Oral Diseases

COUNTRY

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Media Ranking in United Kingdom

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Dentistry (miscellaneous)

Medicine
Otorhinolaryngology

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SJR 2024

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INFORMATION

Homepage

How to publish in this journal

giovanni.lodi@unimi.it

SCOPE

Oral Diseases is a multidisciplinary and international journal with a focus on head and neck disorders, edited by leaders in the field, Professor Giovanni Lodi (Editor-in-Chief, Milan, Italy), Professor Stefano Petti (Deputy Editor, Rome, Italy) and Associate Professor Gulshan Sunavala-Dossabhoy (Deputy Editor, Shreveport, LA, USA). The journal is pre-eminent in oral medicine. Oral Diseases specifically strives to link often-isolated areas of dentistry and medicine through broad-based scholarship that includes well-designed and controlled clinical research, analytical epidemiology, and the translation of basic science in pre-clinical studies. The journal typically publishes articles relevant to many related medical specialties including especially dermatology, gastroenterology, hematology, immunology, infectious diseases, neuropsychiatry, oncology and otolaryngology. The essential requirement is that all submitted research is hypothesis-driven, with significant positive and negative results both welcomed. Equal publication emphasis is placed on etiology, pathogenesis, diagnosis, prevention and treatment.

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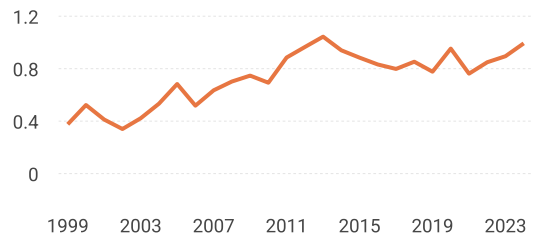

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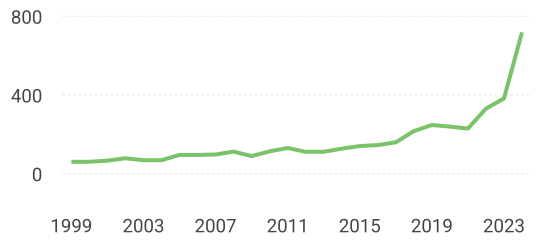

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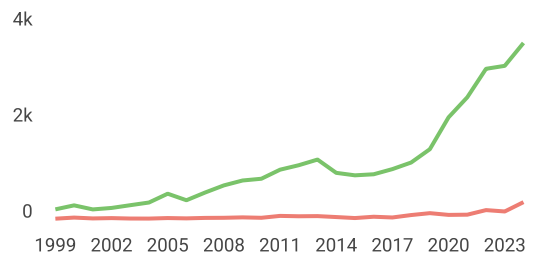

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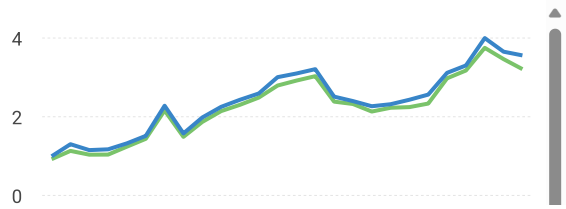

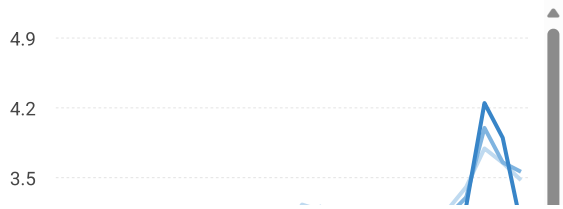

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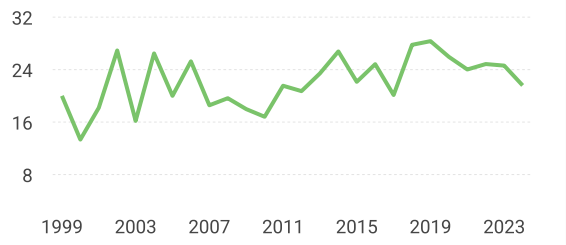

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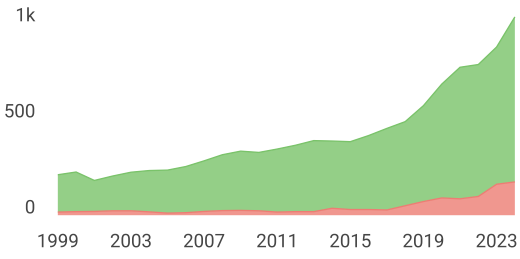

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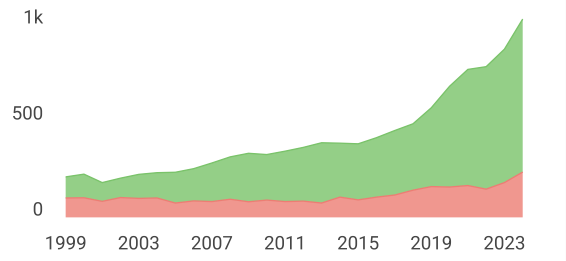

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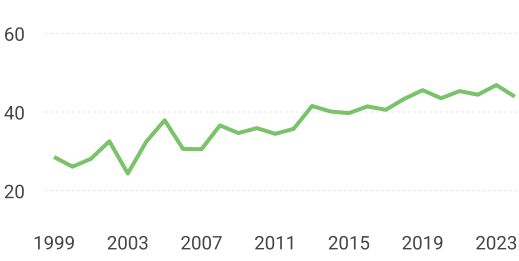

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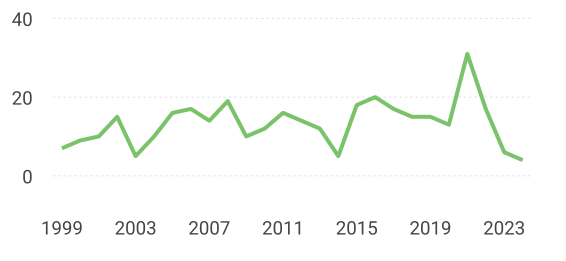

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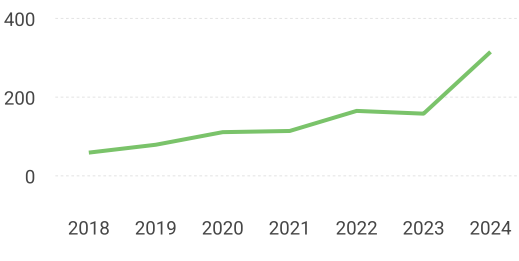

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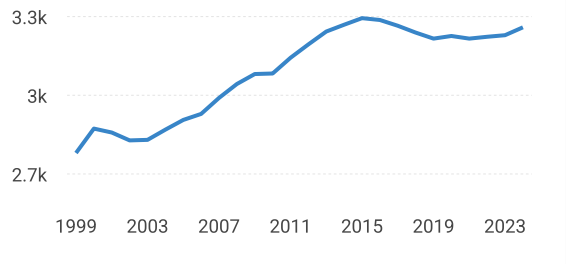

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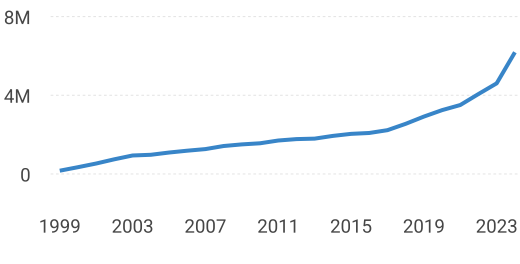

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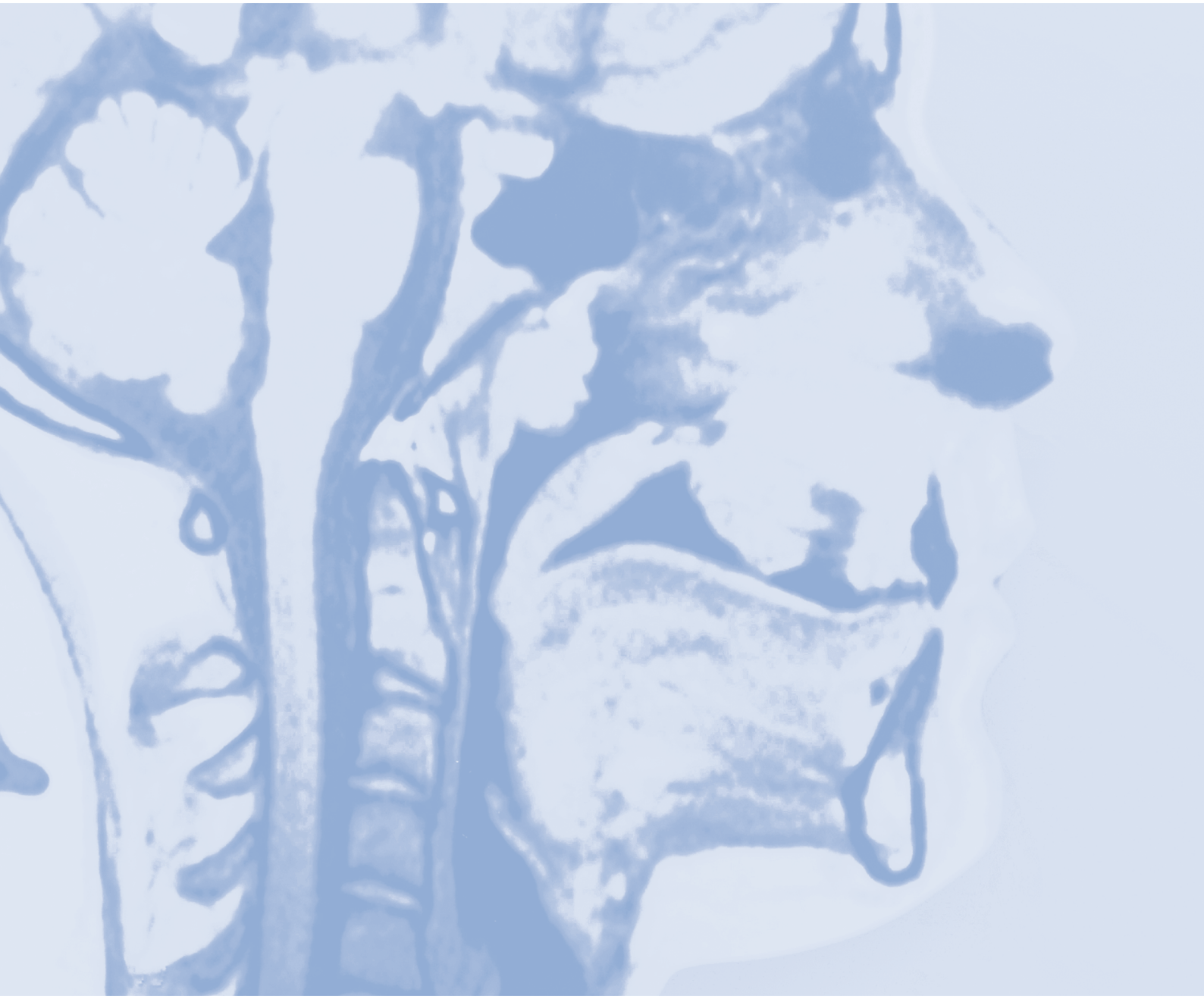

