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Effect of alexithymia and its impact on oral health: a systematic review

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Abstract

Objectives: Alexithymia has also been found to be related to a poor oral health-related quality of life and dental fear which causes anxiety; the latter could lead to the avoidance of oral health services. The results of earlier studies suggest that alexithymic people may be inclined to report poorer OHRQoL than non-alexithymic people with similar dental health conditions. We aimed to undertake a systematic review of the published literature and scientific evidences with the purpose of knowing the impact of alexithymia on oral health.

Materials and Methods: Exposure was limited to those alexithymic trait assessed by TAS questionnaire. Any type of experimental design, investigating outcomes due to alexithymia was included. Outcome was a measure of oral health status among alexithymic individuals.

Results: Electronic search of 3 databases, with citation snowballing, identified 175 titles and abstracts. After reading title and abstracts, full texts of 13 articles were obtained for further review. On basis of inclusion and exclusion criteria 11 articles were included in this systematic review. Among those 2 articles excluded, one article had not used TAS questionnaire to assess alexithymia. Full text of one article was not available on search.

Conclusions: The results of this study showed that, those with higher levels of alexithymia were more likely to have a poorer oral health.

Keywords: Alexithymia, oral health, depression, periodontitis, glossodynia, burning mouth syndrome, TMJ disorders.

Introduction

Depression is among the most prevalent chronic disease worldwide. It is a well-established and important risk factor for many systemic conditions; including obesity, sleep disturbance and other chronic diseases. Major depression in the general population has a lifetime prevalence ranging from 10% to 15% with an increased rate in females.[1] According to the World Health Organisation, depression affects people of all ages,

from all walks of life and in all countries. In order to make mental health a priority; WHO had focussed on 'Depression' as the World Health Day theme for the year 2017.

Alexithymia, is a personality trait involving difficulties in emotional regulation [difficulties in identifying feelings, difficulties in describing feelings, and externally oriented thinking].[1] In major depression(MD), the rate of alexithymia ranges between 45-46% during the acute phase of illness. Significant relationships have been found between alexithymia and depression in the general population and in clinical samples. In the general population, depressive symptoms explained almost 36% of the variance of alexithymic features and were significantly correlated with all alexithymic dimensions. In clinical samples, some studies observed a decrease in the alexithymia scores with the improvement of symptoms in depression and anxiety.[2]

There are at least two explanations for the observed relationship between alexithymia, anxiety and depression. Alexithymia may be a temporary response to a stressful condition, such as an illness episode; in this view "secondary alexithymia" can represent a defense or a strategy to cope with distress (emotional pain, aversive memories and physiological arousal) associated with a mental disorder. In the second hypothesis, the relationship between alexithymia and depression may represent an artifact of the method and measures used, since, particularly, this is associated with different measures of negative effects. Therefore, individuals with negative emotional states (i.e. anxiety and depression) might score higher on the alexithymic dimensions. Alexithymia, can be more a measure of negative affect rather than a measure of deficit in the cognitive processing of emotions across different mental disorders.[2]

According to Ricciardi et al. (2015), the prevalence of alexithymia in the general population is approximately 10%. The prevalence of alexithymia in working-age populations is 9%–17% for men and 5%–10% for women. The prevalence figures of alexithymia in older age-groups are notably higher; over 20% or even over 30% in the oldest populations. Besides older age, alexithymia is also associated with male sex, lower socioeconomic status, fewer years of education, single marital status, and poorer perceived health. Therefore, it has been claimed that alexithymia may be a state-dependent phenomenon. Moreover, alexithymia is normally-distributed in the general population in both sexes.[3]

On the other hand, alexithymia has also been associated with several medical conditions, such as inflammatory bowel disease, essential hypertension, migraine, and diabetes mellitus. Health is an essential component of quality of life. A growing trend is to measure the outcomes of healthcare multidimensionally, including the subjective experience of the patient. Health economists require generic (non–disease-specific) single-dimensional utility measures to compare the costs and benefits of treating different diseases. The health-related quality of life (HRQoL) measurement aims to meet these demands. Alexithymia has been associated with a lower overall quality of life (QOL) in the general population, in patients with coronary heart disease, patients with brain injury and in outpatients with depression. A negative association between alexithymia and HRQoL has been found in medically ill patients and in patients with inflammatory bowel disease, breast cancer, and with end-stage renal disease. Alexithymic individuals had lower levels of physical functioning, more limitations due to emotional problems, less energy, poorer emotional wellbeing, poorer social functioning, more pain, and poorer general health than the non-alexithymic persons.[3]

