

Introduction

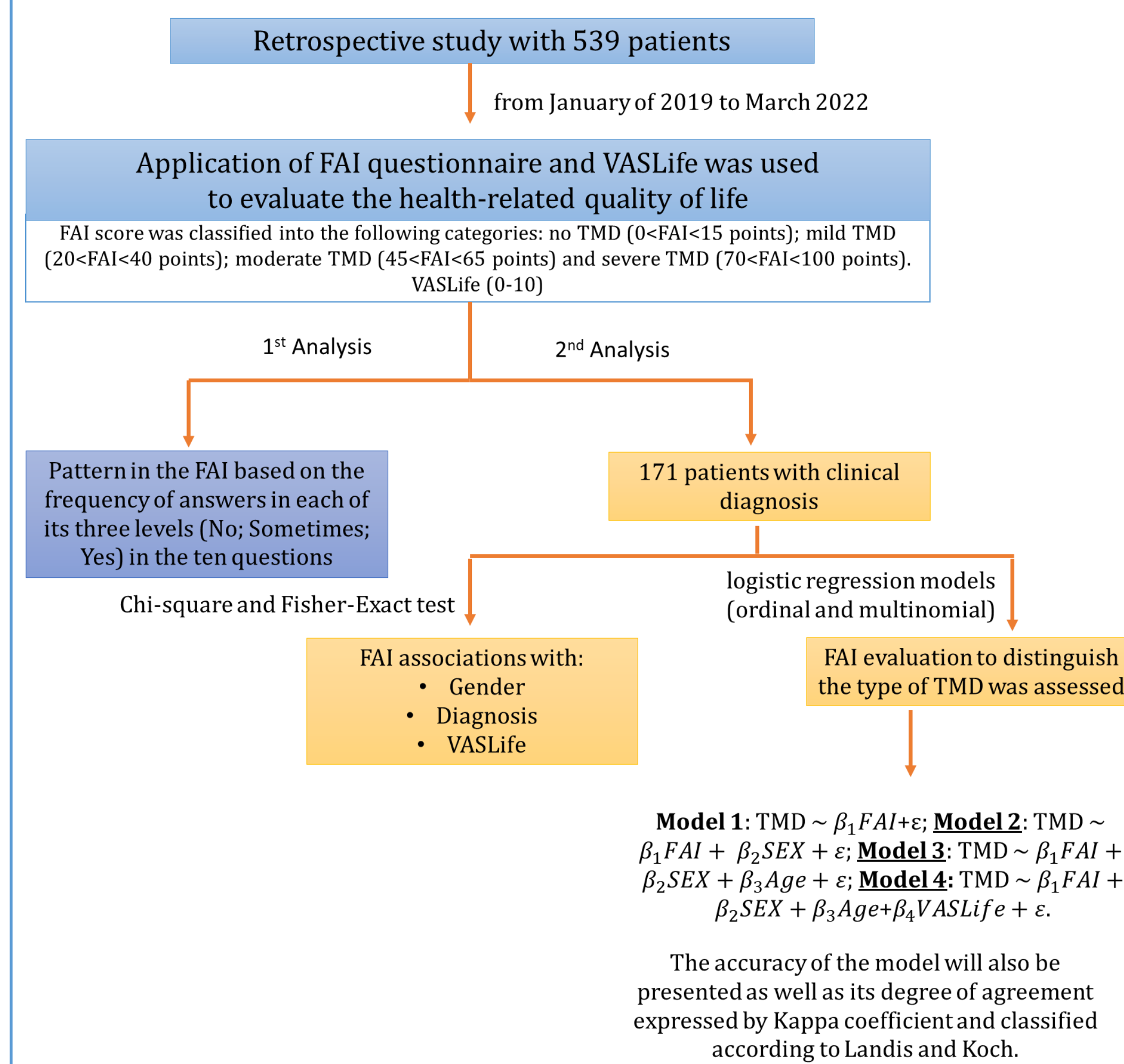
Temporomandibular disorders (TMD) are a set of musculoskeletal and/or articular conditions that affect respectively the masticatory musculature and/or the temporomandibular joint (TMJ) complex. TMD is the most common nondental cause of orofacial pain and have a negative impact on the patient's daily life.