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- Drafting the paper or revising it critically
- Approval of the submitted and final versions

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ORAL DISEASES

Contents

Volume 29 · Number 7 · October 2023

Continues

ISSN: 1354-523X

Continued

Volume 29, Issue 7

Pages: 2463-2984
October 2023

‹ Previous Issue | Next Issue ›

GO TO SECTION

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First Page | PDF | Request permissions

CLINICAL IMAGE

A woman with a non-healing ulcer on the lateral border of the tongue

Andrea Gabusi, Federica Filippi, Cosimo Misciali, Lidia Sacchelli, Camilla Loi, Davide Bartolomeo Gissi, Roberto Rossi, Federico Bardazzi

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REVIEWS

Potential applications of medicinal herbs and phytochemicals in oral and dental health: Status quo and future perspectives

Elaheh Dalir Abdolahinia, Samira Hajisadeghi, Zahra Moayedi Banan, Esmaeel Dadgar, Amin Delaramifar, Sepideh Izadian, Simin Sharifi, Solmaz Maleki Dizaj

Pages: 2468-2482 | First Published: 14 June 2022

Abstract | Full text | PDF | References | Request permissions

Oral and maxillofacial tuberculosis: A systematic review

Amanda de Farias Gabriel, Laura Borges Kirschnick, Bruna Barcelos Só, Lauren Frenzel Schuch, Felipe Martins Silveira, Marco Antonio Trevizani Martins, Vivian Petersen Wagner, Márcio Ajudarte Lopes, Manoela Domingues Martins

Pages: 2483-2492 | First Published: 04 July 2022

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

Synchronous odontogenic tumors: A systematic review

Bruna Luísa Neumann, Bruna Barcelos Só, Lucas Gonçalves Santos, Felipe Martins Silveira, Vivian Petersen Wagner, Pablo Agustin Vargas, Jean Nunes dos Santos, Adalberto Mosqueda-Taylor, Felipe Paiva Fonseca, Lauren Frenzel Schuch, Manoela Domingues Martins

Pages: 2493-2500 | First Published: 11 October 2022

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

Antibiotic resistance in periodontitis patients: A systematic scoping review of randomized clinical trials

Carlos-M. Ardila, Jader-Alexander Bedoya-García, Daniel-Esteban Arrubla-Escobar

Pages: 2501-2511 | First Published: 23 June 2022

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Periodontitis severity relationship with metabolic syndrome: A systematic review with meta-analysis

Heloísa Laís Rosário-dos-Santos, Samilly Silva Miranda, Isaac Suzart Gomes-Filho, Simone Seixas da Cruz, Ana Claudia Morais Godoy Figueiredo, Elivan Silva Souza, Alexandre Marcelo Hintz, Peter Michael Loomer, Johelle de Santana Passos-Soares

Pages: 2512-2520 | First Published: 08 November 2022

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

Temporomandibular joint osteoarthritis: A review of animal models induced by surgical interventions

Jiahao Zhou, Rong Ren, Zhen Li, Songsong Zhu, Nan Jiang

Pages: 2521-2528 | First Published: 25 May 2022

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

Epigenetic regulation of osteogenic differentiation of periodontal ligament stem cells in periodontitis

Jingwei Cao, Qiong Zhang, Qiyuan Yang, Yue Yu, Mingmei Meng, Jing Zou

Pages: 2529-2537 | First Published: 29 December 2022

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Association of anxiety and depression with oral mucositis: A systematic review

José Alcides Almeida de Arruda, Fernanda Vieira Heimlich, Victor Zanetti Drumond, Lauren Frenzel Schuch, Manoela Domingues Martins, Lucas Guimarães Abreu, Antonio Lucio Teixeira, Ricardo Alves Mesquita, Tarcília Aparecida Silva

Pages: 2538-2551 | First Published: 22 August 2022

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The homeostasis and therapeutic applications of innate and adaptive immune cells in periodontitis

Li Junxian, Mojtaba Mehrabanian, Hassan Mivehchi, Morteza Banakar, Enas Abdalla Etajuri

Pages: 2552-2564 | First Published: 25 August 2022

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Research progress of odontogenic extracellular vesicles in regeneration of dental pulp

Yanan Li, Chaoran Liu, Guanghong Han

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Caries, periodontitis and tooth loss after haematopoietic stem cell transplantation: A systematic review

Lucky L. A. van Gennip, Marjolein S. Bulthuis, Nicole M. A. Blijlevens, Marie-Charlotte D. N. J. M. Huysmans, Stephanie J. M. van Leeuwen, Renske Z. Thomas

Pages: 2578-2591 | First Published: 25 August 2022

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Association between axial spondyloarthritis and temporomandibular disorders: A systematic review

Elma Mariana Verçosa de Melo-Silva, Remberto Argandoña Valdez, Izabella Maria da Barbosa-Silva, Marina Moura Chateaubriand, Angela Luzia Branco Pinto Duarte, Luiz Alcino Gueiros

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Salivary biomarkers in burning mouth syndrome: A systematic review and meta-analysis

María Fernández-Agra, José González-Serrano, Miguel de Pedro, Leire Virto, Vito Carlo Alberto Caponio, Elena Ibáñez-Prieto, Gonzalo Hernández, Rosa María López-Pintor

Pages: 2600-2613 | First Published: 22 September 2022

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

Diagnostic delay in autoimmune oral diseases

Massimo Petruzzi, Fedora della Vella, Nicola Squicciarini, Davide Lilli, Guglielmo Campus, Giuseppina Piazzolla, Alberta Lucchese, Isaac van der Waal

Pages: 2614-2623 | First Published: 24 December 2022

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

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Oral lichen planus and related lesions. What should we accept based on the available evidence?

Miguel Ángel González-Moles, Pablo Ramos-García

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Oral health in pediatric short bowel syndrome

Francesca Gigola, Chiara Grimaldi, Francesco Cairo, Francisco Cammarata-Scalisi, Maria Chiara Cianci, Riccardo Coletta, Antonino Morabito, Michele Callea

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CANCER AND POTENTIALLY MALIGNANT DISORDERS

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WEE1 kinase inhibitor MK-1775 sensitizes oral tongue squamous cell carcinoma cells to radiation irrespective of TP53 status

Aisha Hussein Al-Jamaei, Jan G. A. M. de Visscher, V. Ramadugula Subramanyam, Tymour Forouzanfar, Peter Sminia, Behrouz Zandieh Doulabi, Marco N. Helder

Pages: 2640-2649 | First Published: 07 June 2022

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

The modified vermilion border-marionette line approach: A management for buccal cancer with wider indications and higher satisfaction

Bo Li, Aoming Cheng, Huan Liu, Hao Wang, Chong Wang, Qiaoshi Xu, Zhengxue Han, Zhien Feng

Pages: 2650-2657 | First Published: 04 August 2022

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Identification of potential biomarkers and survival analysis for oral squamous cell carcinoma: A transcriptomic study

Daniela Paola Santos de Paula Souza, Lorena dos Reis Pereira Queiroz, Marcela Gonçalves de Souza, Sabrina Ferreira de Jesus, Emisael Stênio Batista Gomes, Rogério Trancoso Vitorino, Sérgio Henrique Sousa Santos, Lucyana Conceição Farias, Alfredo Maurício Batista de Paula, Marcos Flávio Silveira Vasconcelos D'Angelo, Carlos Alberto de Carvalho Fraga, André Luiz Sena Guimarães

Pages: 2658-2666 | First Published: 07 July 2022

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

Oral leukoplakia classification and staging system with incorporation of differentiated dysplasia

Elisabeth R. Brouns, Ilkay Evren, Leon J. Wils, Jos B. Poell, Ruud H. Brakenhoff, Elisabeth Bloemena, Jan G. A. M. de Visscher

Pages: 2667-2676 | First Published: 28 June 2022

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

hsa_circ_0000264 promotes tumor progression via the hsa-let-7b-5p/HMGA2 axis in head and neck squamous cell carcinoma

