Research Article

Validity of Brief Pain Inventory Questionnaire in Describing Trigeminal Neuralgia and Temporomandibular Joint Disorder Patients

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Abstract

Background and Objectives: Multidimensional pain assessment plays an important role in evaluating diagnosis and treatment. The aim and objectives of the present study is to identify the descriptors for trigeminal neuralgia and temporomandibular joint disorder patients using the brief pain inventory questionnaire and to evaluate its validity and assess the discriminative capacity of the questionnaire in the same patients respectively.

Materials and Methods: Total sample of 144 patients was divided into two groups' i.e., trigeminal neuralgia (72) and temporomandibular joint disorder (72). After obtaining ethical clearance and consent from pain patients with trigeminal neuralgia or temporomandibular joint disorder, using the Standard English version of brief pain inventory questionnaire, the patients were asked to select a descriptor which best describes their pain intensity and the pain severity and interference was graded. The attending oral physician interviewed and filled in the questionnaire based on the patient's responses (clinician administered questionnaire). After completion of the questionnaire, the scores were analyzed and necessary treatments were given to all the patients.

Results: Patients in trigeminal neuralgia group chose "sharp, stabbing, shooting, burning, numb and unbearable" and in temporomandibular joint disorder group chose "aching, nagging" to describe their pain. Chi-square test was done to compare the proportions between these two pain groups p- value was significant ($p < 0.001$). Correlations between pain intensity and pain interference scores in both the study groups showed a positive value for Pearson's coefficient (r) =0.614 and high statistical significance ($p < 0.001$). Factor analysis done with rotated component matrix and Varimax with Kaiser Normalization method to identify factor loadings for pain intensity and pain interference scores revealed two factors and the p-value was significant. Receiver operating curve analysis was done to find a best cut off value for activity score to categorize between trigeminal neuralgia and temporomandibular joint disorder and the area under the curve was 0.624 with a sensitivity, specificity, negative predictive value, positive predictive value, overall accuracy to be 45.8%, 76.4%, 58.5%, 66.0%, 61.1% respectively. For sleep score, the area under curve was 0.651 and the sensitivity, specificity, negative predictive value, positive predictive value and overall accuracy was 68.1%, 58.3%, 64.6%, 62%, and 63.2% respectively.

Conclusion: Though area under curve, sensitivity and specificity of BPI are not excellent, it has higher value than a random classifier. In conclusion, brief pain inventory use as a diagnostic tool alone can be improved by developing new questions and precision tests in further clinical studies.

Keywords: Pain, Trigeminal Neuralgia; Temporomandibular Joint Disorder; Brief Pain Inventory; Validity

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Abbreviations

TN: Trigeminal Neuralgia; TMD: Temporomandibular Joint Disorder; QoL: Quality of Life; HrQoL: Health Related Quality of Life; BPI: Brief Pain Inventory; REM: Relations with Others, Enjoyment of Life, Mood; WAW: Walking, General Activity and Work; MPQ: McGill Pain Questionnaire; IHS: International Headache Society; RDC: Research Diagnostic Criteria; KMO Bartlett's Test: Kaiser-Meyer-Olkin; ROC: Receiver Operating Curve; AUC: Area Under Curve; Sn: Sensitivity; Sp: Specificity; PPV: Positive Predictive Value; NPV: Negative Predictive Value; IASP: International Association for the Study of Pain; WHO: World Health Organization.

Introduction

Pain is one of the most common symptoms in orofacial region and is mostly due to odontogenic and non-odontogenic causes (neurological, vascular and musculoskeletal pathologies) [1]. Among such orofacial pains are trigeminal neuralgia (TN) and pains due to temporomandibular joint disorders (TMD). Assessment of pain and its associated characteristics helps in obtaining detailed information about the patient and monitoring their progress over time post intervention. It also helps in comparing one patient with another from a similar disease population. The diagnosis of a majority of the orofacial pains is based on a careful history and clinical examination. Pain involves cognitive, motivational, effective, behavioral and physical components and is multi-dimensional in that the sensory dimension of pain includes pain intensity or pain severity and the reactive dimension of pain includes its interference with daily function [2,3]. Hence, a good pain assessment should include quality and quantity of pain as well as its interference on the quality of life (emotional and psychological impact). The diagnosis of a majority of the orofacial pains is based on a careful history and clinical examination. Often, the usual clinical exchange about pain between the doctor and the patient is so casual or unstructured that poor pain assessment is assured [4]. Questionnaire is one of the key tools in research consisting of a series of questions and other prompts for the purpose of gathering information from respondents. Unidimensional pain questionnaires measure only the sensory dimension i.e. pain intensity in the form of scales whereas the multidimensional pain questionnaires measure both the sensory as well as reactive component (pain interference). Since pain is multidimensional, assessing the pain through multidimensional questionnaires is of great help to the clinician in evaluation of both diagnosis and prognosis [5].

