hygiene

Oral health status

1. Are **your teeth/ your oral gum with denture** painful when chewing ?

Yes No

2. Does **your jaw** hurt when chewing or shortly after ?

Yes No

3. Have you had **pain in the face, jaw, in front of the ear, or cheeks in the past 6 months** ?

None Little Moderate Great Extreme

If yes, **how long** have you had this pain ?

_____ years and months

4. Have you had **pain** in the face, jaw, in front of the ear, or cheeks **after onset of RA** ?

Yes No

5. Do you have any difficulty when **opening your mouth** ?

None Little Moderate Great Extreme

6. Do you have difficulties **swallowing any foods** ?

Yes No

7. Do your mouth **feel dry** when eating a meal ?

Yes No

8. Do you **sip liquids** to aid in swallowing dry foods?

Yes No

Performance of oral daily hygiene

9. Does your arthritis make it **difficult for you to brush your teeth** ?

None Little Moderate Great Extreme

10. Do you brush your teeth with **fluoride toothpaste** ?

No Yes Never heard of fluoride

11. How often have you **visited dentist** in the previous 12 months?

Regularly When in pain None Not remember

Appendix F: Questionnaires (Japanese version)

生活の質に関するお口の健康のアンケート；OHQOL-UK

このアンケートは、生活の質に対するお口の健康の影響を調査するもので、16のテーマに関する質問で構成されています。それぞれのテーマに対し、2つの簡単な質問にお答えください。このアンケートに関して、正しい答えや間違った答えはありませんので、思った通りの答えをそのままお選びください。

1(a)

ご自分の歯、歯ぐき、お口、そして/または入れ歯の状態は、あなたの容姿にどんな影響を与えますか？

答え) よい影響、 何の影響もない、 悪い影響

1(b)

どのくらいよい/悪い影響を与えますか？

(1.(a)で“何の影響もない”を選んだ方は、1.(b)“まったく影響ない”を選んでください。)

答え) まったく影響ない、 少しの影響、 まあまあ、 大きな影響、 極度の影響

2(a)

ご自分の歯、歯ぐき、お口、そして/または入れ歯の状態は、あなたの食事と食の楽しみにどんな影響を与えますか？

答え) よい影響、 何の影響もない、 悪い影響

2(b)

どのくらいよい/悪い影響を与えますか？

答え) まったく影響ない、 少しの影響、 まあまあ、 大きな影響、 極度の影響

3(a)

ご自分の歯、歯ぐき、お口、そして/または入れ歯の状態は、あなたの話し方や会話にどんな影響を与えますか？

答え) よい影響、 何の影響もない、 悪い影響

3(b)

どのくらいよい/悪い影響を与えますか？

答え) まったく影響ない、 少しの影響、 まあまあ、 大きな影響、 極度の影響

4 (a)

ご自分の歯、歯ぐき、お口、そして/または入れ歯の状態は、あなたの全身の健康にどんな影響を与えますか？

答え) よい影響、 何の影響もない、 悪い影響

4 (b)

どのくらいよい/悪い影響を与えますか？

答え) まったく影響ない、 少しの影響、 まあまあ、 大きな影響、 極度の影響

5 (a)

ご自分の歯、歯ぐき、お口、そして/または入れ歯の状態は、あなたの快適さにどんな影響を与えますか？

答え) よい影響、 何の影響もない、 悪い影響

5 (b)

どのくらいよい/悪い影響を与えますか？

答え) まったく影響ない、 少しの影響、 まあまあ、 大きな影響、 極度の影響

6 (a)

ご自分の歯、歯ぐき、お口、そして/または入れ歯の状態は、あなたのお口のにおいにどんな影響を与えますか？

答え) よい影響、 何の影響もない、 悪い影響

6 (b)

どのくらいよい/悪い影響を与えますか？

答え) まったく影響ない、 少しの影響、 まあまあ、 大きな影響、 極度の影響

7 (a)

ご自分の歯、歯ぐき、お口、そして/または入れ歯の状態は、あなたの社会生活にどんな影響を与えますか？

答え) よい影響、 何の影響もない、 悪い影響

7 (b)

どのくらいよい/悪い影響を与えますか？

答え) まったく影響ない、 少しの影響、 まあまあ、 大きな影響、 極度の影響

8 (a)

ご自分の歯、歯ぐき、お口、そして/または入れ歯の状態は、あなたの恋愛の関係にどんな影響を与えますか？

答え) よい影響、 何の影響もない、 悪い影響

8 (b)