Feifei Xue, Hongjie Feng, Tianxiao Wang, Guanying Feng, Nan Ni, Ruixia Wang, Hua Yuan

Pages: 2677-2688 | First Published: 10 October 2022

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

Importance of the vaporization margin during CO_2 laser treatment of oral leukoplakia: A survival study

Marta Vilar-Villanueva, José Manuel Somoza-Martín, Andrés Blanco-Carrión, Abel García-García, Tamara García-Carnicero, Xabier Marichalar-Mendía, Mercedes Gallas-Torreira, Pilar Gándara-Vila

Pages: 2689-2695 | First Published: 08 August 2022

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SALIVA AND SALIVARY GLAND

Salivary biomarkers to evaluate psychological disorders in oral lichen planus: A systematic review with meta-analysis

Alessandra Laís Pinho Valente Pires, Lísia Daltro Borges Alves, Adriana Mendonça da Silva, Franco Arsati, Ynara Bosco de Oliveira Lima-Arsati, Jean Nunes dos Santos, Rodrigo Tripody Calumby, Valéria Souza Freitas

Pages: 2734-2746 | First Published: 25 September 2022

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

Efficacy of new oral rinse containing sodium hyaluronate in xerostomia: A randomized crossover study

Akane Takemura, Kana Hashimoto, Alex Ho, Michele Bessinger, Sandra Law, Robert E. Schifferle, Sebastian G. Ciancio

Pages: 2747-2755 | First Published: 18 December 2022

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

Prevalence of Sjögren's syndrome in patients with dry mouth in the region of Central Hungary

Anna Júlia Dézsi, Csilla Erdei, Tamás Demeter, Alexandra Kovács, Gábor Nagy, Károly Mensch, Orsolya Németh, Péter Hermann, György Tóth, Ágnes Füst, Emese Virág Kiss, László Kőhidai, Attila Zalatnai, Krisztina Márton

Pages: 2756-2764 | First Published: 25 May 2022

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Ayşe Toraman, Ebru Sağlam, Levent Savran, Mehmet Sağlam, Serhat Köseoğlu

Pages: 2765-2771 | First Published: 02 November 2022

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Initial neutrophil-to-lymphocyte ratio predicts radiation-induced trismus in parotid gland cancer

Efsun Somay, Busra Yilmaz, Erkan Topkan, Ahmet Kucuk, Berrin Pehlivan, Ugur Selek

Pages: 2772-2779 | First Published: 08 November 2022

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BONE AND HARD TISSUES

Correlates between temporomandibular disorder severity, emotional distress, and eudaimonic well-being among young adults

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Andrea Butera, Maurizio Pascadopoli, Matteo Pellegrini, Benedetto Trapani, Simone Gallo, Monica Radu, Andrea Scribante

Pages: 2789-2798 | First Published: 22 September 2022

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Medication-related osteonecrosis of the jaw triggered by endodontic failure in oncologic patients

Angela Tempesta, Saverio Capodiferro, Simona Di Nanna, Silvia D'Agostino, Marco Dolci, Antonio Scarano, Gianluca Gambarini, Eugenio Maiorano, Gianfranco Favia, Luisa Limongelli

Pages: 2799-2805 | First Published: 20 November 2022

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

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Biao Li, Mingyuan Du, Qiao Sun, Zhengguo Cao, Hong He

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Erythropoietin induces odontoblastic differentiation of human-derived pulp stem cells via EphB4-Mediated MAPK signaling pathway

Deao Gu, Hanxiao Liu, Xinyi Qiu, Yijun Yu, Xuna Tang, Chao Liu, Leiying Miao

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KDM4D enhances osteo/dentinogenic differentiation and migration of SCAPs via binding to RPS5

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Correlates between temporomandibular disorder severity, emotional distress, and eudaimonic well-being among young adults

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Abstract

Objectives: This study examined the correlates between severity of temporomandibular disorders (TMDs), emotional distress, and eudaimonic well-being.

Subjects and Methods: TMD severity, negative emotions, and eudaimonia were assessed with the Fonseca Anamnestic Index (FAI), Depression, Anxiety, Stress Scales-21 (DASS-21), and Psychological Well-being Scale-18 (PWBS-18) in a cohort of community young adults. Statistical evaluations were done with non-parametric tests/correlation and multivariate regression analyses ($\alpha = 0.05$).

Results: Amongst the 873 participants (mean age 19.8 ± 1.66 years), 40.7%, 49.0%, and 10.3% had no (NT), mild (MT), and moderate-to-severe (ST) TMD, respectively. Significant differences in total-DASS, depression, anxiety, and stress were ST ≥ MT > NT. Significant variances in total-PWSB and self-acceptance were NT > MT > ST while that for environmental mastery, positive relations, and purpose in life were NT > MT, ST. An inverse relationship was discerned between total-DASS and total-PWBS (correlation coefficient = −0.54). The prospect of ST was increased by anxiety but reduced by positive relations and self-acceptance.

Conclusions: Young adults with mild and moderate-to-severe TMD experienced substantially higher emotional distress and lower eudaimonia than those with no TMD. As emotional distress and eudaimonic well-being are interrelated, positive psychological interventions may be beneficial for managing TMD-related psychosocial disabilities.

KEYWORDS
anxiety, depression, mental health, psychology, temporomandibular disorders

1 | INTRODUCTION

Temporomandibular disorders (TMDs) are a cluster of medical and dental conditions involving the masticatory musculature, temporomandibular joints (TMJs), and contiguous structures. They are the second most common musculoskeletal problem after chronic lower back pain and occur in up to 15% of adults (Schiffman et al., 2014; Gauer & Semidey, 2015). Women have two times odds of suffering from TMDs than men, with a peak incidence between 20 and 40 years of age (Bueno et al., 2018). The features of TMDs encompass facial/periauricular pain, TMJ sounds, and dysfunction, including jaw movement restrictions. The biopsychosocial etiology of TMDs is recognized (Slade et al., 2013), and emotional distress, including depression, anxiety, and stress, are known contributing factors (Fillingim et al., 2013; Cao et al., 2021).

Though the connection between TMDs and psychological/emotional distress is widely reported, their association with psychological well-being is seldom investigated (Marpaung et al., 2021). Psychological well-being can be defined using the hedonic and eudaimonic perspectives. While the hedonic approach concentrates

on "happiness," eudaimonic well-being focuses on the optimal experience, in terms of "meaning and self-realization," as well as the positive functioning of individuals (Ryan & Deci, 2001). Eudaimonia, usually appraised with the Ryff's Psychological Well-being Scales (PWBS; Ryff & Keyes, 1995), had been studied in other musculoskeletal disorders such as rheumatoid arthritis and fibromyalgia (Mangelli et al., 2002; Schleicher et al., 2005). Findings suggested that individuals with high eudaimonic well-being usually have less depression, illness-linked fatigue, and disability.

This study is the first to examine the correlates between TMD severity, emotional distress, and eudaimonic well-being among community young adults. Young or early adulthood embodies the life era with the greatest energy, contradictions, and tension (Levinson, 1986). Additionally, the study also sought to compare the extent of depression, anxiety, stress, and positive psychological functioning in individuals with differing severity of TMDs. TMD severity was assessed with the Fonseca Anamnestic Index (FAI; Fonseca et al., 1994), whilst emotional distress and eudaimonic well-being were appraised with the short-form versions of the Depression, Anxiety, Stress Scales (DASS-21; Antony et al., 1998), and PWBS (PWBS-18; Ryff et al., 2010), respectively. The null hypotheses were (a) no significant differences in emotional distress and eudaimonic well-being are present among individuals with no and varying severity of TMDs, and (b) FAI, total DASS-21, and total PWBS-18 scores are not significantly correlated.

2 | SUBJECTS AND METHODS

2.1 | Study design and participants

This study was endorsed by the Institutional Review Board at the School of Dentistry, Trisakti University (protocol number: 377/S1/KEPK/FKG/8/2020). Young adults, aged ≥18 years old, were enrolled via a convenience sampling procedure from a private University in the capital city. The exclusion criteria included a history of orofacial trauma, debilitating systemic diseases, psychiatric treatment, and cognitive impairments. Applying a Wilcoxon-Mann–Whitney model with a 0.50 effect size, 0.05 alpha error, 95% power, and allocation ratio of 6 derived from an earlier study (Natu et al., 2018), a minimum sample size of 448 was calculated a priori using the G*Power software version 3.1.9.3 (Faul et al., 2007). Participation in the study was voluntary, with no financial or other compensations given. All eligible participants provided informed consent before completing an online questionnaire that comprised demographic information, the FAI, DASS-21, and PWBS-18. The survey was conducted over ten months from Feb 2020 to Nov 2020.

2.2 | Study measures

The presence and severity of TMDs were ascertained with the FAI whose reliability, validity, and accuracy are well established (Berni et al., 2015; Topuz et al., 2020; Kaynak et al., 2020). More recently, it was shown to be highly accurate for establishing the presence of pain-related and/or intra-articular TMDs when evaluated against the Diagnostic Criteria for TMDs (DC/TMD) standard (Yap et al., 2021). Furthermore, the FAI remains one of the few validated TMD measures that quantifies and categorizes TMD severity (Yap et al., 2022). The FAI contains 10-items about pain (headache, neck, masticatory muscle, and TMJ pain) and function-related (TMJ noises, opening, and lateral-movement difficulties) TMD symptoms as well as TMD-associated risk factors (bruxism, malocclusion, and emotional tension). The items are appraised using "no," "sometimes," and "yes" responses that are scored 0, 5, and 10 points correspondingly. Sum scores are calculated, and TMD severity is classified as "no" (0–15 points), "mild" (20–40 points), "moderate" (45–65 points), or "severe" (70–100 points).