One such multi-dimensional pain questionnaires is the Brief pain inventory (BPI) questionnaire which was first developed by the pain research group of the WHO collaborating Centre for symptom evaluation in cancer care to measure the cancer pain in 1970s [6]. It contains questions related to pain severity (as pain least, average, worst and right now) and pain interference as (an affective sub dimension REM: relations with others, enjoyment of life, and mood and an activity sub dimension WAW: walking, general activity, and work). The BPI uses 0-10 numerical rating scales (due to its simplicity and lack of ambiguity) to assess the interference of pain with mood, walking, general activity, work, relations with others, sleep and enjoyment of life. The mean of these scores can be used as a pain interference score which is highly correlated with an interference factor derived from a common factor analysis solution. As ratings on pain worst increase, additional pain interference items are rated as impaired. BPI also contains diagrams where the patients are asked to mark their pain location(s) on front/back body diagrams and to describe their perception of the cause of pain, the types of pain treatment they were receiving, and the amount of relief provided by their treatment. A potential aid to diagnosis that merits investigation is the different verbal descriptors used by patients to describe their pain. In BPI, to describe the quality of pain, the patients are asked to choose words among a list of fifteen verbal descriptors (derived from the McGill Pain Questionnaire).

Materials and Methods

The study population consisted of a total of 144 patients and they were divided into two groups (Group-1TN=72, Group-2 TMD=72). The sample size was calculated by 80% power of the study with Alpha Error (%) = 5.

Inclusion and exclusion criteria

Symptomatic patients (both men and women) aged 18 years and above who have been diagnosed with trigeminal neuralgia (IHS criteria) and temporomandibular joint disorder (RDC criteria) have been included in this study [7,8]. Patients with a history of surgical management for TN and TMD and other causes of orofacial pain, pregnant patients, medically compromised patients (with

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definitive systemic illness other than TN and TMD) have been excluded for this study.

Methodology

After obtaining approval from the institutional scientific and ethical committee (SRB/SDMDS12OMR1,IHEC/SDMDS12OMR1) the study was started. After obtaining consent, the patients attending the department of oral medicine and radiology with a complaint of pain were taken in this study once they have been diagnosed with TN or TMD based on history, examinations and imaging techniques whenever indicated. The Standard English version of BPI questionnaire was used in this study. The patients were asked to grade pain severity and the disability caused by pain on their daily functional activities. Also, they were asked to select a descriptor which describes their pain intensity. The attending oral physician interviewed and filled in the questionnaire based on the patient's responses (clinician administered questionnaire). After completion of the questionnaire, necessary treatments were given to all the patients.

Analysis of the pain scores

The total scores on the subscale of pain interference with functions are calculated by adding the scores for each item on pain interference. The four severity and the seven interference items can also each be summed to form composite scores [6].

Results and Discussion

Results

A total of 144 were present in the study population. The data was entered into an excel sheet and analyzed by SPSS version 18.

Age and gender groups

Table 1 shows the distribution subjects in different age groups among the study population. TN was more prevalent in the age group between 41-50 years (54.2%) and above 60 years (40.3%) On the other hand, TMD was more prevalent among the age group of 21-40 years (63.9%).The data in table 2 shows distribution of males and females in the study population. 49.3% (71) were males and 50.7% (73) were females among the total participants in the study. In the TMD group, there were 29 males and 43 females. In the TN group, there were 42 males and 30 females.

Age of study subjects	TMD	TN	Total
<20 years	8 11.1%	0 0%	8 5.6%
21-40 years	46 63.9%	4 5.6%	50 34.7%
41-50 years	15 20.8%	39 54.2%	54 37.5%
>60 years	3 4.2%	29 40.3%	32 22.2%
Total	72 100.0%	72 100.0%	144 100.0%

Table 1: Distribution of age groups in the study population.

Gender of the study subjects	TMD	TN	Total
Males	29 40.3%	42 58.3%	71 49.3%
Females	43 59.7%	30 41.7%	73 50.7%
Total	72 100.0%	72 100.0%	144 100.0%

Table 2: Distribution of males and females in the study population.

Verbal descriptors

The data in table 3 and figure 1 shows prevalence of verbal descriptors in TN and TMD groups. In our study, patients with TN chose mostly "sharp, stabbing, shooting, burning, numb and unbearable" to describe their pain. Statistical analysis revealed high significance for these words in describing pain of TN ($p < 0.001$). Typical verbal descriptors among TMD patients were "aching, nagging" and they were statistically highly significant ($P < 0.001$) for TMD patients. Chi-square test was done to compare the proportions between these two pain groups and it revealed statistical significance of ($p < 0.001$).