どのくらいよい/悪い影響を与えますか？

答え) まったく影響ない、 少しの影響、 まあまあ、 大きな影響、 極度の影響

9 (a)

ご自分の歯、歯ぐき、お口、そして/または入れ歯の状態は、あなたの笑顔や笑いにどんな影響を与えますか？

答え) よい影響、 何の影響もない、 悪い影響

9. (b)

どのくらいよい/悪い影響を与えますか？

答え) まったく影響ない、 少しの影響、 まあまあ、 大きな影響、 極度の影響

10 (a)

ご自分の歯、歯ぐき、お口、そして/または入れ歯の状態は、あなたの仕事/日常作業にどんな影響を与えますか？

答え) よい影響、 何の影響もない、 悪い影響

10 (b)

どのくらいよい/悪い影響を与えますか？

答え) まったく影響ない、 少しの影響、 まあまあ、 大きな影響、 極度の影響

11 (a)

ご自分の歯、歯ぐき、お口、そして/または入れ歯の状態は、あなたの財政にどんな影響を与えますか？

答え) よい影響、 何の影響もない、 悪い影響

11 (b)

どのくらいよい/悪い影響を与えますか？

答え) まったく影響ない、 少しの影響、 まあまあ、 大きな影響、 極度の影響

12(a)

ご自分の歯、歯ぐき、お口、そして/または入れ歯の状態は、あなたの自信にどんな影響を与えますか？

答え) よい影響、 何の影響もない、 悪い影響

12(b)

どのくらいよい/悪い影響を与えますか？

答え) まったく影響ない、 少しの影響、 まあまあ、 大きな影響、 極度の影響

13(a)

ご自分の歯、歯ぐき、お口、そして/または入れ歯の状態は、あなたの睡眠/くつろぎにどんな影響を与えますか？

答え) よい影響、 何の影響もない、 悪い影響

13(b)

どのくらいよい/悪い影響を与えますか？

答え) まったく影響ない、 少しの影響、 まあまあ、 大きな影響、 極度の影響

14(a)

ご自分の歯、歯ぐき、お口、そして/または入れ歯の状態は、あなたの態度にどんな影響を与えますか？

答え) よい影響、 何の影響もない、 悪い影響

14(b)

どのくらいよい/悪い影響を与えますか？

答え) まったく影響ない、 少しの影響、 まあまあ、 大きな影響、 極度の影響

15(a)

ご自分の歯、歯ぐき、お口、そして/または入れ歯の状態は、あなたの気分にどんな影響を与えますか？

答え) よい影響、 何の影響もない、 悪い影響

15(b)

どのくらいよい/悪い影響を与えますか？

答え) まったく影響ない、 少しの影響、 まあまあ、 大きな影響、 極度の影響

16 (a)

ご自分の歯、歯ぐき、お口、そして/または入れ歯の状態は、あなたの性格にどんな影響を与えますか？

答え) よい影響、 何の影響もない、 悪い影響

16 (b)