In addition to the general health conditions, oral diseases have also been associated with depression.[1] The result of a systematic review and meta-analyses[1] showed a positive association between depression and oral diseases like dental caries, tooth loss and edentulism in adults and elders.[4] The problem of poor oral hygiene is not limited to the patients suffering from severe mental disorders and presenting limited management skills, but pertains also to patients affected by mild psychiatric disturbances.[5]

According to earlier studies, alexithymia is associated with somatization. Somatizing people report medically unexplained symptoms or amplify symptoms that have organic aetiology. It has been found that, in the elderly, somatization is associated with poorer overall OHRQoL as well as physical pain and functional limitation. This is of particular interest with regard to the self-reporting of OHRQoL. The results of earlier studies suggest that alexithymic people may be inclined to report poorer OHRQoL than non-alexithymic people with similar dental health conditions. Consequently, if not recognized, there is a risk that the alexithymia-related reporting of poorer OHRQoL will have a deleterious effect on the patient–dentist relationship.[6]

Thus, understanding the oral health of alexithymic people can help improve patient-dentist relationship. Since to date there are no studies on the impact of alexithymia on oral health, this article is aimed to review the published literature and scientific evidences with the purpose of knowing the impact of alexithymia on oral health.

Materials and methods

Design

A systematic review was undertaken using objective and transparent method as per the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, to identify, evaluate and summarize all relevant research findings. The protocol for this review was registered with PROSPERO (International prospective register of systematic reviews). Registration number is: CRD42019121019.

Eligibility criteria

On applying the PICO analysis to the articles searched, the criteria were set as shown below:

PICO Analysis

- **P**opulation – People affected with Alexithymia
- **I**ntervention/ **I**nterest- Alexithymia assessed by Toronto Alexithymia Scale (TAS)questionnaire
- **C**omparison- General population
- **O**utcome- Oral health status among alexithymic individuals [assessment of Glossodynia by General Health Questionnaire (GHQ), Burning mouth syndrome by Visual Analogue Scale (VAS), TMJ disorders by Facially expressed emotion labelling (FEEL) test, Periodontitis by Clinical attachment level (CAL)].

Based on the inclusion criteria studies that assessed the oral health status of patients affected with alexithymia assessed using TAS/TAS-20/TAS-26 questionnaires formed the study interest. Studies that enrolled individuals above 16 years, which assessed influence of alexithymia on oral health as their primary and secondary objective were included. Studies done from the time of introduction of TAS questionnaire (1994) were only included, which included case control, cohort, cross-sectional study design. All the articles published in English language in the last 23 years from 1995 to 2018 were included.

Exclusion criteria included studies which assessed the effect of alexithymia on general health. Further studies which had participants taking medicines for systemic illness or conditions were excluded. Publications with no abstract and those which were widely out of scope of the study were eliminated. Studies that required translation to English language were excluded.

The studies were sorted on basis of their title and abstract. Finally, those studies in which the abstract fulfilled all inclusion criteria were selected for full-text reading. In those articles in which the study met the eligibility criteria but the information in the abstract was insufficient, full texts of the articles were also obtained. Further literature search was performed based on the bibliography of the selected articles.

Search strategy

Relevant studies were included from the period of January 1995 to February 2018 via MEDLINE (PUBMED), COCHRANE and GOOGLE SCHOLAR. A detailed search strategy was developed for MEDLINE through the use of MeSH terms and was revised for Google Scholar and Cochrane. The first set of terms include 'influence of alexithymia', 'oral health' separated by Boolean operator AND. The second set included the term 'impact', 'influence' separated by Boolean operator "OR" 'and the third set included the term 'oral health', 'dental health','orodental','caries', 'periodontitis', 'gingivitis', 'decay', 'caries', 'quality of life', 'TMJ' separated by Boolean operator OR .

Table 1 depicts the search applied in terms of MeSH terms and search words for each database.