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Descriptor		Pain Group						P-Value
		TMD		TN		Total		
		N	%	N	%	N	%	
Aching	Yes	71	98.6	13	18.1	84	58.3	<0.001
	No	1	1.4	59	81.9	60	41.7	
	Total	72	100.0	72	100.0	144	100.0	
Throbbing	Yes	67	93.1	2	2.8	69	47.9	<0.001
	No	5	6.9	70	97.2	75	52.1	
	Total	72	100.0	72	100.0	144	100.0	
Shooting	Yes	10	13.9	58	80.6	68	47.2	<0.001
	No	62	86.1	14	19.4	76	52.8	
	Total	72	100.0	72	100.0	144	100.0	
Stabbing	Yes	17	23.6	72	100.0	89	61.8	<0.001
	No	55	76.4	0	.0	55	38.2	
	Total	72	100.0	72	100.0	144	100.0	
Gnawing	Yes	36	50.0	11	15.3	47	32.6	<0.001
	No	36	50.0	61	84.7	97	67.4	
	Total	72	100.0	72	100.0	144	100.0	
Sharp	Yes	9	12.5	72	100.0	81	56.3	<0.001
	No	63	87.5	0	.0	63	43.8	
	Total	72	100.0	72	100.0	144	100.0	
Tender	Yes	53	73.6	56	77.8	109	75.7	0.560
	No	19	26.4	16	22.2	35	24.3	
	Total	72	100.0	72	100.0	144	100.0	
Burning	Yes	0	.0	49	68.1	49	34.0	<0.001
	No	72	100.0	23	31.9	95	66.0	
	Total	72	100.0	72	100.0	144	100.0	
Exhausting	Yes	2	2.8	0	.0	2	1.4	0.497
	No	70	97.2	72	100.0	142	98.6	
	Total	72	100.0	72	100.0	144	100.0	

Table 3: Pain descriptors scores in TN and TMD Groups.

Figure 1: Pain descriptors in TN and TMD groups.

Mean pain intensity scores

The data in table 4 and figure 2 shows the mean pain intensity scores in the study. The mean values of pain intensity scores revealed that the mean worst pain in TMD group is 7.82 with a standard deviation of 1.117 where as in TN group it is 8.15 with a standard deviation of 1.016. The independent sample t-test result shows that the two mean values are not significant (p = 0.063).The mean least pain in TMD group is 5.15 with a standard deviation of 1.933 where as in TN group it is 4.76 with a standard deviation of 1.682. The independent sample t-test result shows that the two mean values are not significant (p = 0.200).The mean average pain

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in TMD group is 6.08 with a standard deviation of 1.253 where as in TN group it is 6.40 with a standard deviation of 1.329. The independent sample t-test result shows that the two mean values are not significant (p = 0.140).The mean pain now in TMD group is 6.94 with a standard deviation of 1.775 where as in TN group it is 6.76 with a standard deviation of 2.388. The independent sample t-test result shows that the two mean values are not significant (p = 0.607).

	Pain Group	N	Mean	Standard deviation	t-Value	p-value
Worst Pain	TMD	72	7.82	1.117	1.873	0.063
	TN	72	8.15	1.016		
Least Pain	TMD	72	5.15	1.933	1.288	0.200
	TN	72	4.76	1.682		
Average Pain	TMD	72	6.08	1.253	1.484	0.140
	TN	72	6.40	1.329		
Pain now	TMD	72	6.94	1.775	0.515	0.607
	TN	72	6.76	2.388		

Table 4: Mean pain intensity scores.

Figure 2: Mean pain intensity scores.

Mean pain interference scores

The data in table 5 and figure 3 shows the mean pain interference scores in the study. The mean values of pain interference scores in study subjects revealed statistical significance in both activity (p = 0.035) and sleep (p = 0.693). The mean value of activity in TMD group is 6.65 with a standard deviation of 1.634 where as in TN group it is 7.15 with a standard deviation of 1.659. The independent sample t- test result shows that the two mean values are statistically significant (p = 0.035). The mean value of sleep in TMD group is 4.86 with a standard deviation of 1.849 where as in TN group it is 3.90 with a standard deviation of 1.929. The independent sample t- test result shows that the two mean values are statistically significant (p = 0.003).

|	Pain Group	N	Mean	Std. Dev	t-Value	P-Value
Activity	TMD	72	6.57	1.634	2.126	0.035
	TN	72	7.15	1.659		
Mood	TMD	72	5.54	1.601	0.235	0.815
	TN	72	5.61	1.932		
Walking	TMD	72	5.04	1.732	0.142	0.887
	TN	72	5.08	1.790		
Work	TMD	72	5.76	1.873	0.303	0.762
	TN	72	5.67	1.979		
Relationship	TMD	72	5.28	1.576	0.396	0.693
	TN	72	5.17	1.784		
Sleep	TMD	72	4.86	1.849	3.043	0.003
	TN	72	3.90	1.929		
Enjoyment	TMD	72	5.75	1.726	0.001	0.999
	TN	72	5.75	1.867		

Table 5: Mean pain interference scores.
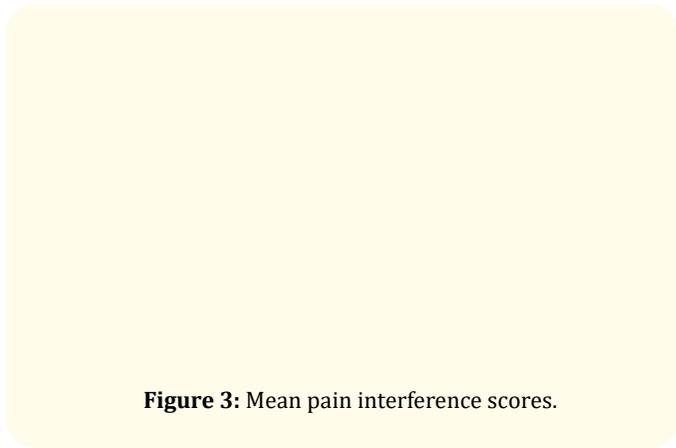
Figure 3: Mean pain interference scores.

