What's new for the clinician – summaries of recently published papers (March 2024)

SADJ March 2024, Vol. 79 No.2 p109-112

Edited and compiled by Prof V Yengopal, Faculty of Dentistry, University of the Western Cape

1. INVESTIGATING THE POTENTIAL CLINICAL IMPACT OF PERIODONTITIS ON THE PROGRESSION OF ALZHEIMER'S DISEASE: A PROSPECTIVE COHORT STUDY

Alzheimer's disease (AD), which is characterised by insidious onset and progressive deterioration in behavioural and cognitive functions, is a neurodegenerative disease that commonly affects the central nervous system (CNS).[1] The prevalence of AD increases with advancing age and, after the age of 65, the risk of AD doubles every five years. It is more common in women than men.[1] It is thought that chronic inflammatory diseases and conditions in peripheral organs such as cardiovascular disease, diabetes and periodontitis can affect the inflammatory state in the CNS and exacerbate the molecular pathology of AD.[1]

The current literature shows that periodontal disease can affect AD via multiple ways. It is thought that understanding the causal relationship between periodontal disease and AD may be effective in preventing the incurable AD or in reducing cognitive decline[1]. Karaduran and colleagues (2023)[1] reported on a study that sought to investigate the relationship between the current periodontal and occlusal relationship status and the rate of AD progression in individuals with AD. Their hypothesis was that periodontitis may accelerate the rate of AD progression.

METHODOLOGY

This study was designed according to the STROBE (STrengthening the Reporting of OBservational studies in Epidemiology) statement.

Systemic anamnesis of the participants were taken at their initial appointment in a neurology department. Their diagnosis and medical records were reviewed, and dental anamnesis was obtained to ensure all participants met the inclusion criteria. Ninety participants who met the National Institute of Neurological and Communicative Disorders and Stroke-Alzheimer's Disease and Related Disorders Association (NINCDS-ADRDA) and DSM-V diagnostic criteria for probable Alzheimer's disease were divided into 3 groups as Stage I (mild), Stage II (moderate) and Stage III (severe) according to the Clinical Dementia Rating Scale.

Those who have been diagnosed with probable AD in the age range of 50-89 years, not having dementia other than Alzheimer's-type dementia, not having psychiatric disorders affecting cognitive status, not using regular anti-inflammatory, corticosteroids and drugs that affect cognitive status, and non-smokers were included in the study. Patients who received any dental treatment in the past year, had systemic disease not under control other than AD (diabetes and cardiovascular disease) and had less than 10 with the edentulousness was not prosthetically rehabilitated were excluded from the study.

All participants were found eligible for cognitive status assessment, and cognitive status was assessed using Standardised Mini-Mental Test (SMMT) scores. With SMMT, it is possible to understand the process of AD in the individual. In this test, which lasts for 10 minutes in total, 30 questions are asked to evaluate the individual's time, recording memory, attention and calculation, recall and language. The score obtained by the individual with SMMT varies between 0 and 30. The SMMT score was determined at the participants' first appointments in the neurology department and at the six-month follow-up appointments. The change in the SMMT score (ΔSMMT) between the follow-up periods was calculated.

Participants were referred to the periodontology department at the six-month follow-up appointment in the neurology department. Dental anamnesis of the patients was taken and intraoral examinations were performed in the periodontology department. Periodontal examination of all existing teeth of all participants with at least one remaining tooth (excluding third molars) with a Williams-marked periodontal probe and all molars and maxillary first premolars with Nabers probe was performed. Percentage of dental plaque (P%) and percentage of bleeding on probing (BOP%), clinical attachment level (CAL) and probing pocket depth (PPD) were recorded. PPD and CAL were measured at six sites/teeth (excluding third molars). The current occlusal relationship status of all patients was evaluated using the Eichner Index and classified as Type 1 (A1-A2-A3-B1), Type 2 (B2-B3) and Type 3 (B4-C1-C2-C3). Also, the current C-Reactive Protein (CRP) value of Alzheimer's patients, measured within the six months before the date of participation, was retrospectively determined and recorded.

RESULTS

When comparing the ages of Alzheimer's patients according to the stages, there was no significant difference between Stage I and Stage II groups, although Stage III patients had a significantly higher mean age than Stage I and Stage II patients ($p<0.05$). There was no significant difference between the groups in terms of gender and the presence or absence of systemic disease that is under control ($p>0.05$).

The initial (T0), the sixth month (T1) and the ΔSMMT scores were analysed based on the current toothed/edentulousness status of the patients. ΔSMMT was significantly higher in Stage III than in Stage I ($p=0.000$) and

Stage II (p=0.001) Alzheimer groups. Furthermore, it was determined that the SMMT0 and SMMT1 scores of the Stage III edentulous Alzheimer's patients were significantly lower than those of the Stage I Alzheimer's patients (p<0.05), and there was no difference between the Stage I and Stage II Alzheimer's patients (p>0.05). In addition, it was determined that there was no significant difference between the groups in the ΔSMMT (p>0.05).