Data searches were done at September 2018 and again at March 2019. Hand searches of reference lists of included studies were conducted to ensure additional relevant references were identified. Where multiple publications reporting on the same study existed in different databases, data from the study were extracted and reviewed only once. Duplication of article was identified using Mendeley software(1.19/2018). Finally 11 articles were selected for data extraction.

Study selection

Study selection was conducted by two authors who independently screened titles and abstracts against the inclusion/ exclusion criteria and identified relevant papers. Then the same two authors independently reviewed the full text studies unable to be excluded by title and abstract alone. Comparison of papers was completed between the two authors with no disagreements regarding inclusion.

Data extraction

The data extraction from final 11 articles was done using a data extraction form. It included the first author name, year of publication of the article, objectives of the study, study design, study population, sampling method, inclusion and exclusion criteria, method of obtaining relevant information (Assessment Tool), type of analyses and results (Table 2).

Quality assessment of the included studies

Eleven articles were included in the final analysis of which 7 were case-control studies, 2 cohort studies and 2 descriptive cross sectional studies respectively. Articles included in data extraction were further assessed for quality using Newcastle-Ottawa Quality Assessment Scale(NOS) for case-control and cohort studies and the modified Newcastle-Ottawa scale for descriptive cross-sectional studies.

Among the 7 case-control studies assessed by NOS scale, 2 studies [7,8] was of high quality (score >7) and the remaining 5 studies[5,9,10,11,12] was of moderate quality (score 5-7). Each of the 2 cohort studies[13,14] had a score of 3 according to NOS scale indicating low quality studies (score <5). Both descriptive cross-sectional studies[6,15] had a high quality (>7) according to modified NOS scale.

Table 3 shows the quality assessment of the 7 case-control studies, 2 cohort studies and 2 descriptive cross-sectional studies taken for analysis.

Results

Search results

The search generated a total of 175 articles from three different electronic bases: PUBMED , COCHRANE and GOOGLE SCHOLAR. PUBMED produced 64 articles, COCHRANE produced 1 article and Google Scholar produced 110 articles.

Figure 1 shows the search strategy according to PRISMA guidelines

After reading the title, 13 articles were obtained for further review. On basis of inclusion and exclusion criteria 11 articles were included in this systematic review. Among those 2 articles excluded, one article had not used TAS questionnaire to assess alexithymia. Full text of one article was not available on search. Bibliographical search of the selected articles yielded no eligible study for inclusion.

Main findings

All the included studies reported alexithymic traits among subjects with Burning Mouth syndrome, periodontitis, temporomandibular disorders, glossodynia and poor oral health related quality of life (OHRQL).

Assessment tool

All the 11 studies utilized TAS questionnaire to assess alexithymia. The 20-item Toronto Alexithymia Scale (TAS) is a reliable instrument consisting of three subscales assessing alexithymia: subscale (I) assessing the difficulty in identifying feelings; subscale(II) assessing the difficulty in describing feelings; subscale (III) assessing externally oriented thinking and the lack of introspective capacities. A total score of 61 and above indicates an alexithymic state. Scores between 51 and 60 indicate a condition of borderline alexithymia.[5]

In each study TAS was applied along with different questionnaires to assess different oral health conditions. In one study, TAS was applied along with Visual Analogue Scale-VAS [which assesses the patient's health state subjectively using a scale ranging from 0 to 10 with 0 being the worst possible state of health and 10 better] to assess Burning Mouth Syndrome [BMS][13] and with Oral Health Impact Profile [OHIP-14] to assess Oral Health Related Quality of Life [OHRQL][6]. It was used with Facially Expressed Emotion Labelling [FEEL] test as test instrument for Facial Emotion Recognition [FER] which is an applicable tool to detect impairments in emotional processing in patients with Temporomandibular Disorder [TMD][8] and with Experience Sampling Methodology [ESM] to assess pain severity among people with painful TMD[7]. Along with Symptom Checklist [SCL-90-R], it was used as Research Diagnostic Criteria for Temporomandibular Disorders to assess signs of TMD and Research Diagnostic Criteria for Temporomandibular Disorders Questionnaire [RDC-TMD][11].