Correlation between pain intensity and pain interference in both groups and in individual groups

The data in table 6 and figure 4 shows the correlation between pain intensity and pain interference in both groups in the study.

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Correlations between pain intensity and pain interference scores in both the study groups showed a positive value for Pearson's coefficient (r) =0.614 and high statistical significance (p < 0.001). The data in table 7 and figures 5 and 6 show the correlation between pain intensity and pain interference in each individual group in the study. Individually the correlation coefficients between pain intensity and pain interference showed r = 0.558 in TMD group (Figure 5) and r = 0.676 in TN group (Figure 6), both revealing high statistical significance (p < 0.001).

		Pain interference score (Total)
Pain intensity score	Pearson Correlation	0.614
	P-Value	<0.001
	N	144

Table 6: Correlation between pain intensity and pain interference in both groups.

Pain Group			Pain interference score (Total)
TMD	Pain intensity score	Pearson Correlation	0.558
		P-Value	<0.001
		N	72
TN	Pain intensity score	Pearson Correlation	0.676
		P-Value	<0.001
		N	72

Table 7: Correlation between pain intensity and pain interference in individual groups.
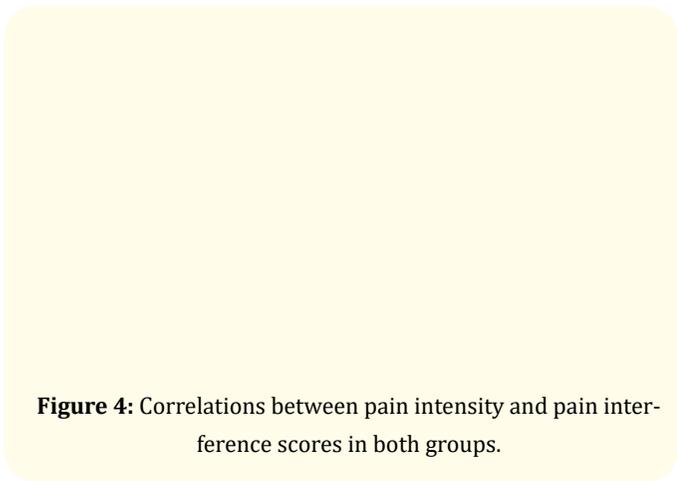

Figure 4: Correlations between pain intensity and pain interference scores in both groups.
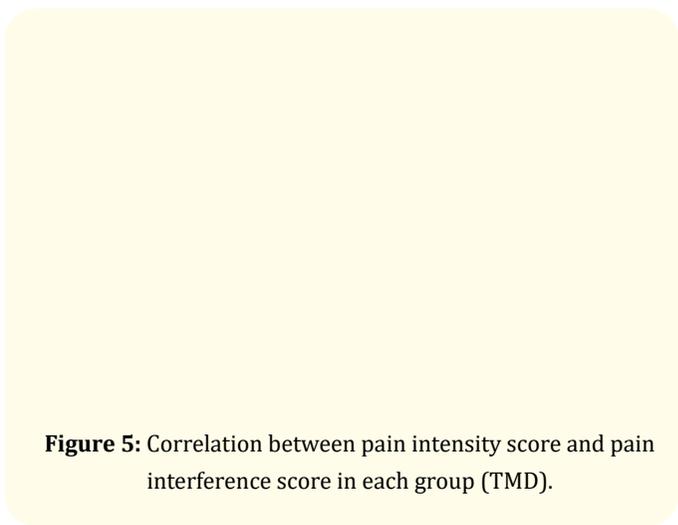

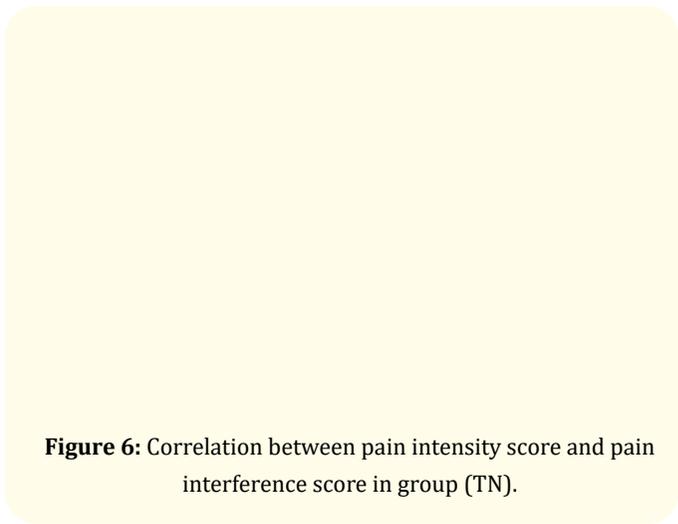**Figure 5:** Correlation between pain intensity score and pain interference score in each group (TMD).