どのくらいよい/悪い影響を与えますか？

答え) まったく影響ない、 少しの影響、 まあまあ、 大きな影響、 極度の影響

日常生活動作能力（ADL）に関するアンケート； m-HAQ

1. 衣服の着付け；

ご自分で、靴の紐を結ぶことと、衣服のボタンをかけることができますか？

答え) 何の苦もない、 1.少し困難である、 2.とても困難である、 3.できない

2. 起き上がり；

ご自分で、ベッドに入ることと、ベッドから起きることができますか？

答え) 0.何の苦もない、 1.少し困難である、 2.とても困難である、 3.できない

3. 食事；

ご自分で、コップやお茶碗をお口に運ぶことができますか？

答え) 0.何の苦もない、 1.少し困難である、 2.とても困難である、 3.できない

4. 歩行；

ご自分で、外の平らなところを歩くことができますか？

答え) 0.何の苦もない、 1.少し困難である、 2.とても困難である、 3.できない

5. 衛生；

ご自分で、体の全ての部分を洗うことができますか？

答え) 0.何の苦もない、 1.少し困難である、 2.とても困難である、 3.できない

6. 体の曲げ；

ご自分で、床から衣服を取り上げるために体を曲げることができますか？

答え) 0.何の苦もない、 1.少し困難である、 2.とても困難である、 3.できない

7. 手の握り；

ご自分で、水道の蛇口を閉めることと開けることができますか？

答え) 0.何の苦もない、 1.少し困難である、 2.とても困難である、 3.できない

8. ご自分で、車に乗ることと出ることができますか？

答え) 0.何の苦もない、 1.少し困難である、 2.とても困難である、 3.できない

お口の健康状態に関するアンケート

お口の健康状態

1. 歯の痛みが原因で、食べ物をかむのに困難がありますか？

答え) はい、 いいえ

2. あごの痛みが原因で、食べ物をかむのに困難がありますか？

答え) はい、 いいえ

3. 過去6ヶ月の間に、顔やあご、または、耳のまわりや頬に、痛みがありましたか？

答え) 何の痛みもない、少しの痛み、まあまあの痛み、かなりの痛み、極度の痛み、

痛みがある、と答えた方、

どのくらい長くその痛みは続いていますか、または、続きましたか？

.....年 と ヶ月

4. リウマチにかかってから、顔やあご、または、耳のまわりや頬に、痛みがありましたか？

答え) 何の痛みもない、少しの痛み、まあまあの痛み、かなりの痛み、極度の痛み、

5. お口を開けるのに困難がありますか？

答え) 何の困難もない、 少しの困難、 まあまあ、 大きな困難、 極度の困難

6. 食べ物を飲み込むのに困難がありますか？

答え) はい、 いいえ

7. 食事の際、お口の乾燥がありますか？

答え) はい、 いいえ

8. 乾燥した食べ物を飲み込む際、何らかの液体をお口に含む必要がありますか？

答え) はい、 いいえ

お口の健康管理

9. リウマチの症状が、歯を磨くのに影響していますか？

答え) 何の影響もない、 少しの影響、 まあまあ、 大きく影響、 極度の影響

10. フッ素入りの歯磨き粉で歯を磨いていますか？

答え) はい、 いいえ、 フッ素について聞いたこともない

11. 過去12ヶ月の間にどういった理由で歯医者さんに行きましたか？

答え) 定期的に、 痛みがあったときに、 いいえ、 覚えていない

Appendix G: Clinical examination forms

Oral Clinical Examination

ID _____ Name _____ Date _____

Tooth	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Coronal																
Root																
Mobility																

Tooth	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Coronal																
Root																
Mobility																

Coronal codes

- 0 sound
- 1 primary decay
- 2 secondary decay
- M missing
- F filled
- C crown or bride abutment
- De denture partial or full
- B bridge

Rule

If in doubt, assign the lesser code.

Root codes

- 0 default code for tooth that do not have exposed surfaces
- 1 non-cavitated surface that is hard and shiny, any colour)
- 2 non-cavitated soft surface (any colour, usually yellow/brown)
- 3 cavitated surface
- F sound filled surface
- F2 filled surface with secondary decay

Mobility codes

- 0 no mobility
- 1 1 mm horizontal mobility
- 2 2 mm horizontal mobility
- 3 >2mm horizontal and/or vertical mobility

口腔診査

ID _____ 名前 _____ 日付 _____

歯	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
歯冠																
歯根																
動揺度																

歯	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
歯冠																
歯根																
動揺度																

- 歯冠コード
- 0 健全
 - 1 1次う蝕
 - 2 2次う蝕
 - M 喪失
 - F 充填
 - C クラウン又は、ブリッジアバットメント
 - D 全義歯又は、部分義歯
 - B ブリッジ

- 歯根コード
- 0 露出なし
 - 1 う蝕なし（硬い歯根面）
 - 2 う蝕なし（柔らかい歯根面、黄色又は茶色）
 - 3 う蝕（cavitated）
 - F 充填
 - F2 2次う蝕

- 動揺度コード
- 0 動揺なし
 - 1 1 mm 水平動揺あり
 - 2 2 mm 水平動揺あり
 - 3 >2mm 水平又は垂直動揺あり

TMJ Examination

ID

NAME

DATE

IIO

Overbite

+ or -

mm

mm

Pain

Yes / No

Palpation

Yes / No

	Left	Right
TMJ		
Tempolaris		
Masseter		

Joint sound

Yes / No

	Left	Right
Clicking		
Crepitus		

TMJ 診査

ID	名前	日付
----	----	----

IIO		mm
Overbite	+ or -	mm

顎関節痛	Yes / No
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触診	Yes / No
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	左	右
TMJ		
咬筋		
咬合筋		

顎関節音	Yes / No
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	左	右
クリッキング		
クレピタス		