The two main origins of pain in this region are considered to be due to intra-articular or masticatory muscle changes. Actually, the diagnosis of TMD is largely based on the patient's symptoms, as pain in TMJ and surrounding muscles, difficulty in opening the mouth, and other complaints such as the presence of clicking in the joint, malocclusion and headaches. The Fonseca Anamnestic Index (FAI) is a TMD patient-reported questionnaire, quick and easy to administer, based in signs and symptoms with 10 questions, used in recent years to classify the severity of TMD.

Objectives

The presented study aimed to screen the FAI accuracy to discriminate different types of TMD: intra-articular (AD), Masticatory Muscular Disorders (MMD), or the presence of both typologies.

Methodology



The significance level set was 5% and all statistical treatment and graphical representation was performed in the R programming language.

Results

The items 7, 6, 10 had the highest mean score on the FAI, which reflects a higher concentration of answers at the last level of the scale (Yes) (Figure 1). In opposition, the items with the lowest mean score were 1, 9 and 2, respectively, reflected by the less frequent answers in the highest score (Yes) (Figure 1).

Item	FAI	No	Sometimes	Yes
Item 7	7.1 (± 3.82)	17%	24%	59%
Item 6	6.66 (± 3.88)	19%	29%	52%
Item 10	6.6 (± 3.65)	16%	36%	48%
Item 3	6.12 (± 4.02)	24%	30%	46%
Item 4	5.9 (± 4.03)	25%	32%	43%
Item 8	5.6 (± 4.27)	31%	26%	43%
Item 5	5.57 (± 4.15)	29%	30%	41%
Item 1	5.47 (± 3.71)	23%	44%	33%
Item 9	5.17 (± 4.29)	35%	27%	38%
Item 2	4.63 (± 4)	36%	35%	29%
	Mean (± SD)			

Figure 1: an assessment of the frequency of answers and mean score of the different FAI questions.

In second part of study, 171 patients with clinical diagnosis (between 9 and 90 years old), were included. 30 patients were diagnosed with MMD, 33 with AD and 107 with both.

The existence of an association between the type of diagnosis (MMD, AD, Both) and the level of the FAI (No, Sometimes, Yes) was verified ($\chi^2 = 47.0, 4, <0.001$).

Cramer's V coefficient assumed a value of 0.117 classifying the intensity as moderate (95% CI=[0.079;0.147]).

Table 1. Contingency table relatively to the type of diagnosis and the level of Fonseca Anamnestic Index (FAI).

FAI	No	Sometimes	Yes	χ^2 ; df; p-value
Diagnostic				
MMD	$O_{11}=84$ $e_{11}=70.50$	$O_{12}=108$ $e_{12}=97.22$	$O_{13}=109$ $e_{13}=133.27$	47.0; 4; <0.001
AD	$O_{21}=108$ $e_{21}=77.77$	$O_{22}=115$ $e_{22}=107.24$	$O_{23}=109$ $e_{23}=147.00$	
Both	$O_{31}=209$ $e_{31}=252.73$	$O_{32}=330$ $e_{32}=348.53$	$O_{33}=540$ $e_{33}=477.73$	

Legend: MMD-Masticatory Muscle Disorder; AD-Articular Disorder; χ^2 -Chi-Square test; df- degrees of freedom, O_{ij} - observed value in row i (i=MMD, AD, Both) and column j (j=No, Sometimes, Yes); e_{ij} - expected value in the row i (i=MMD, AD, Both) and column j (j=No, Sometimes, Yes)

It is possible to verify a greater number of moderate and severe cases of the FAI, when muscular changes are verified simultaneously with intra-articular alterations. At the same time, a different distribution of severity of cases in females and males was demonstrated (Table 2)

Table 2. Contingency table regarding gender and type of diagnosis compared to the severity level of the Fonseca Anamnestic Index (FAI) determined by Fisher-Exact test.