Figure 6: Correlation between pain intensity score and pain interference score in group (TN).

Factor analysis

Table 8 shows the factor analysis for pain intensity and pain interference in both TN and TMD groups. To identify the factor loadings for pain intensity and pain interference scores factor analysis was performed. Kaiser-Meyer-Olkin (KMO) Bartlett's test was done to test the model adequacy and its results showed that Kaiser-Meyer-Olkin(KMO) Measure of Sampling Adequacy is 0.857 with a p value <0.001, indicating that the data is suitable for doing a factor analysis. The factor analysis was done with rotated component matrix and Varimax with Kaiser Normalization method. Usually, if the factor loading is more than 0.500 then factor grouping is considered. The results of the factor analysis identified two factors, one factor involved with all pain intensity variables and activity of pain interference and the other factor involved with all pain interference variables except activity. Factor analysis done for pain inten-

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sity and interference scores in TMD group showed KMO Bartlett's Measure of Sampling Adequacy to be 0.857 with a p value of <0.001 where as in TN group showed 0.807 with a p value of<0.0001. The data in table 9 shows the factor analysis values for pain intensity and pain interference in each individual group. When factor analysis for pain intensity and pain interference was done in each group, the same KMO Bartlett's test was done to test the model adequacy and the test results show that KMO Measure of Sampling Adequacy is 0.844 with a p-value <0.001 in TMD group (Table 9), which indicates that the data is suitable for doing a factor analysis. The factor analysis was done with rotated component matrix and Varimax with Kaiser Normalization method. The factor analysis result identifies two factors, one factor with all pain intensity variables and the other factor involving with all pain interference variables (Table 9). KMO Bartlett's test was done to test the model adequacy and the results of this test showed test that Kaiser-Meyer-Olkin Measure of Sampling Adequacy is 0.807 with a p-value <0.001in TN group, indicating that the data is suitable for doing a factor analysis. The factor analysis was done with rotated component matrix and Varimax with Kaiser Normalization method. The factor analysis results identified two factors, one factor with all pain intensity variables and the other factor evolves with all pain interference variables except walking (Table 9).

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.857
Bartlett's Test of Sphericity	Approx. Chi-Square	657.638
	Df	55	
	Sig.	.000	
Rotated Component Matrix		
	Component	
	Factor-1	Factor-2
Worst Pain	0.053	0.798
Least Pain	0.308	0.767
Average Pain	0.189	0.861
Pain now	0.376	0.627
Activity	0.419	0.585
Mood	0.743	0.050
Walking	0.622	0.269
Work	0.806	0.240
Relationship	0.641	0.301
Sleep	0.707	0.185
Enjoyment	0.612	0.247
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in 3 iterations.		

Table 8: Factor analysis for pain intensity and pain interference in both (TN and TMD) groups.

KMO Bartlett's Test		TMD	TN
KMO Measure of sampling adequacy		0.844	0.807
Bartlett's test of sphericity			
Approximate chisquare		411.139	334.787
df		55	55
Sig.		0.000	0.000
Rotated component matrix			
Component			
Factor-1		Factor-2	
TMD	TN	TMD	TN
Worst pain	.196	.789	.787	-.067
Least pain	.250	.746	.811	.386
Average pain	.194	.847	.827	.263
Pain now	.236	.587	.727	.499
Activity	.680	.735	.344	.240
Mood	.792	-.041	.076	.778
Walking	.807	.405	.162	.376
Work	.842	.187	.263	.798
Relationship	.571	.285	.381	.659
Sleep	.740	.289	.210	.607
Enjoyment	.721	.192	.297	.497
Extraction method: principal component analysis Rotation method: Varimax with Kaiser normalization. Rotation converged in 3 iterations			

Table 9: Factor analysis for pain intensity and pain interference in individual group (TN and TMD).