Alexithymia and oral health conditions

Burning mouth syndrome

A case-control study reported that the TAS-20 score of the BMS group revealed a significantly higher average score and higher prevalence of alexithymic traits. The pain intensity [VAS score] was not related to the TAS-20 score[9]. A cross-sectional study, reported mean VAS for pain as 132mm [range 10-200mm] and for general well-being as 135 [range 53-200]. Fourteen patients were registered with manifestation of alexithymic traits (>73). Two exceeded the cut-off score for non-alexithymic individuals (≤62) and were registered with latent alexithymic traits. The study demonstrated no correlation between alexithymic traits in pain and well-being[13].

Glossodynia

Patients with glossodynia scored significantly higher on the TAS than the healthy control subjects[10].

Periodontitis

Statistically significant relationship was present between the participant's Clinical Attachment Level(CAL) and their TAS- 20 total score. There were no significant association between the total TAS- 20 and factor scores and age, probing depth, periodontal index, and bleeding on probing[12]. With regard to the correlation between periodontal status and alexithymia, it was demonstrated that 55.2% of depression subjects with alexithymia presented a poor plaque index score versus 12.5% of depression subjects without alexithymia and 15.4% of depression subjects with borderline alexithymia. A significant difference was also found when considering periodontal index, only 17.2% of depression subjects with alexithymia presented an excellent periodontal index, versus 53.8% of depression subjects with borderline alexithymia and 37.5% of depression subjects without alexithymia[5].

Temporo-mandibular disorders (TMD)

Patients with temporo-mandibular disorders rated themselves as significantly more alexithymic than did the healthy controls using the TAS-26. Analyses of the three factors of the TAS-26 revealed that the patients had significantly more difficulty 'identifying feelings'. The results of the TAS (I) subscale were highly significant versus controls. However, the TAS (II) subscale ('describing feelings') did not show significant differences between the groups versus controls. Likewise, the TAS (III) subscale ('externally oriented thinking') was not different between patients and controls versus controls[8].

The result of a study comparing 49 painful TMD participants with 52 pain-free controls on alexithymia showed that the two groups did not differ on TAS-20 total, but differed in opposite directions on two facets; DIF (Difficulty Identifying Feelings) was significantly higher, but EOT (Externally Oriented Thinking) was significantly lower, in the painful TMD group than controls. The group difference in DIF was completely eliminated, but the painful TMD group continued to have lower EOT scores than controls. TAS-20 scores were correlated with jaw pain severity on 43 participants with painful TMD. The TAS-20 total, DIF, and EOT correlated positively with pain severity[7].

TMD-related symptoms was associated significantly with alexithymia. Alexithymia was also significantly more prevalent among those who reported having tender teeth ($p<0.01$). According to logistic regression, the probability of alexithymia was significantly positively associated with pain symptoms ($p<0.05$) and painless TMD-related symptoms ($p<0.01$)[11].

Alexithymia was moderately to strongly associated with temporomandibular joint pain, frequency and severity of facial pain. TAS- 20 scores ≥52 points occurred in 187 subjects (12.5%), TAS- 20 scores ≥61 points or alexithymia occurred in 37 subjects (2.5%)[15].

Significantly greater difficulty in speaking was present in alexithymic patients than in other patients[14].

Oral health related quality of life (OHRQL)

Higher DMF index, higher TAS-20 score, as well as higher DIF (Difficulty Identifying Feelings), DDF (Difficulty Differentiating Feelings) and EOT (External Oriented Thinking) scores had statistically significant association with poorer OHRQoL measured by all dichotomous OHIP-14 variables. The associations between all OHIP-14 variables and all alexithymia variables were statistically significant in unadjusted analyses. In adjusted analyses, all associations remained significant ($p< 0.001$) for TAS- 20, DIF, and DDF, whereas EOT was not significantly associated with any dimension. According to the Poisson regression analyses, all standardized alexithymia variables were statistically significantly ($p< 0.001$) associated with the continuous

OHIP-14 score. In unadjusted analysis, the incidence rate ratio (IRR unadjusted) for the TAS-20 score was 1.49 (95% CI, 1.47–1.51), and in adjusted analysis, the incidence rate ratio (IRR adjusted) for the TAS-20 score was 1.32 (95%CI, 1.30–1.35)[6].