The psychometric properties of the DASS-21 are also well researched (Lee et al., 2019). It comprises of 21-items equally distributed amongst the three emotional states. The items are evaluated on a 4-point Likert scale where 0 = "did not apply to me at all" and 3 = "applied to me very much/most of the time." Sum scores are processed for total-DASS (emotional distress) in addition to the depression, anxiety, and stress subscales with higher scores signifying greater symptom gravity. The cut-off points for the various severity groupings (i.e., normal to extremely severe) are specified in the DASS manual (Lovibond and Lovibond, 1995). The PWBS-18 involves 18-items with three items for each of the six subscales. The items are appraised with a 7-point rating scale varying from 1 = "strongly agree" to 7 = "strongly disagree." Sum scores are computed for total-PWBS (eudaimonic well-being) as well as the autonomy, environmental mastery, personal growth, positive relations with others, purpose in life, and self-acceptance subscales. Higher scores indicate greater psychological well-being.

2.3 | Statistical assessment

Statistical assessments were conducted using the SPSS Statistics software Version 24.0 (IBM Corporation) with a significance level of 0.05. Qualitative data were conveyed as frequencies (with percentages) whilst quantitative data were presented as both means (with standard deviations [SD]) and medians (with interquartile ratios [IQR]). The Kolmogorov–Smirnov test was performed to examine data distribution. As DASS-21 and PWBS-18 data were not normally distributed, the Kruskal–Wallis and post-hoc Mann–Whitney U tests were used for comparing scores among the various TMD severity groups. Associations between FAI, total-DASS, and total-PWBS scores were determined utilizing Spearman's rank-order correlation. Correlation coefficients (r_s) were deemed "weak" (0.1–0.3), "moderate" (0.4–0.6), or "strong" (0.7–0.9) based on Dancey and Reid's nomenclature (Dancey and Reid, 2017). Multivariate logistic regression analyses were ultimately conducted to confirm the demographic and psychological predictors for mild and moderate-to-severe TMD. Total-DASS and total-PWBS were omitted from the regression

models to circumvent collinearity and a step-wise selection procedure was employed with a threshold of $p < 0.10$ for removing insignificant variables. Outcomes were computed as odds ratios (ORs) with 95% confidence intervals (95% CIs).

3 | RESULTS

3.1 | Population characteristics

Out of a total of 1028 young adults screened, 128 were excluded, and 27 declined participating in the study giving a response rate of 97.0%. The study population had a mean age of 19.8 ± 1.66 years and 77.9% were women. As the number of participants with severe TMD was small ($n = 7$), the moderate and severe TMD groups were combined into one. Amongst the 873 study participants, 40.7% had no TMD (NT), whereas 49.0% and 10.3% had mild TMD (MT) and moderate-to-severe (ST) TMD. The prevalence of the various TMD symptoms/risk factors for the three TMD severity groups is reflected in Table 1. Headaches (56.5%–80.0%) and TMJ sounds (33.2%–70.0%) were the most frequent pain and function-related TMD symptoms for the MT and ST groups. Emotional tension was the most common TMD risk factor (78.3%–88.9%).

The mean and median DASS-21, as well as PWBS-18 scores, are presented in Tables 2 and 3. Significant differences in total-DASS, anxiety, and stress scores were ST > MT > NT. For the depression subscale, scores between the ST and MT groups were insignificant (i.e., ST, MT > NT). When psychological well-being was compared, significant differences in total-PWBS and self-acceptance were NT > MT > ST. Apart from autonomy and personal growth, the NT group had significantly greater scores than both the MT and ST groups (i.e., NT > MT, ST) for the remaining subscales. While person growth scores were inconsequential, the NT group exhibited significantly higher autonomy scores than the ST group (i.e., NT > ST).

Tables 4 and 5 display the outcomes of Spearman's correlation and multivariate logistic regression analyses. The correlation between FAI and total-DASS scores was positive and near moderate ($r_s = 0.37$) while that between FAI and total-PWBS scores was negative and weak ($r_s = -0.25$). The inverse relationship between total-DASS and total-PWBS was moderately strong ($r_s = -0.54$). Though the female gender (OR = 1.67), anxiety (OR = 1.23), and positive relations (0.92) were associated with MT, the presence of ST was significantly increased by anxiety (OR = 1.65) but reduced by positive relations (OR = 0.82) and self-acceptance (OR = 0.71).

4 | DISCUSSION

4.1 | Overview and measures

The correlates between TMD severity, emotional distress, and eudaimonia were established. As significant differences in emotional distress and eudaimonic well-being were present among young adults with varying TMD severity and correlations among FAI,

TABLE 1 Demographic characteristics and frequency of TMD symptoms/risk factors for the three TMD severity groups

Variables	Total 873 (100%)	No TMD (NT) $n = 355$ (40.7%)	Mild TMD (MT) $n = 428$ (49%)	Moderate-to-severe TMD (ST) $n = 90$ (10.3%)
Gender				
Male, *n* (%)	194 (22.2%)	97 (27.3%)	82 (19.2%)	15 (16.7%)
Female, *n* (%)	679 (77.8%)	258 (72.7%)	346 (80.8%)	75 (83.3%)
Age				
Mean ± SD	19.8 (1.7)	19.8 (2.1)	19.7 (1.3)	20.0 (1.4)
Median (IQR)	20.0 (2.0)	19.0 (2.0)	20.0 (2.0)	20.0 (2.0)
TMD symptoms/risk factors				
Opening difficulty	169 (19.4)	19 (5.6)	106 (24.8)	44 (48.9)
Side-movement difficulty	66 (7.6)	4 (1.1)	37 (8.6)	25 (27.8)
Muscle pain	315 (36.1)	47 (13.2)	200 (46.7)	68 (75.6)
Headache	374 (42.8)	60 (16.9)	242 (56.5)	72 (80.0)
Neck pain	351 (40.2)	45 (12.7)	241 (56.3)	65 (72.2)
TMJ pain	143 (16.4)	0 (0)	92 (21.5)	51 (56.7)
TMJ noises	228 (26.1)	23 (6.5)	142 (33.2)	63 (70.0)
Parafunction	233 (26.7)	45 (12.7)	138 (32.2)	50 (55.6)
Malocclusion	348 (39.9)	59 (16.6)	213 (49.8)	76 (84.4)
Emotional tension	563 (64.5)	148 (41.7)	335 (78.3)	80 (88.9)

Note: Presence of TMD symptom/risk factor = "sometimes" or "yes" response to the respective items.

TABLE 2 Mean and median depression, anxiety, stress Scales-21 (DASS-21) scores for the three TMD severity groups

Variables	No TMD (NT)	Mild TMD (MT)	Moderate-to-severe TMD (ST)	*p*-value	Post-hoc
Total-DASS					ST > MT > NT
Mean ± SD	15.11 ± 8.65	20.85 ± 9.68	25.40 ± 10.90	<0.001	
Median (IQR)	15.00 (11.00)	21.00 (12.00)	23.00 (19.00)		
Depression					ST, MT > NT
Mean ± SD	3.80 ± 3.29	5.20 ± 3.65	5.611 ± 3.70	<0.001	
Median (IQR)	3.00 (4.00)	4.00 (5.00)	4.00 (5.00)		
Anxiety					ST > MT > NT
Mean ± SD	4.94 ± 2.94	7.28 ± 3.50	9.43 ± 4.01	<0.001	
Median (IQR)	5.00 (4.00)	7.00 (5.00)	10.00 (5.25)		
Stress					ST > MT > NT
Mean ± SD	6.38 ± 3.57	8.36 ± 3.99	10.36 ± 4.73	<0.001	
Median (IQR)	6.00 (5.00)	8.00 (5.00)	10.00 (7.00)		

Note: Results of Kruskal–Wallis/post-hoc Mann–Whitney U tests ($p < 0.05$).

TABLE 3 Mean and median psychological well-being Scales-18 (PWBS-18) scores for the three TMD severity groups

Variables	No TMD (NT)	Mild TMD (mt)	Moderate-to-severe TMD (ST)	*p*-value	Post-hoc
Total-PWBS					NT > MT > ST
Mean ± SD	92.25 ± 11.34	88.01 ± 10.86	84.22 ± 10.12	<0.001	
Median (IQR)	94.00 (14.00)	89.00 (14.00)	84.00 (14.50)		
Autonomy					NT > ST
Mean ± SD	13.96 ± 2.62	13.53 ± 2.59	13.10 ± 3.25	0.009	
Median (IQR)	14.00 (3.00)	14.00 (3.00)	13.00 (4.00)		
Environmental mastery					NT > MT, ST
Mean ± SD	14.63 ± 2.74	13.81 ± 2.70	12.94 ± 2.97	<0.001	
Median (IQR)	15.00 (5.00)	14.00 (4.00)	13.00 (4.00)		
Personal growth					—
Mean ± SD	17.76 ± 2.61	17.57 ± 2.36	17.74 ± 2.96	0.223	
Median (IQR)	18.00 (3.00)	18.00 (3.00)	18.00 (4.00)		
Positive relations					NT > MT, ST
Mean ± SD	14.86 ± 2.93	13.71 ± 3.13	12.79 ± 3.06	<0.001	
Median (IQR)	15.00 (4.00)	14.00 (4.00)	14.00 (5.00)		
Purpose in life					NT > MT, ST
Mean ± SD	15.29 ± 2.62	14.84 ± 2.73	14.58 ± 2.63	0.008	
Median (IQR)	16.00 (3.00)	15.00 (4.00)	15.00 (3.00)		
Self-acceptance					NT > MT > ST
Mean ± SD	15.75 ± 2.99	14.55 ± 3.18	13.07 ± 2.82	<0.001	
Median (IQR)	16.00 (4.00)	15.00 (5.00)	13.00 (3.00)		