	Severity				p-value
	No Severe	Mild	Moderate	Severe	
Sex					
F	1	26	54	59	0.05
M	0	12	12	7	
Diagnostic					
MMD	0	8	17	5	<0.001
AD	0	13	13	7	
Both	1	17	36	54	

Legend: F- Feminine; M- Masculine; MMD-Masticatory Muscle Disorder; AD-Articular Disorder.

In Figure 2B there is a positive correspondence in females between the FAI score and the level of complexity of TMD, while in men this profile was not verified, and it is not possible to draw the same conclusion. Finally, we sought to assess to what extent the FAI could be a good predictor of the type of TMD diagnosis using the ordinal logistic regression model. After verifying the absence of multicollinearity of the predictors by the Variance Inflation Factor-VIF (FAI:1.17;SEX:1.04;AGE:1.04;VASLife:1.20) the hypothesis of proportionality of risks was rejected in Models 1 to 4 (p-values 0.05; 0.00; 0.01; 0.01, respectively) leading to the approach by multinomial logistic regression where the independence of irrelevant alternatives by Hausman McFadden was tested (p-values≈1).

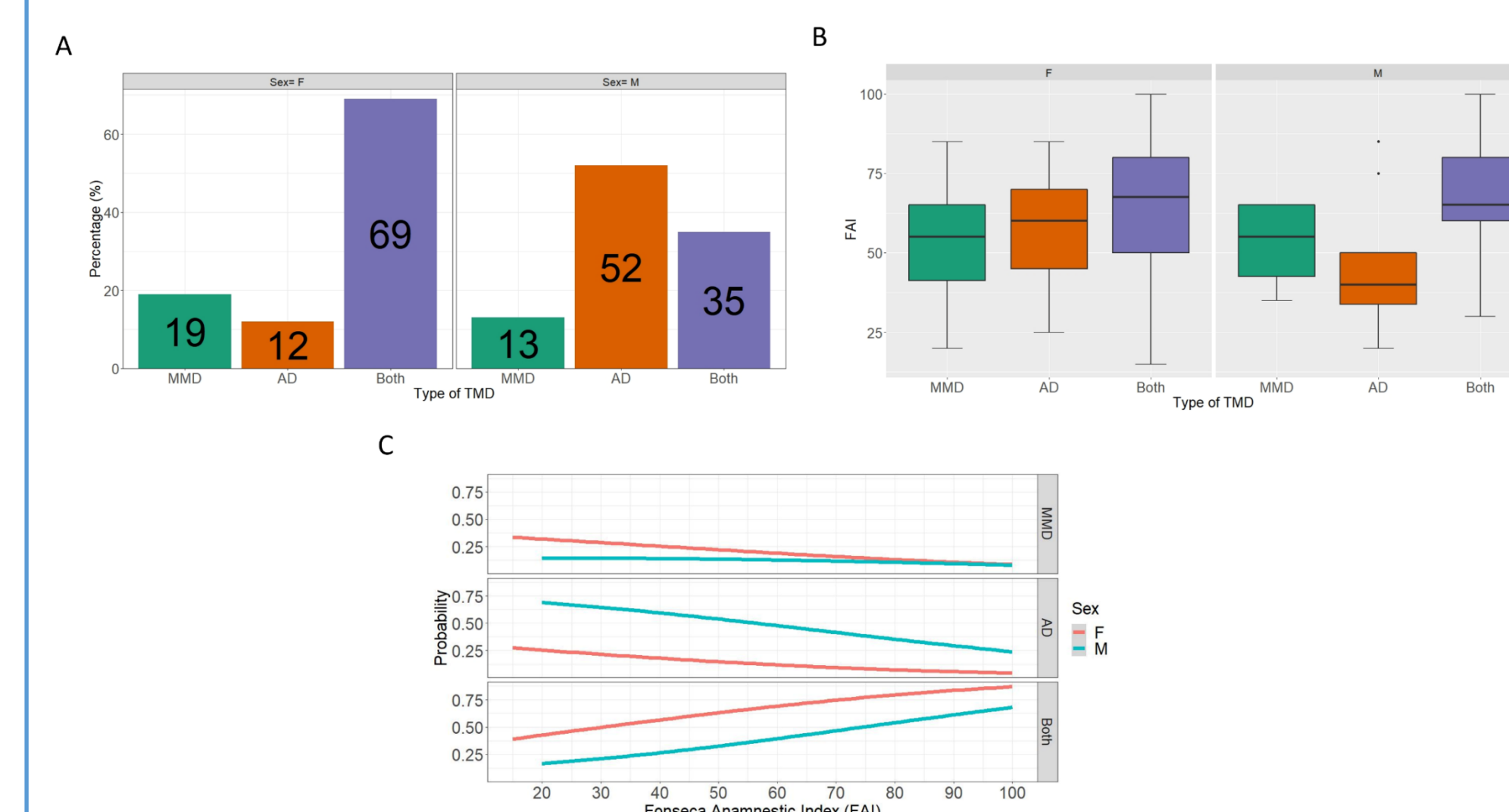


Figure 2. Analysis of the type of temporomandibular disorders (TMD) as a function of the Fonseca Anamnestic Index (FAI) taking gender into account. A. Percentage of the number of TMD cases by gender. B. Dispersion of FAI score by type of diagnosis and sex. C. Graphical representation of the multinomial logistic regression model.

The predictors AGE and VASLife did not show any statistical significance (Model 3: AD:AGE p-value=0.31; Both:AGE p-value=0.357; Model 4: AD:AGE p-value=0.305; Both:AGE p-value=0.337;AD:VASLife p-value=0.783; Both:VASLife p-value=0.125) and the choice between