Discussion

Several possible explanations have been suggested for the elevation of alexithymia in patients with various health problems. One hypothesis has related alexithymia to the avoidance of the regulation of negative emotions, resulting in increased negative affect, elevated resting sympathetic arousal, and immune impairments, all of which may contribute to the development or exacerbation of somatic disease. Another hypothesis proposed that alexithymia may lead to somatic diseases as a result of behavioral, maladaptive strategies, and unhealthy actions[12]. According to this suggestion, alexithymia may prompt people to engage in behaviors that have a potentially adverse effect on health, such as failing to seek prompt medical assistance when necessary. For all the above reasons, alexithymia may represent a general risk factor for somatic diseases. Alexithymia may contribute to the progression of periodontal disease via psychological, immunological, or behavioral mechanisms, or a combination of these mechanisms. As the development of periodontal disease is related to psychological conditions that alter the host's resistance to periodontopathic bacteria, immune impairment associated with alexithymic features may negatively affect the host's response to periodontal diseases. Alexithymia may increase behaviors that promote periodontal disease, for example, by neglecting oral hygiene or dental care. In addition, the characteristics of alexithymia may lead to a delay between the onset of symptoms and clinical consultation for periodontal diseases and the delay in the treatment of early periodontal lesions may result in disease progression. The features of alexithymia can also worsen the dentist-patient relationship[12]. Scientific evidence also proves there is a significant association between alexithymia and glossodynia[10], temporomandibular disorders[11] and burning mouth syndrome[13].

In the present review, the search based on PRISMA guidelines narrowed down on a set of 7 case-control studies, 2 cohort studies, and 2 descriptive cross sectional studies which suggested the effect of alexithymia on oral health.

Studies have quoted poor oral health status among alexithymic individuals. The reason could be due to a variety of factors influencing in this trait. One publication has associated alexithymia with somatization. Patients with temporomandibular disorders who had possible proximity with somatoform disorders rated themselves as significantly more alexithymic than did the healthy controls using the TAS-26[8].

Alexithymic people may be inclined to report poorer OHRQoL which could lead to the avoidance of oral health services. It was stated that if a person is not able to describe his or her feelings (Difficulty Describing Feelings-DDF), the only way to express emotional distress may be to describe poorer physical and functional states. It is possible that poorer OHRQoL may be associated with difficulties in emotional processing rather than explicitly with objective oral health problems[6].

All the 11 studies assessed different oral health disturbances due to alexithymia. Glossodynia patients were more alexithymic than controls[10], whereas a study reported that a majority of burning mouth syndrome (BMS) patients included were rated as alexithymic and confirmed earlier reports on BMS being associated with anxiety and depression[13]. The results were comparable to the study which confirmed a significant link between BMS with occurrence of alexithymic traits of 79.3% in

BMS subjects compared to 6.9% of controls[9].

In this systematic review, 5 studies reported association between alexithymia and temporomandibular disorders. Alexithymia and depressive mood were positively associated with several pain symptoms and painless TMD-related symptoms[11]. Alexithymia may help explain variations in pain severity among those with TMD[7]. Patients with temporomandibular disorders rated themselves as significantly more alexithymic than did the healthy controls[8].

One might speculate that because painful TMD is a focal pain disorder that is literally “in one’s head”, people with painful TMD become less externally focused and instead, attend more internally which is consistent with a study of TAS-20 scores in patients with another focal disorder (migraine headaches) compared to people with systemic, “bodily” pain disorders of rheumatoid arthritis or systemic lupus[7]. Another explanation could be that affect regulation failure, characterising alexithymia, is linked with chronic pain. Empirical studies have confirmed that psychological factors – that is, emotional dysregulation – play an important role in the presence of pain in patients with TMD[14].

Studies reported correlation and association between alexithymia and poor periodontal health respectively[5,12]

Limitation

The articles included in this review were different in terms of study design and methods used to assess alexithymia and oral health had high level of heterogeneity. The authors of the included articles have used different scales such as Visual Analogue Scale (VAS) for burning mouth syndrome (BMS), Experience Sampling Methodology (ESM), Facially Expressed Emotion Labelling (FEEL) test, Guidelines by the Academy of Orofacial Pain for Temporomandibular disorders (TMD), Oral Health Impact Profile-14 (OHIP-14) for Oral Health Related Quality of Life (OHRQoL), Plaque Index (PI), Clinical Attachment Level (CAL), Bleeding On Probing (BOP) for periodontitis.