Note: Results of Kruskal–Wallis/post-hoc Mann–Whitney U tests ($p < 0.05$).

total-DASS, and total-PWBS scores were significant, the two null hypotheses were suitably rejected. Young adults were chosen as they typified the peak incidence of TMDs and the bulk of TMD patients (Gauer & Semidey, 2015; Yap et al., 2021). Both FAI and DASS-21 had been used together in other TMD research (Natu et al., 2018; Gaş et al., 2021). When referenced to the DC/TMD benchmark, the FAI showed sensitivity and specificity of up 98.2% and 87.7%, respectively (Zhang et al., 2020; Yap et al., 2021). The DASS-21 allows for the simultaneous assessment of depression (feeling of despair/dysphoria), anxiety (feeling of unease/apprehensive), and

stress (physiological/psychological response to worries). It was demonstrated to have a bifactor structure and should also use as a general score for emotional distress (Lee et al., 2019; Zanon et al., 2021). The latter was duly adopted in the current study (i.e., total-DASS). Eudaimonic well-being that "protects mental and physical health" is receiving growing attention in healthcare. While Ryff's scales are more popular, other measures of eudaimonia include the Mental Health Continuum and Orientations to Happiness Subscales (Brandel et al., 2017).

4.2 | TMD symptoms and emotional distress

The small number of participants with severe TMD was anticipated and consistent with findings of other FAI-based studies involving similar non-clinical samples (Natu et al., 2018; Augusto et al., 2016; Habib et al., 2015). The high prevalence of TMD (59.3%) and preponderance of TMD symptoms/risk factors were also congruent with these studies. The higher frequency of headaches and TMJ sounds observed corroborated the greater prevalence of muscle disorders and TMJ disc displacements in the general population (Manfredini et al., 2011). "Headache attributed to TMDs" is a recognized DC/TMD Axis I (physical) diagnosis and characterized by temporal headaches secondary to painful TMDs and influenced by jaw movements, function, and parafunction (Schiffman et al., 2014). TMDs are also associated with primary headaches including tension-type headaches and migraines (Graff-Radford & Abbott, 2016; Réus et al., 2022), and the close association between two conditions was explained by central/peripheral nervous system sensitization, impairments of pain modulatory pathways, and referred pain (Conti et al., 2016). In the presence of TMJ disc displacements, "clicking, popping or snapping noises" could occur with disc reduction during jaw movements and function (Schiffman et al., 2014). TMJ disc displacements are often associated with TMJ degenerative joint disease which produces crepitus or grating/sandy sounds (Lei et al., 2017; Silva et al., 2020).

Participants with more severe TMDs generally reported substantially higher levels of emotional distress (total-DASS), depression, anxiety, and stress. While depressive symptoms were mild (5–6 points) and stress levels were mild-to-moderate (8–12 points), the MT and ST groups presented moderate-to-severe anxiety (6–9 points; Lovibond and Lovibond, 1995). The results supported those of Lei et al. who found that 65.2% of Chinese youths experienced anxiety that significantly predicted the presence of TMD symptoms (Lei et al., 2016). In a study on Brazilian youths,

De Paiva Bertoli et al. also determined that anxiety was linked to the occurrence of TMD symptoms (De Paiva Bertoli et al., 2018). However, Reiter et al., like other studies on TMD patient populations, concluded that anxiety might have a less critical role in TMD than depression and somatization (De La Torre Canales et al., 2018; Reiter

TABLE 4 Correlations between FAI, total-DASS, and total-PWBS scores

Variables	FAI	Total-DASS	Total-PSWB
FAI	—	—	—
Total-DASS	0.37*	—	—
Total-PWBS	−0.25*	−0.54*	—

Note: Results of Spearman's correlation (*indicates $p < 0.01$).
Abbreviations: DASS, depression, anxiety, stress scales; FAI, Fonseca Anamnestic Index; PWBS, psychological well-being scales.

TABLE 5 Multivariate logistic regression analyses for mild and moderate-to-severe TMD

	Mild TMD		Moderate-to-severe TMD	
Variables	Odds ratio (95% CI)	*p*-value	Odds ratio (95% CI)	*p*-value
Gender				
Male	Reference			
Female	1.67 (1.16–2.40)	0.006		
Age				
Psychological distress				
Depression				
Anxiety	1.23 (1.17–1.29)	<0.001	1.65 (1.47–1.86)	<0.001
Stress				
Psychological well-being				
Autonomy				
Environmental mastery				
Personal growth				
Positive relations	0.92 (0.87–0.97)	0.002	0.82 (0.74–0.92)	0.001
Purpose in life				
Self-acceptance			0.71 (0.63–0.81)	<0.001

Note: Results of multivariate logistic regression analysis ($p < 0.05$).

et al., 2015). Besides the disparity in study samples, the variance could also be contributed by the comorbidity between depression and anxiety, their overlapping symptoms, and inter-relationships, arising from possible genetic as well as neurobiological similarities (Gorman, 1996; Anderson & Hope, 2008;Yap et al., 2021). The association between FAI and total-DASS scores though significant was not strong ($r_s = 0.37$). Correlation coefficients are anticipated to be higher in TMD patient populations considering their elevated prevalence of moderate-to-severe depression (21.4%–60.1%; De La Torre Canales et al., 2018).

4.3 | Eudaimonic well-being and correlations

Participants with mild and moderate-to-severe TMD were found to have diminished eudaimonic well-being (total-PWBS) and significantly lower environmental mastery, positive relations with others, purpose in life, as well as self-acceptance than those with no TMD. Significant differences in total-PWBS and self-acceptance scores were also noted between those with mild and moderate-to-severe TMD. Additionally, individuals with moderate-to-severe TMD also had significantly reduced autonomy than their counterparts with no TMD. TMDs are often associated with pain, jaw functional limitations, and negative emotions that impair quality of life and undermine opportunities for optimal psychological functioning as well as life satisfaction (Bitiniene et al., 2018; Ryan & Deci, 2001). This explains the lower total-PWBS and subscale scores reported by the MT and ST groups except for personal growth. The disposition to new experiences and sense of growth/development was thus not influenced by TMDs. For the ST group, deficits in environmental mastery and self-acceptance appeared to be more marked when contrasted with the NT group. Participants with moderate-to-severe TMD may hence have problems controlling their personal situations/surroundings and accepting their functional, physical, and social limitations.

While the correlation between FAI and total-PWBS scores was negative and weak ($r_s = -0.25$), that between total-DASS and total-PWBS scores was negative and moderately strong ($r_s = -0.54$). Eudaimonia is thus more strongly related to emotional distress than the physical aspects of TMDs. This substantiated the work of Jackson and MacLeod who determined that well-being subscales were strongly linked to psychological distress but independent of physical factors in patients with chronic fatigue syndrome (Jackson & MacLeod, 2017). Moreover, Schleicher et al. found that greater eudaimonic well-being was accompanied by less fatigue and disability, but not pain in fibromyalgia patients (Schleicher et al., 2005). Eudaimonia has been implicated in disease prevention, health behavior promotion, and biological regulation including the reduction of stress hormones and inflammatory markers (Ryff, 2014). Furthermore, there is some evidence demonstrating that individuals with higher eudaimonia have differentiated brain responses to negative and positive stimuli. While the former includes reduced amygdala activation and greater higher-order cortex engagement, the latter involves prolonged activation of the reward pathway ensuing in lower cortisol release (Ryff, 2014). The aforesaid helps clarify the moderately strong inverse relationship between eudaimonia and emotional distress. Multivariate analyses indicated that being female and anxious increased the odds of mild TMD by 67% and 23%, respectively, whereas anxiety alone increased the likelihood of moderate-to-severe TMD by 65%. Findings suggest that anxiety could play a more substantial role than the female gender with advancing TMD severity and corroborated earlier studies on the prominence of anxiety in TMDs among young people (Lei et al., 2016; Yap & Natu, 2020). Positive relations and self-acceptance had protective effects and reduced the prospects of TMDs by 8%–18% and 29% accordingly. Recently, lower scores for positive relations and self-acceptance were also reported to be predictors of psychological distress in young adults (Lopes & Nihei, 2021).

The negative psychosocial impacts of chronic illnesses including TMDs could be mitigated by the provision of holistic positive psychology interventions (PPIs) that promote positive feelings, cognition, and/or behaviors. PPIs include mindfulness, life-review, and forgiveness therapy, gratitude and strength-based interventions, as well as optimism and kindness exercises. Their efficacy in reducing depressive symptoms, enhancing both hedonic, and eudaimonic well-being was confirmed by many studies (Bolier et al., 2013; Sin & Lyubomirsky, 2009). In addition, research had also indicated that mindfulness meditation decreases pain symptoms and improves the quality of life in chronic pain patients (Hilton et al., 2017). The acceptance and effectiveness of PPIs for the management of TMDs have not been explored and randomized controlled clinical trials are required to provide the needful evidence.

4.4 | Limitations of the study

Several study limitations exist. First, the cross-sectional design employed does not permit causal relationships to be determined. A longitudinal study will be necessary to verify the consequence of TMD severity on emotional distress and eudaimonia. Second, only community young adults were examined, and outcomes might differ with older participants and TMD patient samples. Findings also cannot be generalized without further investigations on other racial and ethnic groups. Third, although non-response bias was not a problem (high response rate of 97.0%), self-report partiality may still occur as all measures were self-administered. Future work could involve clinical examinations and interviews to confirm the presence of TMDs and emotional disturbances. Lastly, the association between emotional distress and eudaimonic well-being may be somewhat over-simplified. Their interdependency is probably highly complex, multifaceted, and anticipated to vary depending on a plethora of biological and psychological factors including severity/chronicity of illness, genetics, age, gender, stress, and other individual vulnerabilities.

