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What's new for the clinician – excerpts from and summaries of recently published papers (October 2018)

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1. Is depression associated with oral health outcomes in adults and elders? A systematic review and meta-analysis

MG Cademartori, MT Gastal., Lappin, GG Nascimento. et al.
Clin Oral Invest 2018; 22: 2685-2702.

Depression is among the most prevalent chronic diseases worldwide. It is a well-established and important risk factor for many systemic conditions, including obesity, sleep disturbance, and chronic diseases. In South Africa, depression rates reported from different studies and settings have ranged from 18% -35%. Oral diseases have also been associated with depression.

Most studies have drawn attention to the contribution of poor oral health status to depression, although there are also published studies whose results have suggested that there exists a bi-directional relationship between oral health and mental disorders.

In view of the relevance of depression to oral health, and the lack of consensus about the association between these conditions, a study that summarizes the literature is of great importance. Cademartori and colleagues (2018)[1] reported on a systematic review that sought to investigate any association between depression and oral health.

ACRONYMS

BDI:	Beck's Depression Inventory
CI:	Confidence Interval
GDS:	Geriatric Depression Scale
OR:	Odds Ratio

METHODS

This review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. An electronic search was conducted in PsychInfo, PubMed, Scielo, Scopus, and Web of Science, without language restrictions and with no initial date restriction until 20 April 2018.

Based on the inclusion and exclusion criteria, two reviewers independently screened titles and abstracts. In case of disagreement, a consensus was determined by discussion after a comparison of the lists of the included studies.

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In the next step, the same two reviewers read the full texts of the articles, reviewing according to the inclusion and exclusion criteria. When articles were excluded reasons for the exclusion were recorded. The reviewers also performed a hand search in the reference lists of the included studies. Original cross-sectional and longitudinal prospective and retrospective observational studies were included.

To be included, studies should have investigated an association between major depression disorder and oral health conditions (dental caries and/or periodontal disease and/or tooth loss). In order to ensure adequate power to detect statistical significance and the representativeness of the sample, the study was expected to present details regarding sample selection, or the study should have clearly described the representativeness of the sample (e.g., representative subsample of a national survey).

Studies of specific sample, such as psychiatric populations, individuals with periodontitis, children or adolescents, populations comprising only pregnant women or people with learning disability were not included. Studies that described their sample as "convenience" were also excluded. Additionally, case-control studies, reviews, technical reports, case reports and series, abstracts from conferences, letters to the editor, animal studies, *in vitro* studies, and qualitative studies were not considered.

As criteria for a diagnosis of depression, studies with a primary diagnosis of depression, including clinical diagnoses or diagnostic criteria through validated tools, were selected.

When measures of lifetime and current diagnoses were presented, a preference was given for current diagnoses, again using validated tools. Other mental disorders and dental phobias were not included.

In relation to oral diseases, only those considered as public health problem with a global burden were included. Therefore, studies that presented dental caries, periodontal disease, or tooth loss as outcome or as exposure were considered. As inclusion criteria, oral health should have been evaluated by self-reported measures or clinical diagnoses. When these were presented, a preference was given for clinical diagnoses.

In addition, when more than one category of oral disease was presented; the most severe was chosen. Tooth loss and edentulism were considered separately. Studies that explored other oral diseases including erosion, temporomandibular dysfunction, or xerostomia were not included. Studies of qualitative measures related to dental outcomes such as poor oral health were also excluded.

Data related to study identification (first author's name and year of publication), location, sample characteristics, the study design, and information regarding exposure and outcomes variables were extracted. The statistical methods and effect measures used, adjustments performed, and confounding factors which had been considered were recorded. When necessary, authors were contacted and questions about the study were clarified.

The methodological quality assessment of the included studies was performed using the Critical Appraisal Checklist for observational studies referred by The Joanna Briggs Institute (JBI). The checklist is comprised of ten items, which are to be answered with "Yes," "No," or "Unclear" by reviewers. The sum of the number of "Yes" answers defined the overall score for each study, ranging from 0 to 10. Studies were classified as follows: low quality (0–3 scores); medium quality (4–6 scores); and high quality (7–10 scores). The data extraction and the quality assessment process were independently performed by the same two reviewers, who matched the information collected and discussed cases of disagreement.