The effect of confounders on the relationship between alexithymia and oral health have been controlled with regression analysis only in five out of eleven studies[6,8,11,14,15]. Alexithymia variables were significantly ($p<0.001$)associated with the continuous OHIP-14 score[6]. TAS-26 score had a significant influence on the Facially Expressed Emotion Labelling (FEEL) scores[8]. Difficulty Identifying Feeling (DIF) was associated with pain, frequency and severity of facial pain and Externally Oriented Thinking(EOT) was the strongest alexithymia exposure for migraine but associations between Difficulty Describing Feeling (DDF) and pain were uncertain[15]. Physical symptom variable was associated significantly with alexithymia[11]. In a study, when pain was the dependent variable, alexithymia and age were both significant[14]. The remaining studies have not accounted for the effect of confounders. Overall, different studies have confirmed that there is a significant relationship between alexithymia and oral health.

Although the validity of the TAS scale for alexithymia have been shown to be good, one limitation in the present study was that all the alexithymia assessments were self-reports. It may not be possible to make psychiatric diagnostic assessments using questionnaires alone.

Another limitation of this review were the few numbers of articles available associating these issues and the lack of studies about alexithymia itself. This situation points to the need for new studies that seek to understand alexithymia and existing associations and phenomena between it and oral health, in larger series. A better understanding of these two conditions may increase the possibility of diagnosis, leading to more effective approach and appropriate intervention with consequent

improved life quality.

Conclusion

The results of this review showed that subjects with alexithymia had higher levels of oral disturbances when compared to non-alexithymic individuals, indicating a higher level of morbidity among those patients.

The recognition of alexithymia among dental patients is important, as it can worsen the dentist-patient relationship, especially among dentally anxious patients. In the future, works including actual effect of alexithymia on oral conditions could improve our further understanding of these relationships. Also, it seems necessary to revise dental health services in favour of the alexithymic individuals.

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Legends Figure and Tables

Table 1: The search applied in terms of MeSH terms and search words for each database.

Database	Search pattern
PubMed	(((influence[All Fields] OR ((impact[All Fields] AND ("alexithymia" [Text word] AND ("oral health"[MeSH Term] OR "oral"[Text word] AND "health"[MeSH Term]))) OR ("dental health"[Text word] OR (("dental"[Text word] AND "health"[MeSH Term)) OR ("orodental" [All Fields]))))
Cochrane	*ID Search* *#1 MeSH descriptor: alexithymia* *#2 influence* *#3 impact* *#4 MeSH descriptor: oral health* *#5 dental health* *#6 #1 and #2 or #3* *#7 #4 or #5* *#8 #5 and #6 and #7*
Google Scholar	(influence OR impact of "alexithymia" on Oral health OR Dental health)

Table 2: The data extraction from final 11 articles.

Author -year	Title	Aim	Study design &Subjects &Sampling method	Inclusion and exclusion criteria	Assessment tool	Result
Miyaoka et al., 1995	A Psychiatric Appraisal of "Glossodynia"	To obtain a psychiatric profile of female patients with "Glossodynia "	Case-control Cases-50 female outpatients, Keio university hospital, Tokyo Controls-24female employees of a single	Inclusion Age-36-73yrs *Pain or burning sensation on surface of tongue, *Absence of local or systemic diseases *No administration of any drugs more than 4weeks before first	Eysenck Personality Questionnaire(EPQ), General Health Questionnaire(GHQ), Toronto Alexithymia Scale(TAS)	The mean EPQ neuroticism score of the patients tended to be higher and that their extraversion score was lower

			company	attendance.		than those of the control subjects. No significant difference in the mean GHQ score between patients and the controls. Patients were more alexithymia than controls
Jerlang, 1997	Burning mouth syndrome(BMS)and the concept of alexithymia - a preliminary study	To examine the occurrence of alexithymic traits in a group of BMS subjects	Cohort 20 women registered as BMS subjects.	Inclusion Age-54-72yrs Exclusion *malignant disease *chronic pain other than BMS *severe physical handicap *severe drug/alcohol abuse/severe dementia/hearing problems	Beck's depression inventory, Spielberger's state-trait anxiety scale , Toronto alexithymia scale (TAS-26), Pain intensity-VAS score Interviewer blinded	Majority of patients included are rated as alexithymic and confirm earlier reports on BMS being associated with anxiety