5 | CONCLUSION

The correlates between severity of TMDs, emotional distress, and eudaimonic well-being were established in a sample of non-clinical community young adults. Participants with mild and moderate-to-severe TMD presented considerably higher levels of emotional distress, depression, anxiety, and stress. Moreover, they also had diminished eudaimonic well-being and significantly lower environmental mastery, positive relations with others, purpose in life, and self-acceptance than their peers with no TMD. While the association between TMD severity and emotional distress was not strong, emotional distress, and eudaimonia were inversely related and moderately correlated. The presence of moderate-to-severe TMD was also substantially increased by anxiety but reduced by positive relations and self-acceptance. Positive psychology interventions may therefore help ameliorate the emotional distress and psychosocial disabilities related to TMDs.

AUTHOR CONTRIBUTIONS

Adrian Yap: Conceptualization; data curation; formal analysis; investigation; methodology; project administration; resources; validation; visualization; writing—original draft. **Carolina Marpaung:** Conceptualization; data curation; formal analysis; investigation; methodology; project administration; resources; software; validation; writing—review and editing.

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CONFLICT OF INTEREST

The authors declare that they have no financial or personal interests related to the present work.

PATIENT CONSENT STATEMENT

The authors declare that informed consent was obtained from the participants and that the study was performed in accordance with the Declaration of Helsinki.

DATA AVAILABILITY STATEMENT

Data available on request from the authors.

PEER REVIEW

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Correlates between temporomandibular disorder severity, emotional distress, and eudaimonic well-being among young adults

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Correlates between temporomandibular disorder severity, emotional distress, and eudaimonic well-being among young adults

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Abstract

Objectives: This study examined the correlates between severity of temporomandibular disorders (TMDs), emotional distress, and eudaimonic well-being.

Subjects and Methods: TMD severity, negative emotions, and eudaimonia were assessed with the Fonseca Anamnestic Index (FAI), Depression, Anxiety, Stress Scales-21 (DASS-21), and Psychological Well-being Scale-18 (PWBS-18) in a cohort of community young adults. Statistical evaluations were done with non-parametric tests/correlation and multivariate regression analyses ($\alpha = 0.05$).

Results: Amongst the 873 participants (mean age 19.8 ± 1.66 years), 40.7%, 49.0%, and 10.3% had no (NT), mild (MT), and moderate-to-severe (ST) TMD, respectively. Significant differences in total-DASS, depression, anxiety, and stress were ST ≥ MT > NT. Significant variances in total-PWSB and self-acceptance were NT > MT > ST while that for environmental mastery, positive relations, and purpose in life were NT > MT, ST. An inverse relationship was discerned between total-DASS and total-PWBS (correlation coefficient = −0.54). The prospect of ST was increased by anxiety but reduced by positive relations and self-acceptance.

Conclusions: Young adults with mild and moderate-to-severe TMD experienced substantially higher emotional distress and lower eudaimonia than those with no TMD. As emotional distress and eudaimonic well-being are interrelated, positive psychological interventions may be beneficial for managing TMD-related psychosocial disabilities.

KEYWORDS
anxiety, depression, mental health, psychology, temporomandibular disorders

1 | INTRODUCTION

Temporomandibular disorders (TMDs) are a cluster of medical and dental conditions involving the masticatory musculature, temporomandibular joints (TMJs), and contiguous structures. They are the second most common musculoskeletal problem after chronic lower back pain and occur in up to 15% of adults (Schiffman et al., 2014; Gauer & Semidey, 2015). Women have two times odds of suffering from TMDs than men, with a peak incidence between 20 and 40 years of age (Bueno et al., 2018). The features of TMDs encompass facial/periauricular pain, TMJ sounds, and dysfunction, including jaw movement restrictions. The biopsychosocial etiology of TMDs is recognized (Slade et al., 2013), and emotional distress, including depression, anxiety, and stress, are known contributing factors (Fillingim et al., 2013; Cao et al., 2021).

Though the connection between TMDs and psychological/emotional distress is widely reported, their association with psychological well-being is seldom investigated (Marpaung et al., 2021). Psychological well-being can be defined using the hedonic and eudaimonic perspectives. While the hedonic approach concentrates

on "happiness," eudaimonic well-being focuses on the optimal experience, in terms of "meaning and self-realization," as well as the positive functioning of individuals (Ryan & Deci, 2001). Eudaimonia, usually appraised with the Ryff's Psychological Well-being Scales (PWBS; Ryff & Keyes, 1995), had been studied in other musculoskeletal disorders such as rheumatoid arthritis and fibromyalgia (Mangelli et al., 2002; Schleicher et al., 2005). Findings suggested that individuals with high eudaimonic well-being usually have less depression, illness-linked fatigue, and disability.

This study is the first to examine the correlates between TMD severity, emotional distress, and eudaimonic well-being among community young adults. Young or early adulthood embodies the life era with the greatest energy, contradictions, and tension (Levinson, 1986). Additionally, the study also sought to compare the extent of depression, anxiety, stress, and positive psychological functioning in individuals with differing severity of TMDs. TMD severity was assessed with the Fonseca Anamnestic Index (FAI; Fonseca et al., 1994), whilst emotional distress and eudaimonic well-being were appraised with the short-form versions of the Depression, Anxiety, Stress Scales (DASS-21; Antony et al., 1998), and PWBS (PWBS-18; Ryff et al., 2010), respectively. The null hypotheses were (a) no significant differences in emotional distress and eudaimonic well-being are present among individuals with no and varying severity of TMDs, and (b) FAI, total DASS-21, and total PWBS-18 scores are not significantly correlated.

2 | SUBJECTS AND METHODS

2.1 | Study design and participants

This study was endorsed by the Institutional Review Board at the School of Dentistry, Trisakti University (protocol number: 377/S1/KEPK/FKG/8/2020). Young adults, aged ≥18 years old, were enrolled via a convenience sampling procedure from a private University in the capital city. The exclusion criteria included a history of orofacial trauma, debilitating systemic diseases, psychiatric treatment, and cognitive impairments. Applying a Wilcoxon-Mann–Whitney model with a 0.50 effect size, 0.05 alpha error, 95% power, and allocation ratio of 6 derived from an earlier study (Natu et al., 2018), a minimum sample size of 448 was calculated a priori using the G*Power software version 3.1.9.3 (Faul et al., 2007). Participation in the study was voluntary, with no financial or other compensations given. All eligible participants provided informed consent before completing an online questionnaire that comprised demographic information, the FAI, DASS-21, and PWBS-18. The survey was conducted over ten months from Feb 2020 to Nov 2020.

2.2 | Study measures

The presence and severity of TMDs were ascertained with the FAI whose reliability, validity, and accuracy are well established (Berni et al., 2015; Topuz et al., 2020; Kaynak et al., 2020). More recently, it was shown to be highly accurate for establishing the presence of pain-related and/or intra-articular TMDs when evaluated against the Diagnostic Criteria for TMDs (DC/TMD) standard (Yap et al., 2021). Furthermore, the FAI remains one of the few validated TMD measures that quantifies and categorizes TMD severity (Yap et al., 2022). The FAI contains 10-items about pain (headache, neck, masticatory muscle, and TMJ pain) and function-related (TMJ noises, opening, and lateral-movement difficulties) TMD symptoms as well as TMD-associated risk factors (bruxism, malocclusion, and emotional tension). The items are appraised using "no," "sometimes," and "yes" responses that are scored 0, 5, and 10 points correspondingly. Sum scores are calculated, and TMD severity is classified as "no" (0–15 points), "mild" (20–40 points), "moderate" (45–65 points), or "severe" (70–100 points).

The psychometric properties of the DASS-21 are also well researched (Lee et al., 2019). It comprises of 21-items equally distributed amongst the three emotional states. The items are evaluated on a 4-point Likert scale where 0 = "did not apply to me at all" and 3 = "applied to me very much/most of the time." Sum scores are processed for total-DASS (emotional distress) in addition to the depression, anxiety, and stress subscales with higher scores signifying greater symptom gravity. The cut-off points for the various severity groupings (i.e., normal to extremely severe) are specified in the DASS manual (Lovibond and Lovibond, 1995). The PWBS-18 involves 18-items with three items for each of the six subscales. The items are appraised with a 7-point rating scale varying from 1 = "strongly agree" to 7 = "strongly disagree." Sum scores are computed for total-PWBS (eudaimonic well-being) as well as the autonomy, environmental mastery, personal growth, positive relations with others, purpose in life, and self-acceptance subscales. Higher scores indicate greater psychological well-being.

2.3 | Statistical assessment

Statistical assessments were conducted using the SPSS Statistics software Version 24.0 (IBM Corporation) with a significance level of 0.05. Qualitative data were conveyed as frequencies (with percentages) whilst quantitative data were presented as both means (with standard deviations [SD]) and medians (with interquartile ratios [IQR]). The Kolmogorov–Smirnov test was performed to examine data distribution. As DASS-21 and PWBS-18 data were not normally distributed, the Kruskal–Wallis and post-hoc Mann–Whitney U tests were used for comparing scores among the various TMD severity groups. Associations between FAI, total-DASS, and total-PWBS scores were determined utilizing Spearman's rank-order correlation. Correlation coefficients (r_s) were deemed "weak" (0.1–0.3), "moderate" (0.4–0.6), or "strong" (0.7–0.9) based on Dancey and Reid's nomenclature (Dancey and Reid, 2017). Multivariate logistic regression analyses were ultimately conducted to confirm the demographic and psychological predictors for mild and moderate-to-severe TMD. Total-DASS and total-PWBS were omitted from the regression

models to circumvent collinearity and a step-wise selection procedure was employed with a threshold of $p < 0.10$ for removing insignificant variables. Outcomes were computed as odds ratios (ORs) with 95% confidence intervals (95% CIs).