For each oral disease, distinct meta-analyses were performed, taking into consideration the direction of association presented in the study. If a study presented two or more variables of interest, data were also analysed independently. If a study presented more than one category for the variable of interest, the most severe category was considered.

For meta-analysis, preferably adjusted results were included. When that was not possible, crude result estimates were considered or calculated. Odds ratio (OR) was used to measure effect size with 95% confidence interval (CI). Relative risk measures presented in studies were converted to ORs. Fixed- and random-effects models were used to estimate pooled OR. The random-effects model was chosen in the presence of heterogeneity. Heterogeneity was evaluated with the I^2 statistic and considered when I^2 was more than 50%. Sensitivity analyses were used to observe the effect of each study on the pooled results.

RESULTS

The searches performed in the electronic database presented 2504 potential articles, of which 1127 were duplicates. A first screening was performed for title and abstract in 1377 articles, and resulted in 44 studies. In the second screening, the studies received full-text reading, and 28 publications were excluded. Therefore, 16 studies were included in this systematic review and 15 studies were included in this meta-analysis.

Dental caries versus depression

Two studies assessing association between dental caries and depression were included in this systematic review. The studies considered association depression as an exposure variable and oral health as an outcome variable. The studies were published between 2012 and 2015, with sample sizes ranging from 390 to 4667 individuals with a high methodological quality. Both had a cross-sectional design and assessed depression as a current measure through validated scales, Beck's Depression Inventory (BDI) and Geriatric Depression Scale (GDS).

According to a pooled estimate, depression was associated with dental caries (OR 1.27; 95% CI 1.13–1.44; $p< 0.05$).

Periodontal disease versus depression

Five studies testing the association between periodontal disease and depression were included in this systematic review. The sample sizes ranged from 701 to 63540 individuals. Depression was measured using validated scales, specifically the BDI, the GDS, and the World Health Organization Composite International Diagnostic Interview, auto version 2.1 (CIDI-Auto). In the meta-analysis, the pooled estimate does not show an association (OR 0.96; 95% CI 0.84–1.10; $p>0.05$) between depression and periodontal disease. Heterogeneity among studies was not found (0%).

Tooth loss versus depression

Five studies investigated the association between tooth loss and depression. The studies were published between 2012 and 2015, with sample sizes ranging from 1553 to 5,419,019 individuals.

In the meta-analysis, the pooled estimate revealed an association between depression and tooth loss (OR 1.31; 95% CI 1.24–1.37; $p< 0.05$). Individuals with depression presented 1.31 times higher odds of tooth loss. A prevalence of 13.4% of heterogeneity between studies was found, which is considered as low heterogeneity.

Edentulism versus depression

Seven studies had investigated the association between edentulism and depression. The studies were published between 2012 and 2017, with sample sizes ranging from 768 to 201953.

Two meta-analyses were performed according to the direction of association applied in analyses in the studies. A positive association was found on the pooled estimate for depression as an exposure variable for edentulism.

It was found that depressive individuals presented 1.17 times higher odds of edentulism (OR 1.17; 95% CI 1.02–1.34; p<0.05).

A second meta-analysis was performed for those studies in which edentulism were tested as an exposure variable for the development of depression. The pooled estimate revealed an association between edentulism and depression (OR 1.28; 95% CI 1.06–1.55; P,0.05).

CONCLUSION

The results of this systematic review and meta-analyses show a positive association between depression and oral diseases, specifically dental caries, tooth loss, and edentulism, in adults and elders.

More longitudinal studies are required to test causal and temporal relationship between depression and oral health status.

Implications for practice

Mental and oral health are among the main disabilities worldwide. This high quality systematic review provides evidence of the link between oral health and mental disorders, highlighting the importance for both clinicians and policy makers to consider the patient's psychological status in the management of oral health conditions.

Reference

1. Cademartori, M.G., Gastal, M.T., Nascimento, G.G. et al. Is depression associated with oral health outcomes in adults and elders? A systematic review and meta-analysis. Clin Oral Invest. 2018; 22: 2685-2702.

2. Does the use of CAD/CAM technology produce dentures with improved fit?

O Steinmassl, H Dumfahrt, I Grunert. et al. Clin Oral Invest 2018; 22: 2829.