ROC curve analysis

The validity indicators sensitivity, specificity, positive predictive value (PPV) and negative predictive values (NPV) were calculated. An ROC (receiver operating curve) analysis was performed to determine the cutoff value of BPI scores providing the best values of sensitivity (Sn), specificity (Sp), for diagnosis of patients with TN and TMD. Also, for each cutoff score, apart from Sn and Sp; negative predictive value (NPV), positive predictive value (PPV) according to standard criterion or reference diagnosis, the AUC (area under curve) is calculated and its significance level was estimated. The 95% confidence intervals (95%CI) of the estimators of the cutoff paint selected as optimum were calculated. The data in figure 7 shows ROC analysis to find a best cut off value for activity score to categorize between TN and TMD. The data in table 10 shows Sn, Sp,

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NPV, PPV and overall accuracy values for this cut off score. To find a best cut off value for activity score to categorize between TN and TMD ROC curve analysis was done. A random classifier has an area under curve (AUC) value which equals to 0.5; the higher the value of AUC, the better distinguishing the capabilities of the classifier. In our study, the area under the AUC was 0.624 i.e., if the activity score is less than or equal to six, then it is categorized as TMD and if it is more than six it is categorized as TN (Figure 7). This cut off value has the Sn of 45.8% and Sp of 76.4%, the NPV to be 58.5% and a PPV of 66.0%.The overall accuracy to be 61.1% (Table 10). The data in figure 8 shows ROC analysis to find a best cut off value for sleep score to categorize between TN and TMD. The data in table 11 shows Sn, Sp, NPV, PPV and overall accuracy values for this cut off score. For sleep, the ROC curve analysis, revealed the AUC as 0.651 and showed the cut off value to classify as TMD to be > 4. If it is less than or equal to 4 it can be categorized as TN (Figure 8). This cut off value has the Sn of 68.1% and Sp of 58.3% the PPV is 62% and NPV is 64.6%. The overall accuracy is 63.2% (Table 11).
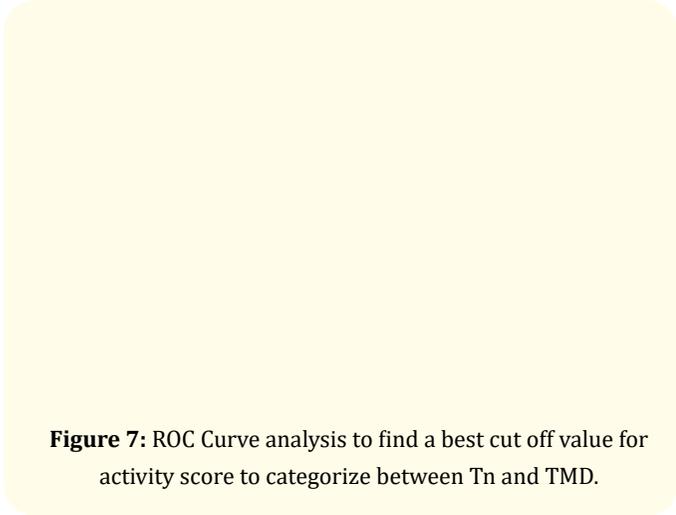
TMD		Pain Group		Total
		TN		
Activity score	≤ 6 (TMD)	33	17	50
	>6 (TN)	39	55	94
Total		72	72	144
Parameter		Estimate		95% CIs
Sensitivity		45.83%		(34.83, 57.26)
Specificity		76.39%		(65.40, 84.70)
Positive Predictive Value		66.00%		(52.15, 77.56)
Negative Predictive Value		58.51%		(48.41, 67.95)
Diagnostic Accuracy		61.11%		(52.96, 68.69)

Table 10: Sensitivity and specificity analysis for activity score.

TMD		Pain Group		Total
		TN		
Sleep score	>4 (TMD)	49	30	79
	≤ 4 (TN)	23	42	65
Total		72	72	144

Parameter	Estimate	95% CIs
Sensitivity	68.06%	(56.61, 77.67)
Specificity	58.33%	(46.81, 69.01)
Positive Predictive Value	62.03%	(51.00, 71.93)
Negative Predictive Value	64.62%	(52.47, 75.12)
Diagnostic Accuracy	63.19%	(55.07, 70.63)

Table 11: Sensitivity and specificity analysis sleep score.

Figure 7: ROC Curve analysis to find a best cut off value for activity score to categorize between Tn and TMD.

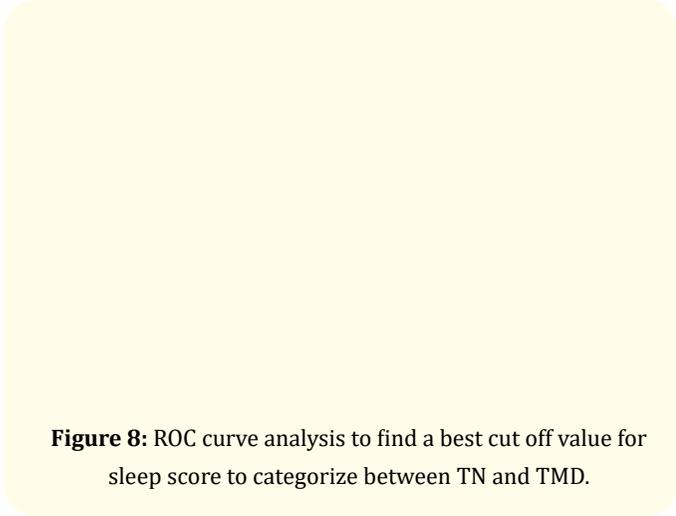**Figure 8:** ROC curve analysis to find a best cut off value for sleep score to categorize between TN and TMD.