3 | RESULTS

3.1 | Population characteristics

Out of a total of 1028 young adults screened, 128 were excluded, and 27 declined participating in the study giving a response rate of 97.0%. The study population had a mean age of 19.8 ± 1.66 years and 77.9% were women. As the number of participants with severe TMD was small ($n = 7$), the moderate and severe TMD groups were combined into one. Amongst the 873 study participants, 40.7% had no TMD (NT), whereas 49.0% and 10.3% had mild TMD (MT) and moderate-to-severe (ST) TMD. The prevalence of the various TMD symptoms/risk factors for the three TMD severity groups is reflected in Table 1. Headaches (56.5%–80.0%) and TMJ sounds (33.2%–70.0%) were the most frequent pain and function-related TMD symptoms for the MT and ST groups. Emotional tension was the most common TMD risk factor (78.3%–88.9%).

The mean and median DASS-21, as well as PWBS-18 scores, are presented in Tables 2 and 3. Significant differences in total-DASS, anxiety, and stress scores were ST > MT > NT. For the depression subscale, scores between the ST and MT groups were insignificant (i.e., ST, MT > NT). When psychological well-being was compared, significant differences in total-PWBS and self-acceptance were NT > MT > ST. Apart from autonomy and personal growth, the NT group had significantly greater scores than both the MT and ST groups (i.e., NT > MT, ST) for the remaining subscales. While person growth scores were inconsequential, the NT group exhibited significantly higher autonomy scores than the ST group (i.e., NT > ST).

Tables 4 and 5 display the outcomes of Spearman's correlation and multivariate logistic regression analyses. The correlation between FAI and total-DASS scores was positive and near moderate ($r_s = 0.37$) while that between FAI and total-PWBS scores was negative and weak ($r_s = -0.25$). The inverse relationship between total-DASS and total-PWBS was moderately strong ($r_s = -0.54$). Though the female gender (OR = 1.67), anxiety (OR = 1.23), and positive relations (0.92) were associated with MT, the presence of ST was significantly increased by anxiety (OR = 1.65) but reduced by positive relations (OR = 0.82) and self-acceptance (OR = 0.71).

4 | DISCUSSION

4.1 | Overview and measures

The correlates between TMD severity, emotional distress, and eudaimonia were established. As significant differences in emotional distress and eudaimonic well-being were present among young adults with varying TMD severity and correlations among FAI,

TABLE 1 Demographic characteristics and frequency of TMD symptoms/risk factors for the three TMD severity groups

Variables	Total 873 (100%)	No TMD (NT) $n = 355$ (40.7%)	Mild TMD (MT) $n = 428$ (49%)	Moderate-to-severe TMD (ST) $n = 90$ (10.3%)
Gender				
Male, *n* (%)	194 (22.2%)	97 (27.3%)	82 (19.2%)	15 (16.7%)
Female, *n* (%)	679 (77.8%)	258 (72.7%)	346 (80.8%)	75 (83.3%)
Age				
Mean ± SD	19.8 (1.7)	19.8 (2.1)	19.7 (1.3)	20.0 (1.4)
Median (IQR)	20.0 (2.0)	19.0 (2.0)	20.0 (2.0)	20.0 (2.0)
TMD symptoms/risk factors				
Opening difficulty	169 (19.4)	19 (5.6)	106 (24.8)	44 (48.9)
Side-movement difficulty	66 (7.6)	4 (1.1)	37 (8.6)	25 (27.8)
Muscle pain	315 (36.1)	47 (13.2)	200 (46.7)	68 (75.6)
Headache	374 (42.8)	60 (16.9)	242 (56.5)	72 (80.0)
Neck pain	351 (40.2)	45 (12.7)	241 (56.3)	65 (72.2)
TMJ pain	143 (16.4)	0 (0)	92 (21.5)	51 (56.7)
TMJ noises	228 (26.1)	23 (6.5)	142 (33.2)	63 (70.0)
Parafunction	233 (26.7)	45 (12.7)	138 (32.2)	50 (55.6)
Malocclusion	348 (39.9)	59 (16.6)	213 (49.8)	76 (84.4)
Emotional tension	563 (64.5)	148 (41.7)	335 (78.3)	80 (88.9)

Note: Presence of TMD symptom/risk factor = "sometimes" or "yes" response to the respective items.

TABLE 2 Mean and median depression, anxiety, stress Scales-21 (DASS-21) scores for the three TMD severity groups

Variables	No TMD (NT)	Mild TMD (MT)	Moderate-to-severe TMD (ST)	*p*-value	Post-hoc
Total-DASS					ST > MT > NT
Mean ± SD	15.11 ± 8.65	20.85 ± 9.68	25.40 ± 10.90	<0.001	
Median (IQR)	15.00 (11.00)	21.00 (12.00)	23.00 (19.00)		
Depression					ST, MT > NT
Mean ± SD	3.80 ± 3.29	5.20 ± 3.65	5.611 ± 3.70	<0.001	
Median (IQR)	3.00 (4.00)	4.00 (5.00)	4.00 (5.00)		
Anxiety					ST > MT > NT
Mean ± SD	4.94 ± 2.94	7.28 ± 3.50	9.43 ± 4.01	<0.001	
Median (IQR)	5.00 (4.00)	7.00 (5.00)	10.00 (5.25)		
Stress					ST > MT > NT
Mean ± SD	6.38 ± 3.57	8.36 ± 3.99	10.36 ± 4.73	<0.001	
Median (IQR)	6.00 (5.00)	8.00 (5.00)	10.00 (7.00)		

Note: Results of Kruskal–Wallis/post-hoc Mann–Whitney U tests ($p < 0.05$).

TABLE 3 Mean and median psychological well-being Scales-18 (PWBS-18) scores for the three TMD severity groups

Variables	No TMD (NT)	Mild TMD (mt)	Moderate-to-severe TMD (ST)	*p*-value	Post-hoc
Total-PWBS					NT > MT > ST
Mean ± SD	92.25 ± 11.34	88.01 ± 10.86	84.22 ± 10.12	<0.001	
Median (IQR)	94.00 (14.00)	89.00 (14.00)	84.00 (14.50)		
Autonomy					NT > ST
Mean ± SD	13.96 ± 2.62	13.53 ± 2.59	13.10 ± 3.25	0.009	
Median (IQR)	14.00 (3.00)	14.00 (3.00)	13.00 (4.00)		
Environmental mastery					NT > MT, ST
Mean ± SD	14.63 ± 2.74	13.81 ± 2.70	12.94 ± 2.97	<0.001	
Median (IQR)	15.00 (5.00)	14.00 (4.00)	13.00 (4.00)		
Personal growth					–
Mean ± SD	17.76 ± 2.61	17.57 ± 2.36	17.74 ± 2.96	0.223	
Median (IQR)	18.00 (3.00)	18.00 (3.00)	18.00 (4.00)		
Positive relations					NT > MT, ST
Mean ± SD	14.86 ± 2.93	13.71 ± 3.13	12.79 ± 3.06	<0.001	
Median (IQR)	15.00 (4.00)	14.00 (4.00)	14.00 (5.00)		
Purpose in life					NT > MT, ST
Mean ± SD	15.29 ± 2.62	14.84 ± 2.73	14.58 ± 2.63	0.008	
Median (IQR)	16.00 (3.00)	15.00 (4.00)	15.00 (3.00)		
Self-acceptance					NT > MT > ST
Mean ± SD	15.75 ± 2.99	14.55 ± 3.18	13.07 ± 2.82	<0.001	
Median (IQR)	16.00 (4.00)	15.00 (5.00)	13.00 (3.00)		

Note: Results of Kruskal–Wallis/post-hoc Mann–Whitney U tests ($p < 0.05$).

total-DASS, and total-PWBS scores were significant, the two null hypotheses were suitably rejected. Young adults were chosen as they typified the peak incidence of TMDs and the bulk of TMD patients (Gauer & Semidey, 2015; Yap et al., 2021). Both FAI and DASS-21 had been used together in other TMD research (Natu et al., 2018; Gaş et al., 2021). When referenced to the DC/TMD benchmark, the FAI showed sensitivity and specificity of up 98.2% and 87.7%, respectively (Zhang et al., 2020; Yap et al., 2021). The DASS-21 allows for the simultaneous assessment of depression (feeling of despair/dysphoria), anxiety (feeling of unease/apprehensive), and

stress (physiological/psychological response to worries). It was demonstrated to have a bifactor structure and should also use as a general score for emotional distress (Lee et al., 2019; Zanon et al., 2021). The latter was duly adopted in the current study (i.e., total-DASS). Eudaimonic well-being that "protects mental and physical health" is receiving growing attention in healthcare. While Ryff's scales are more popular, other measures of eudaimonia include the Mental Health Continuum and Orientations to Happiness Subscales (Brandel et al., 2017).