Removable complete dentures remain the least invasive and most cost-effective option for the prosthodontic rehabilitation of edentulous patients.[1] A crucial factor determining the quality of removable dentures is the denture fit.[1] Well-fitting dentures show a higher primary wearing comfort and reduce the occurrence of traumatic ulcers.[1] Tissue-congruent denture fit is the most important key factor for good retention in removable complete dentures.[1] Denture retention affects the masticatory performance and speaking ability and thereby has a strong impact on the patients' quality of life.[1] Therefore, achieving maximal tissue congruence should be one of the main goals in complete denture fabrication.[1]

Before the introduction of CAD/CAM technology into removable prosthodontics, the congruence between denture base and denture-bearing tissues was always impeded by the resin's polymerisation shrinkage.[1] The shrinkage causes distortions of the denture base and therefore has a negative impact on fit and retention of removable complete dentures.[1] In CAD/CAM fabrication, on the other hand, the manufacturing process is subtractive: The denture bases are milled from fully polymerised acrylic resin pucks and are therefore not subject to shrinkage or distortion phenomena anymore.[1]

Steinmass and colleagues from Austria (2018)[1] reported on an in vitro study that sought to investigate whether CAD/CAM fabricated denture bases have a higher congruence with the denture-bearing tissues than conventionally processed denture bases. Therefore, the null hypothesis for this study was that there is no difference in the precision of fit between CAD/CAM fabricated and conventional dentures.

MATERIALS AND METHODS

This *in vitro* study included maxillary study casts originating from ten edentulous patients, serving as master casts. Different anatomical situations were included: moderate to strong alveolar resorption with or without undercuts and high and shallow palates, as well as granular and smooth mucosal surfaces. Five dentures were fabricated from each of these ten master casts: four different CAD/CAM dentures and one conventional denture.

The four different CAD/CAM dentures per cast were provided by the four CAD/CAM denture manufacturers (AvaDent Digital dentures [Global Dental Science Europe], Baltic Denture System [Merz Dental GmbH], Whole You Nexteeth [Whole You Inc], Wieland Digital Dentures [Wieland Dental + Technik GmbH & Co]). Each company produced one denture per master cast.

The anatomical information required for manufacturing the study dentures was obtained from master cast scans by AvaDent, Baltic Denture System and Wieland Digital Dentures. The Whole You Nexteeth system could not process master cast scans.

Therefore, impressions of the master casts had to be generated using Imprint 4 Super Quick Heavy and Light polyvinylsiloxane impression material (3 M) and DENTCA impression trays (Dentca INC). The impression scans could then be integrated into the Whole You Nexteeth digital workflow.

The ten conventionally manufactured dentures fabricated from each of the ten original master casts served as a control group. The conventional dentures were made in compressed mould technique. For the mould, class IV gypsum was processed according to the manufacturer's instructions and then isolated with a plaster-against-resin separating fluid. The denture bases were made from heat polymerising resin in the recommended long-term heat polymerisation cycle (75 °C water bath for 8.5 h). All study specimens were finished only on the oral surfaces, while the mucosa-sided surfaces were left unfinished, as is customary in clinical usage. Before analysis, all dentures were stored in sealed beakers containing 200 ml of deionised water at 37.0 °C for 7 days in darkness.

Prior to the fabrication of the conventional dentures, which would involve the destruction of the casts, the master casts were scanned using a 7Series Dental Wings scanner, after applying a thin and homogenous layer of Shera scanspray. The generated digital data (3D meshes) was processed in STL-format. The same procedure was applied to the mucosal surfaces of each study denture.

After standardised cropping of the meshes, the mucosal denture-base surfaces were matched with the master cast surfaces. The measurement points were set at minimal distance, resulting in a 2-mm mesh. Unsigned absolute mismatch-values were used to avoid the neutralisation of positive and negative values. Besides calculating the overall mean mismatch, the master cast surface was also divided into five functionally relevant sections (posterior palatal seal, anterior and lateral border seal, alveolar ridge, tubera maxillaria and palate) to evaluate the region-specific mismatches.

Following these analyses, all specimens were submitted to a thermocycling protocol simulating six months of intraoral use. The dentures underwent 5000 cycles of alternating immersion in deionised water with 5 and 55 °C. After thermocycling, the scanning and matching procedures were repeated, following the aforementioned protocol.