Discussion

The Task force on taxonomy of the International Association for the Study of Pain (IASP) defines pain as: "an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage" [9]. Literature reveals that pain assessment plays a significant role in studies related to clinical management, in conducting clinical trials which might help identify effective pain and epidemiology and health related policies that have a great impact on the patient's quality of life (QoL) [10]. TN is defined by the IASP as "a sudden usually unilateral, severe, brief, stabbing, recurrent pain in the distribution of one or more branches of the fifth cranial nerve" and is prevalent in 2-3% of the population [7,11]. According to American academy of orofacial pain, TMD is defined as "a collective term embracing a number of clinical problems that involve the masticatory muscles, the temoromandibular joint and associated structures or both". It is prevalent in among 6- 12% of the population [8,12].

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Most of the TN patients in our study were in the age group of 41-50 years (54.2%) and above 60 years (40.3%). Several studies have revealed the peak incidence of TN in 50-60 years and an increase with age [13]. In our study in the age group of 21-40 years (63.9%) TMD was mostly seen. These findings were similar to the study done by Mandfredini D et al [14]. Among the total 144 study subjects, 49.3% i.e., 71 were males and 50.7% i.e. 73 were females in the study. In the TMD group, there were 43 females and 29 males. These findings coincided with the studies done by Wadhwa S et al which say that TMD is more prevalent in women [15]. There were 42 males and 30 females in the TN group in our study. Though TN is more prevalent in women, the findings of our study were similar to the study done by Umar et al [16].

As pain includes sensory and emotional components it can be expressed in different ways. Verbal communication of pain complaint, facial and body expression, social dysfunction and physical dysfunction may all be displayed in one individual, whereas another individual may complain less but use facial expression, and a third person may exhibit social or physical dysfunction. Hence, pain is considered to be a multidimensional entity in which the impact of pain on a patient's life and degree of disability are important to consider when planning treatment. Verbal pain descriptors have an importance in recording the patient's perception of pain. Several studies done earlier on McGill pain questionnaire (MPQ) have shown that effective description of pain helps in understanding its underlying mechanism. Dubuisson and Melzack in 1976 found that MPQ can be used to discriminate different kinds of pain [17]. In their study the discriminant analysis was 77% correct in making a prediction of the patients' clinical pain problem on the basis of verbal descriptors alone. Several other studies have confirmed the discriminative capacity of the MPQ [18,19] while a few have found that severe pain may obscure the MPQ's discriminative ability [20,21]. Ronald Melzack et al did a study using MPQ to know the discriminative capacity of pain in patients of trigeminal neuralgia and atypical facial pain, where most of the patients in the trigeminal neuralgia group chose flashing, terrifying, blinding, and torturing words to describe their pain [22]. In a similar study done by Mongini F et al in using MPQ in patients with TMJ disorders and myogenous pain, the TMJ group chose tiring, troublesome, nagging, sore, tender, and aching words to describe their pain whereas in the myogenous pain group the descriptors most frequently chosen were exhausting, punishing and pulling [23]. Pedroni et al used MPQ in group of TMD patients with cervical spine disorders where most of the patients chose the words "pressing", discomfortable and "annoying" [24].

Most of the trigeminal neuralgia patients in our study chose "sharp, stabbing, shooting, burning, numb and unbearable" to describe their pain and they were highly statistically significant ($p < 0.001$). These findings were similar to the typical description of pain in TN [11]. Among TMD patients statistically significant words were "aching, nagging" ($p < 0.001$) and these findings were mostly similar to the study done by Mongini F et al [23]. A Chi-square test done to compare the proportions between these two pain groups revealed statistical significance of ($p < 0.001$).

Several studies have shown that an increase in automatic hyperactivity has often been linked to anxiety and depression caused due to chronic pain. This leads to impairment and loss of function [25,26]. Mood disorders sleep disturbances, opioid dependence, alteration in perception and behavioral changes were linked to chronic pain states in the study done by Hansen et al [27]. A study by WHO showed that individuals who live with persistent pain are four times more likely than those without pain to suffer from depression or anxiety and more than twice as likely to have difficulty in working [28]. In our study, the mean values of pain interference scores in study subjects revealed statistical significance in both activity ($p = 0.035$) and sleep ($p = 0.693$). The independent sample t- test result shows that the two mean values for activity in TN and TMD groups were statistically significant ($p = 0.035$). Also, the two mean values are statistically significant ($p = 0.003$) for sleep in TN and TMD groups.

Quality of life (QoL) is defined as individual's ability to perform a range of roles in society and to reach an acceptable level of satisfaction from functioning in those roles [29,30]. Hunfeld and researchers found that QoL decreased as intensity and frequency of pain increased [31]. One of the most impressive findings were seen in the results of a study where the health related quality of life (HrQoL) was assessed in chronic non cancer and advanced cancer pain patients where the patients with chronic non cancer pain reported even worse QoL than dying cancer patient, a dramatic illustration of the major impact of chronic pain conditions on the global situation of persons with long lasting pain [32,33]. In our study, pain intensity interfered maximum with activity and mood. In the study done by Erdemoglu AK et al, the pain intensity interfered with activity, sleep and mood [34].