4.2 | TMD symptoms and emotional distress

The small number of participants with severe TMD was anticipated and consistent with findings of other FAI-based studies involving similar non-clinical samples (Natu et al., 2018; Augusto et al., 2016; Habib et al., 2015). The high prevalence of TMD (59.3%) and preponderance of TMD symptoms/risk factors were also congruent with these studies. The higher frequency of headaches and TMJ sounds observed corroborated the greater prevalence of muscle disorders and TMJ disc displacements in the general population (Manfredini et al., 2011). "Headache attributed to TMDs" is a recognized DC/TMD Axis I (physical) diagnosis and characterized by temporal headaches secondary to painful TMDs and influenced by jaw movements, function, and parafunction (Schiffman et al., 2014). TMDs are also associated with primary headaches including tension-type headaches and migraines (Graff-Radford & Abbott, 2016; Réus et al., 2022), and the close association between two conditions was explained by central/peripheral nervous system sensitization, impairments of pain modulatory pathways, and referred pain (Conti et al., 2016). In the presence of TMJ disc displacements, "clicking, popping or snapping noises" could occur with disc reduction during jaw movements and function (Schiffman et al., 2014). TMJ disc displacements are often associated with TMJ degenerative joint disease which produces crepitus or grating/sandy sounds (Lei et al., 2017; Silva et al., 2020).

Participants with more severe TMDs generally reported substantially higher levels of emotional distress (total-DASS), depression, anxiety, and stress. While depressive symptoms were mild (5–6 points) and stress levels were mild-to-moderate (8–12 points), the MT and ST groups presented moderate-to-severe anxiety (6–9 points; Lovibond and Lovibond, 1995). The results supported those of Lei et al. who found that 65.2% of Chinese youths experienced anxiety that significantly predicted the presence of TMD symptoms (Lei et al., 2016). In a study on Brazilian youths,

De Paiva Bertoli et al. also determined that anxiety was linked to the occurrence of TMD symptoms (De Paiva Bertoli et al., 2018). However, Reiter et al., like other studies on TMD patient populations, concluded that anxiety might have a less critical role in TMD than depression and somatization (De La Torre Canales et al., 2018; Reiter

TABLE 4 Correlations between FAI, total-DASS, and total-PWBS scores

Variables	FAI	Total-DASS	Total-PSWB
FAI	—	—	—
Total-DASS	0.37*	—	—
Total-PWBS	−0.25*	−0.54*	—

Note: Results of Spearman's correlation (*indicates $p < 0.01$).
Abbreviations: DASS, depression, anxiety, stress scales; FAI, Fonseca Anamnestic Index; PWBS, psychological well-being scales.

TABLE 5 Multivariate logistic regression analyses for mild and moderate-to-severe TMD

	Mild TMD		Moderate-to-severe TMD	
Variables	Odds ratio (95% CI)	*p*-value	Odds ratio (95% CI)	*p*-value
Gender				
Male	Reference			
Female	1.67 (1.16–2.40)	0.006		
Age				
Psychological distress				
Depression				
Anxiety	1.23 (1.17–1.29)	<0.001	1.65 (1.47–1.86)	<0.001
Stress				
Psychological well-being				
Autonomy				
Environmental mastery				
Personal growth				
Positive relations	0.92 (0.87–0.97)	0.002	0.82 (0.74–0.92)	0.001
Purpose in life				
Self-acceptance			0.71 (0.63–0.81)	<0.001

Note: Results of multivariate logistic regression analysis ($p < 0.05$).

et al., 2015). Besides the disparity in study samples, the variance could also be contributed by the comorbidity between depression and anxiety, their overlapping symptoms, and inter-relationships, arising from possible genetic as well as neurobiological similarities (Gorman, 1996; Anderson & Hope, 2008;Yap et al., 2021). The association between FAI and total-DASS scores though significant was not strong ($r_s = 0.37$). Correlation coefficients are anticipated to be higher in TMD patient populations considering their elevated prevalence of moderate-to-severe depression (21.4%–60.1%; De La Torre Canales et al., 2018).

4.3 | Eudaimonic well-being and correlations

Participants with mild and moderate-to-severe TMD were found to have diminished eudaimonic well-being (total-PWBS) and significantly lower environmental mastery, positive relations with others, purpose in life, as well as self-acceptance than those with no TMD. Significant differences in total-PWBS and self-acceptance scores were also noted between those with mild and moderate-to-severe TMD. Additionally, individuals with moderate-to-severe TMD also had significantly reduced autonomy than their counterparts with no TMD. TMDs are often associated with pain, jaw functional limitations, and negative emotions that impair quality of life and undermine opportunities for optimal psychological functioning as well as life satisfaction (Bitiniene et al., 2018; Ryan & Deci, 2001). This explains the lower total-PWBS and subscale scores reported by the MT and ST groups except for personal growth. The disposition to new experiences and sense of growth/development was thus not influenced by TMDs. For the ST group, deficits in environmental mastery and self-acceptance appeared to be more marked when contrasted with the NT group. Participants with moderate-to-severe TMD may hence have problems controlling their personal situations/surroundings and accepting their functional, physical, and social limitations.

While the correlation between FAI and total-PWBS scores was negative and weak ($r_s = -0.25$), that between total-DASS and total-PWBS scores was negative and moderately strong ($r_s = -0.54$). Eudaimonia is thus more strongly related to emotional distress than the physical aspects of TMDs. This substantiated the work of Jackson and MacLeod who determined that well-being subscales were strongly linked to psychological distress but independent of physical factors in patients with chronic fatigue syndrome (Jackson & MacLeod, 2017). Moreover, Schleicher et al. found that greater eudaimonic well-being was accompanied by less fatigue and disability, but not pain in fibromyalgia patients (Schleicher et al., 2005). Eudaimonia has been implicated in disease prevention, health behavior promotion, and biological regulation including the reduction of stress hormones and inflammatory markers (Ryff, 2014). Furthermore, there is some evidence demonstrating that individuals with higher eudaimonia have differentiated brain responses to negative and positive stimuli. While the former includes reduced amygdala activation and greater higher-order cortex engagement, the latter involves prolonged activation of the reward pathway ensuing in lower cortisol release (Ryff, 2014). The aforesaid helps clarify the moderately strong inverse relationship between eudaimonia and emotional distress. Multivariate analyses indicated that being female and anxious increased the odds of mild TMD by 67% and 23%, respectively, whereas anxiety alone increased the likelihood of moderate-to-severe TMD by 65%. Findings suggest that anxiety could play a more substantial role than the female gender with advancing TMD severity and corroborated earlier studies on the prominence of anxiety in TMDs among young people (Lei et al., 2016; Yap & Natu, 2020). Positive relations and self-acceptance had protective effects and reduced the prospects of TMDs by 8%–18% and 29% accordingly. Recently, lower scores for positive relations and self-acceptance were also reported to be predictors of psychological distress in young adults (Lopes & Nihei, 2021).

The negative psychosocial impacts of chronic illnesses including TMDs could be mitigated by the provision of holistic positive psychology interventions (PPIs) that promote positive feelings, cognition, and/or behaviors. PPIs include mindfulness, life-review, and forgiveness therapy, gratitude and strength-based interventions, as well as optimism and kindness exercises. Their efficacy in reducing depressive symptoms, enhancing both hedonic, and eudaimonic well-being was confirmed by many studies (Bolier et al., 2013; Sin & Lyubomirsky, 2009). In addition, research had also indicated that mindfulness meditation decreases pain symptoms and improves the quality of life in chronic pain patients (Hilton et al., 2017). The acceptance and effectiveness of PPIs for the management of TMDs have not been explored and randomized controlled clinical trials are required to provide the needful evidence.

4.4 | Limitations of the study

Several study limitations exist. First, the cross-sectional design employed does not permit causal relationships to be determined. A longitudinal study will be necessary to verify the consequence of TMD severity on emotional distress and eudaimonia. Second, only community young adults were examined, and outcomes might differ with older participants and TMD patient samples. Findings also cannot be generalized without further investigations on other racial and ethnic groups. Third, although non-response bias was not a problem (high response rate of 97.0%), self-report partiality may still occur as all measures were self-administered. Future work could involve clinical examinations and interviews to confirm the presence of TMDs and emotional disturbances. Lastly, the association between emotional distress and eudaimonic well-being may be somewhat over-simplified. Their interdependency is probably highly complex, multifaceted, and anticipated to vary depending on a plethora of biological and psychological factors including severity/chronicity of illness, genetics, age, gender, stress, and other individual vulnerabilities.

5 | CONCLUSION

The correlates between severity of TMDs, emotional distress, and eudaimonic well-being were established in a sample of non-clinical community young adults. Participants with mild and moderate-to-severe TMD presented considerably higher levels of emotional distress, depression, anxiety, and stress. Moreover, they also had diminished eudaimonic well-being and significantly lower environmental mastery, positive relations with others, purpose in life, and self-acceptance than their peers with no TMD. While the association between TMD severity and emotional distress was not strong, emotional distress, and eudaimonia were inversely related and moderately correlated. The presence of moderate-to-severe TMD was also substantially increased by anxiety but reduced by positive relations and self-acceptance. Positive psychology interventions may therefore help ameliorate the emotional distress and psychosocial disabilities related to TMDs.

AUTHOR CONTRIBUTIONS

Adrian Yap: Conceptualization; data curation; formal analysis; investigation; methodology; project administration; resources; validation; visualization; writing—original draft. **Carolina Marpaung:** Conceptualization; data curation; formal analysis; investigation; methodology; project administration; resources; software; validation; writing—review and editing.

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PATIENT CONSENT STATEMENT

The authors declare that informed consent was obtained from the participants and that the study was performed in accordance with the Declaration of Helsinki.

DATA AVAILABILITY STATEMENT

Data available on request from the authors.

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PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7

PAGE 8

PAGE 9