						and depression .
Ahlberg et al., 2004	Associations of perceived pain and painless TMD-related symptoms with alexithymia and depressive mood in media personnel with or without irregular shift work	To analyse whether previously emerged pain symptoms and painless temporomandibular disorder(TMD) symptoms are associated with alexithymia and self-rated depression among media personnel in or not in irregular shift work.	Case-control Cases- employees in irregular shift(n=750) . Controls- Randomly selected controls in regular 8-h daytime work(n=750).	Inclusion Age-42-45	Toronto Alexithymia Scale(TAS-20), Symptom Checklist(SCL-90-R)	Both alexithymia and depressive mood were positively associated with several pain symptoms and painless TMD-related symptoms in non-patient working personnel.
Glaros & Lumley, 2005	Alexithymia and pain in temporomandibular disorder	To clarify the relationship of global alexithymia and its facets with pain, assesses prospectively using experience sampling methods(ESMs	Case-control Cases- People with painful TMD(n=49), Control1- Pain-free somatic controls(n=24), Control2-	Inclusion Age-39-40yrs People diagnosed with TMD Exclusion *Evidence of osteoarthritis / osteoarthrosis of the TMJ. *History of major trauma to the	Toronto Alexithymia Scale(TAS-20), Depression subscale SCL-90, Pain severity -ESM - 0-10	Alexithymia may help explain variations in pain severity among those with TMD, but other

		),in temporomandibular disorders.	Healthy controls(n=28)	head/neck *Current use of intraoral appliance *Active orthodontic treatment *Daily use of any analgesic, antidepressant ,muscle relaxant *Any chronic pain condition other than TMD		factors are probably more important.
Mattila et al., 2012	Difficulties in emotional regulation: association with poorer oral health-related quality of life in the general population	To investigate the association between alexithymia and OHRQoL.	Cross-sectional Two stage stratified cluster sample. n=8028	Inclusion Age->30yrs	Oral Health Impact Profile(OHIP-14), Toronto Alexithymia Scale(TAS-20)	Study suggest that alexithymic people may be inclined to report poorer OHRQoL than non-alexithymic people with similar dental health conditions
Haas et al., 2013	Alexithymic and somatisation scores in	Study suggest dysfunctional emotional	Case-control Cases-20 patients with	Inclusion Age-18-65yrs Patients who	Facially Expressed Emotion Labelling(FEEL) test,	Study points to a possible

	patients with temporomandibular pain disorder correlate with deficits in facial emotion recognition	processing as a key factor in the aetiology of temporomandibular disorder(TMD)	TMD were recruited in consecutive order Controls-Healthy controls(30euro paid)	experienced pain in the TMD region for at least 6months Exclusion Medical disorders, mental illness.	Toronto Alexithymia Scale (TAS-26), Screening for Somatoform Symptoms(SOMS-2a),German Pain Questionnaire ,Hamilton Depression Rating Scale (HAMD-21)	proximity between TMD and somatoform disorders.
Mingarelli et al., 2013	Alexithymia partly predicts pain, poor health and social difficulties in patients with temporomandibular disorders	To evaluate whether alexithymia and its components are associated to pain severity in patients with TMD.	Cohort 132 patients diagnosed with TMD.	Inclusion Age-39-53yrs *Diagnosed with TMD Exclusion *TMJ disorders due to accidents, pre-surgical treatments or any chronic pain conditions other than TMD.	Toronto Alexithymia Scale(TAS-20), Pain scale 0-10	Study confirms association between alexithymia and pain, considering alexithymia as an independent variable.
Luca et al., 2014	Nothing to smile about	Primary-To evaluate the impact of depression and alexithymia on periodontal status Secondary-To investigate the possible impact of personality disorders on	Case-control Cases-50 depression patients referred to psychiatry unit, Sicily, Italy. Controls-40 Healthy individuals from general	Inclusion-Age-56-72yrs Exclusion-Individuals suffering from cancer and acquired or congenital maxillofacial pathologies	The Hamilton Rating Scale for Depression (HRSD),The Hamilton Rating Scale for Anxiety(HRSA), Toronto Alexithymia Scale(TAS), The oral health impact profile(OHIP-14)	Study demonstrated a correlation between psychiatric variables and poor periodontal health.