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In our study, correlations between pain intensity and pain interference scores in both the groups showed a positive value for Pearson's coefficient (r) =0.614 and a high statistical significance (p < 0.001). Individually the correlation coefficients between pain intensity and pain interference showed (r) =0.558 (TMD group) and r = 0.676 (TN), both revealing high statistical significance (p < 0.001). However, correlation coefficients alone do not rule out the reliability of the test instrument. In our study, we did not do the test- retest stability.

Identification of factor loading was done by performing factor analysis for pain intensity and pain interference scores. The results of the factor analysis identified two factors, one factor involved with all pain intensity variables and activity of pain interference and the other factor involved with all pain interference variables except activity. Factor analysis done for pain intensity and interference scores in TMD group showed KMO Bartlett's Measure of Sampling Adequacy to be 0.857 with a p value of <0.001 where as in TN group showed 0.807 with a p value of<0.0001. When factor analysis for pain intensity and pain interference was done in each group, KMO Measure of Sampling Adequacy is 0.844 with a p-value <0.001 in TMD group. Factor analysis result identified two factors, one factor with all pain intensity variables and the other factor involving with all pain interference variables. Kaiser-Meyer-Olkin Measure of Sampling Adequacy is 0.807 with a p-value <0.001 in TN group. The factor analysis results identified two factors, one factor with all pain intensity variables and the other factor evolves with all pain interference variables except walking. In the study done by Erdemoglu et al factor analysis done using the method of principal axis factoring and direct oblimin rotation revealed that BPI is composed of the severity and pain interference on activity, mood and sleep interactions (three factors) [34]. The standard BPI has generally exhibited a two- factor structure such as pain intensity and impact of or pain interference. However, there are also others studies which have stated that BPI may also exhibit three factor structures [35,36].

The results of ROC analysis to find a best cut off value for activity score to categorize between TN and TMD in our study revealed, the area under curve (AUC) to be 0.624 i.e., if the activity score is less than or equal to six, then it is categorized as TMD and if it is more than six it is categorized as TN. This cut off value had a Sn of 45.8% and Sp of 76.4%, NPV of 58.5% and the PPV to be 66.0%. The over-all accuracy is 61.1%. For sleep, the ROC curve analysis, showed the cut off value to classify as TMD to be > 4. If it is less than or equal to 4 it can be categorized as TN. This cut off value had the Sn of 68.1% and Sp of 58.3%, a PPV of 62% and the NPV to be 64.6%. The overall accuracy is 63.2%. In the study done by Erdemoglu et al the ROC curve plotted for the total score showed area under curve (AUC) as 0.69 and the Sn, Sp, PPV and NPV values for criterion total BPI score were 79.37%, 46.9%, 65.8%, and 63.9%, respectively [34].

When asked to talk about their pain, patients are often left entirely on their own to come up with a format for communicating the characteristics and intensity of their pain often leading to an unstructured communication and maximizing the chances of personality, cultural, linguistic and situational variability and related communicational bias. However, such an interchange is not a measurement situation in any sense. By using a standardized set of questions that are to be asked and by introducing measurement scales designed to measure subjective response, this variability in response can be dramatically mitigated. MPQ was validated to evaluate the sensory, affective and evaluative aspects of orofacial pain [37]. However, the MPQ mainly measures the qualities of pain and it does not assess how pain interferes with patient's functioning. Most unidimensional (assessing only pain intensity or interference) pain rating scales oversimplify the assessment of some types of pain [38]. The BPI is easily understood by patients and takes short time to complete, could be self-administered for literate patients or be completed by interview for illiterate patients. The form of administration has little effect on outcome. Several studies have shown that BPI can be easily translated for non- English speaking patients. BPI can be used in studies of the epidemiology of pain, in the clinic, in effectiveness of treatments and their outcomes. The validity of BPI has been well documented by many studies previously [35,36,39-41].

The present study is unique in doing the validation in trigeminal Neuralgia and temoporomandibular joint disorder patients. Our study demonstrates that BPI is a valid tool for evaluating the pain's intensity and its interference in trigeminal neuralgia and temporomandibular joint disorder patients. The limitations of this study include the non-examination of treatment outcome measures and test-re-test stability as this study is a validation of BPI and descriptors for trigeminal neuralgia and temporomandibular joint disorders. Though AUC, sensitivity and specificity of BPI are not excellent, it has higher value than a random classifier.

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Conclusion

In conclusion, as BPI assesses the severity of pain and its impact on daily functioning and other aspects of pain its use as a diagnostic tool alone can be improved by developing new questions and precision tests further in clinical studies.

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Conflict of Interest

No conflict of interest.

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