Appendix H: The American Rheumatism Association (ARA) 1987 revised criteria

Table 33: The 1987 revised criteria for the classification of rheumatoid arthritis (traditional format)*

Criterion	Definition
1. Morning stiffness	Morning stiffness in and around the joints, lasting at least 1 hour before maximal improvement
2. Arthritis of 3 or more joint areas	At least 3 joint areas simultaneously have had soft tissue swelling or fluid (not bony overgrowth alone) observed by a physician. The 14 possible areas are right or left PIP, MCP, wrist, elbow, knee, ankle, and MTP joints
3. Arthritis of hand joints	At least 1 area swollen (as defined above) in a wrist, MCP, or PIP joint
4. Symmetric arthritis	Simultaneous involvement of the same joint areas (as defined in 2) on both sides of the body (bilateral involvement of PIPs, MCPs, or MTPs is acceptable without absolute symmetry)
5. Rheumatoid nodules	Subcutaneous nodules, over bony prominences, or extensor surfaces, or in juxtaarticular regions, observed by a physician
6. Serum rheumatoid factor	Demonstration of abnormal amounts of serum rheumatoid factor by any method for which the result has been positive in <5% of normal control subjects
7. Radiographic changes	Radiographic changes typical of rheumatoid arthritis on posteroanterior hand and wrist radiographs, which must include erosions or unequivocal bony decalcification localized in or most marked adjacent to the involved joints (osteoarthritis changes alone do not qualify)

* For classification purposes, a patient shall be said to have rheumatoid arthritis if he/she has satisfied at least 4 of these 7 criteria. Criteria 1 through 4 must have been present for at least 6 weeks. Patients with 2 clinical diagnoses are not excluded. Designation as classic, definite, or probable rheumatoid arthritis is not to be made.

Appendix I: Steinbrocker's criteria

Table 34: Classification of stages of rheumatoid arthritis

Stage I, Early	*1. No destructive changes roentgenologically. 2. Roentenologic evidence of osteoporosis may be present.
Stage II, Moderate	*1. Roentgenologic evidence of osteoporosis, with or without slight subchondral bone destruction; slight cartilage destruction may be present. *2. No joint deformities, although limitation of joint mobility may be present. 3. Adjacent muscle atrophy. 4. Extra-articular soft tissue lesions, such as nodules and tenovaginitis, may be present.
Stage III Severe	*1. Roentgenologic evidence of cartilage and bone destruction, in addition to osteoporosis. *2. Joint deformity, such as subluxation, ulnar deviation or hyperextension, without fibrous or bony ankylosis. 3. Extensive muscle atrophy 4. Extra-articular soft tissue lesions, such as nodules and tenovaginitis, may be present.
Stage IV, Terminal	*1. Fibrous or bony ankylosis. 2. Criteria of stage III.

* indicates criteria required to be present.

Appendix J: The American College of Rheumatology 1991 revised criteria

Table 35: American College of Rheumatology revised criteria for classification of functional status in rheumatoid arthritis*

Class I	Completely able to perform usual activities of daily living (self-care, vocational, and avocational)
Class II	Able to perform usual self-care and vocational activities, but limited in avocational activities.
Class III	Able to perform usual self-care activities, but limited in vocational and avocational activities
Class IV	Limited in ability to perform usual self-care, vocational, and avocational activities

*Usual self-care activities include dressing, feeding, bathing, grooming, and toileting. Avocational (recreational and /or leisure) and vocational (work, school, homemaking) activities are patient-desired and age- and sex-specific.

**Appendix K: Kappa value calculation
tables**

Table 36: Distribution of diagnoses for duplicate examinations (Kappa* = 0.96)

Examination 2					
Examination 1	Sound	Decayed	Missing	Filled	Total
Sound	66 (19.14)**			5	71
Decayed		13 (0.66)			13
Missing			106 (43.89)		106
Filled	3			63 (17.53)	66
Total	69	13	106	68	256

*Kappa value = $P_o - P_e / 1 - P_e$

Of 256 teeth assessed for DMFT, the observed proportion, P_o , is:

$$P_o = 66 + 13 + 106 + 63 / 256 = 0.97$$

The chance-expected proportion of agreement, P_e , is:

$$P_e = 19.14 + 0.66 + 43.89 + 17.53 / 256 = 0.32$$

$$\text{and hence Kappa} = 0.97 - 0.32 / 1 - 0.32 = 0.96.$$

**Numbers in parentheses are chance-expected frequencies of agreement, for example, 19.14 = $69 \times 71 / 256$