		dental status	population			
Sezer et al., 2015	Relationship between Alexithymia and Chronic Periodontitis	To investigate the potential relationship between alexithymia and chronic periodontitis in adult subjects	Case-control Cases-114 chronic periodontitis patients. Controls-108 participants with no history of periodontitis Convenience sample	Inclusion-Age-21-63yrs Exclusion-*Acute Necrotizing Ulcerative Gingivitis, *Systemic/Psychiatric disorder *Medicines related to periodontal alterations or psycho-trophic drugs, *Pregnant, *Periodontal therapy in last 6 months, *<18 Teeth	Toronto Alexithymia Scale (TAS-20), Plaque index (PI),Probing pocket depth(PD),Clinical Attachment Level(CAL),Bleeding On Probing(BOP).	The study points to an association between alexithymia and periodontal disease.
Marino et al., 2015	Peculiar alexithymic traits in burning mouth syndrome :case-control study	To assess the occurrence of alexithymic traits in BMS subjects and to correlate alexithymic traits to anxious and depressive traits in BMS subjects	Case-control Cases-58 BMS subjects Controls-Healthy controls Recruiters unaware of hypothesis	Inclusion Age-50-75yrs *isolated complaint of chronic burning/pain in oral mucosa Exclusion *Subjects with diabetes not under pharmacological control *Local effect of	Visual Analogue Scale(VAS), Toronto Alexithymic Scale(TAS-26), Hamilton Anxiety Rating Scale(HARS), Montgomery and Asberg Depression Rating Scale(MADRS)	Study confirms a significant link between BMS and the occurrence of alexithymic traits.

				dental material		
Kindler et al., 2018	Alexithymia and temporo-mandibular joint and facial pain in the general population	To investigate the associations of alexithymia and its subfactors with signs of TMD and with facial pain, head pain and migraine in the general population.	Cross-sectional 1494 participants	Inclusion Age-20-79 yrs.	Toronto Alexithymic Scale(TAS-20), Post-Traumatic Stress Disorder(PTSD),Structured Clinical Interview for DSM-4(SCID),Mini-mental statement examination, International Diagnostic Screener(CID-S)	Alexithymia was moderately to strongly associated with signs and symptoms of TMD.

Table 3:The quality assessment of the 7 case-control studies, 2 cohort studies and 2 descriptive cross-sectional studies taken for analysis.

New castle ottawa scale for case-control studies								
	Study	Miyaoka et al., 1995	Ahlberg et al., 2004	Glaros & Lumley, 2005	Haas et al., 2013	Luca et al., 2014	Sezer et al., 2015	Marino et al., 2015
Selection	Is the case definition adequate?	0	0	1	1	0	1	1
	Representativeness of the cases	0	0	1	1	0	1	1
	Selection of Controls	1	1	1	1	1	0	0
	Definition of Controls	1	1	1	1	1	1	0
Comparability	Comparability of cases and controls on the basis of the design or analysis	1	1	2	2	1	1	2

Exposure	Ascertainment of exposure	1	1	1	1	1	1	0
	Same method of ascertainment for cases and controls	1	1	1	1	1	1	1
	Non-Response rate	0	0	0	0	0	0	0
New castle ottawa scale for cohort studies								
		Jerlang, 1997	Mingarelli et al., 2013					
Selection	Representativeness of the exposed cohort	1	1					
	Selection of the non-exposed cohort	0	0					
	Ascertainment of exposure	1	1					
	Demonstration that outcome of interest was not present at start of study	0	0					
Outcome	Assessment of outcome	1	1					
	Was follow-up long enough for outcomes to occur	0	0					
	Adequacy of follow up of cohorts	0	0					
Modified new castle ottawa scale for cross-sectional studies								
		Mattila et al., 2012	Kindler et al., 2018					
Selection& exposure	Sample representation	1	1					
	Sample size	1	1					
	Ascertainment of exposure	1	1					
	Non-respondents	1	1					
Outcome	Assessment of outcome	2	2					

	Statistical test	1	1					

Figure 1: The search strategy according to PRISMA guidelines