RESULTS

Overall denture fit

The deviations between mucosal denture surfaces and the corresponding master cast surfaces were measured at an average of 650.2, SD = 86.1 measuring points per denture. There were no outliers in the data, and the deviation values were normally distributed. Conventionally fabricated dentures showed a mean deviation of 0.105 mm, SD = 0.019 from the master cast. All CAD/CAM fabricated dentures had lower mean denture base incongruences than did the conventionally fabricated dentures. AvaDent Digital Dentures showed the greatest congruence with the master cast surface with a mean deviation of 0.058 mm, SD = 0.005. Wieland Digital Dentures showed a mean deviation of 0.068 mm, SD = 0.005, Whole You Nexteeth prostheses showed a mean deviation of 0.074 mm, SD = 0.011 and Baltic Denture System prostheses showed a mean deviation of 0.086 mm, SD = 0.012.

The mean incongruence values indicated statistically highly significant differences among the manufacturers, $F(1.873, 16.855) = 28.878$, $p < 0.0005$, partial $\eta 2 = 0.762$.

AvaDent Digital Dentures, Wieland Digital Dentures and Whole You Nexteeth prostheses showed a highly significantly better denture base congruence than did the conventional dentures. Baltic Denture System prostheses also showed a more precise fit than the conventionally fabricated dentures, but the mean value difference was not statistically significant.

Compared with the conventional dentures, AvaDent Digital Dentures had a difference of mean misfit of 0.047 mm (95% CI [0.023, 0.071], $p < 0.0005$), Wieland Digital Dentures of 0.037 mm (95% CI [0.016, 0.058], $p = 0.001$) and Whole You Nexteeth dentures of 0.031 mm (95% CI [0.008, 0.054], $p = 0.008$). The fit of all three CAD/CAM systems was statistically highly significantly better than in the control group. The mean misfit of Baltic Denture System was 0.019 mm (95% CI [– 0.007, 0.046]), smaller than in conventional dentures, but this difference, as previously mentioned, was not statistically significant ($p = 0.258$). Therefore, the null hypothesis had to be rejected.

Region-specific misfit

The functional regions with the most precise fit in conventional and in almost all the CAD/CAM dentures were the alveolar ridge and the palate. The greatest extent of misfit was found in the posterior palatal seal regions and the anterior and lateral seal regions. AvaDent dentures and Wieland Digital Dentures, which had the highest precision of fit, also showed rather low deviations in the posterior palatal seal regions (0.057 mm, SD = 0.005 and 0.071 mm, SD = 0.008) and the anterior and lateral seal regions (0.084 mm, SD = 0.017 and 0.088 mm, SD = 0.011, respectively). Whole You Nexteeth prostheses showed the highest values of deviation in the posterior palatal seal region (0.166 mm, SD = 0.044).

The differences in the denture base congruence between the various functional regions were statistically highly significant in conventional dentures and also in all CAD/CAM dentures ($p < 0.01$). The congruence in the palatal region was statistically significantly higher than in the anterior and lateral seal region, in all groups ($p < 0.05$). In Whole You Nexteeth prostheses, the posterior palatal seal region showed a statistically significantly higher misfit than all other regions ($p < 0.05$).

Post-thermocycling misfit

Thermocycling did not have a statistically significant impact on the precision of fit. Not only were the changes in fit within the imprecision of the scanning and matching processes, but there was also no reproducible trend towards increased or diminished precision of fit, neither for conventional, nor for CAD/CAM dentures.

CONCLUSION

Computer-aided design and manufacturing produced dentures with higher tissue congruence than with conventional denture fabrication. AvaDent Digital Dentures, Whole You Nexteeth prosthesis and Wieland Digital Dentures had a significantly higher precision of denture base fit than did the conventional dentures.

Implications for practice

The investigated CAD/CAM systems were able to reproduce the master cast surfaces very precisely with even more precision than the conventional manufacturing protocol. The findings of the present study explain the observed clinical excellence of CAD/CAM-fabricated dentures regarding retention.

Reference

1. Steinmassl, O., Dumfahrt, H., Grunert, I. et al. CAD/CAM produces dentures with improved fit. Clin Oral Invest. 2018; 22: 2829.