Models 1 and 2 was made. Analysis of deviance table revealed that both predictors in models 1 and 2 are statistically significant (Model 1: FAI, likelihood-ratio $\chi^2 = 15.764$, df=2, p-value=<0.001; Model 2: FAI, likelihood-ratio $\chi^2 = 12.132$, df=2, p-value<0.001, SEX likelihood-ratio $\chi^2 = 17.694$, df=2, p-value=<0.001). Since Model 2 has a lower Akaike Information Criterion (AIC) value relatively to Model 1 (196.73 vs 204.60) and higher Nagelkerke pseudo R^2 (0.3 vs 0.21), this model was chosen. The accuracy of the model is 0.667 (95% CI=[0.580, 0.754]) and the level of agreement expressed by the Kappa coefficient is 0.230 being classified as satisfactory in according to Landis and Koch. In the model test the accuracy value was 0.629 (95% CI=[0.449, 0.785]) with a Kappa agreement level of 0.19. The Figure 2C represents the adjusted logistic model.

The adjusted Model 2 can be expressed by the following set of equations:

$$\log \left[\frac{P(Y = AD)}{P(Y = MMD)} \right] = 0.618 - 0.012FAI + 1.202SEX.Male \quad (\text{Equation 1})$$

$$\log \left[\frac{P(Y = Both)}{P(Y = MMD)} \right] = -0.463 + 0.027FAI - 0.560SEX.Male \quad (\text{Equation 2})$$

Conclusions

FAI is a good initial methodology in TMD diagnosis, however as a model for distinguish the typology of TMD has proved to be insufficient. It is expected that the combination of this survey with other outcomes will make the model more accurate.

Acknowledgements

This work was supported by Research Grant SORG 2019 - project: "EUROTMJ – recording TMJ outcomes in a central database". This study is partially financed by national funds through FCT under the project UIDB/00006/2020.