Ninety Alzheimer's patients consisted of 25 edentulous individuals without periodontal disease and 65 toothed individuals diagnosed with periodontitis. Accordingly, initial SMMT, six-month SMMT and ΔSMMT of the study population were also analysed according to the presence of current periodontal disease. When the initial and six-month SMMT score values were evaluated according to the presence of periodontal disease, T0 and T1 SMMT scores did not differ between the groups (p>0.05); however, ΔSMMT scores in patients having periodontitis were higher than those not having current periodontitis (p<0.05).

Although P% and number of teeth were not statistically different between groups (p>0.05), BOP% was significantly higher in the Stage III Alzheimer's group than in the other groups (p<0.05). In addition, CAL and PPD values were found to be significantly higher in Stage III than in Stage I Alzheimer's patients (p<0.05).

All participants included in the study were also evaluated based on their occlusal relationship and classified as Type 1, Type 2 and Type 3. The scores of initial (T0) and six-month (T1) SMMT and the change in evaluated time periods (ΔSMMT) were not statistically different between types which was determined according to the occlusal relationship (p>0.05). According to the occlusal relationship type, periodontal parameters were not statistically significant in patients with toothed Alzheimer's (p>0.05); on the other hand, as expected there was a significant difference in the number of teeth (p<0.05).

The serum CRP level was found to be significantly higher in the Stage III Alzheimer's group (4.46±3.68) than in the Stage I Alzheimer's group (2.22±2.53) (p<0.05). When the individuals were assessed according to their toothed/edentation status, serum CRP levels were found to be significantly higher in toothed Stage III Alzheimer's patients (5.36±3.65) than in toothed Stage I Alzheimer's patients (1.78±1.84) (p<0.05). Serum CRP levels did not differ between the Alzheimer's stages in edentulous patients.

Correlation analysis was performed between the clinical and biochemical parameters of the study population. Age was positively correlated with BOP% and CAL and negatively correlated with SMMT0, SMMT1 and number of teeth (p<0.05). Furthermore, ΔSMMT scores were positively correlated with BOP% (r=0.308, p=0.013) and PPD (r=0.275, p=0.027) and the number of teeth (r=0.291, p=0.005) negatively correlated with SMMT0 and SMMT1 scores (p<0.05). Serum CRP levels were positively correlated with BOP% and negatively correlated with SMMT0 and SMMT1 scores (p<0.05).

Linear regression models showed that the individuals in the Stage II and Stage III Alzheimer's group, the age and presence of periodontitis variable had a statistically significant effect on ΔSMMT (p<0.05). Consequently, being in the Stage II group increased ΔSMMT by 0.249 units and being in the Stage III group by 0.673 units. It was determined that an increase in age by 1 unit decreased ΔSMMT by -0.040 units in Alzheimer's patients. In addition, presence of periodontitis was found to increase ΔSMMT by 0.425 units. The effects of female gender, presence of systemic disease under control and CRP level on ΔSMMT were not statistically significant (p>0.05).

CONCLUSION

The researchers found that the presence of periodontitis may accelerate the progression of AD. The occlusal relationship has no significant clinical effect on AD progression when the partial/total edentulism was prosthetically rehabilitated.

IMPLICATIONS FOR PRACTICE

These results once again highlight the link between systemic disease and oral health and also show the importance of good oral hygiene in slowing the progression of AD.

REFERENCE

1. Karaduran K, Aydogdu A, Gelisin O, Gunpinar S. Investigating the potential clinical impact of periodontitis on the progression of Alzheimer's disease: a prospective cohort study. Clinical Oral Investigations. 2023 Dec 30;28(1):67

2. IS CONE-BEAM COMPUTED TOMOGRAPHY (CBCT) AN ALTERNATIVE TO PLAIN RADIOGRAPHY IN ASSESSMENTS OF DENTAL DISEASE IN MEDICALLY COMPROMISED PATIENTS?

Patients who are about to undergo treatment due to head and neck malignancies, generalised tumour spread, organ transplant or severe infection are generally more thoroughly examined both clinically and radiographically to diagnose oral disease.[1] In Sweden, for example, health programmes have been designed to make, for example, cancer treatment nationally standardised – ie equal and efficient. Therefore, these patients may be excluded from a more individualised approach as regards the extent of the radiographic examination, ie the principles of ALARA (As Low As Reasonably Achievable) or ALADAIP (As Low As Diagnostically Acceptable being Indication-oriented and Patient-specific).

Due to their medical condition, these patients are more vulnerable than a healthy population. They may suffer from generalised fatigue due to reduced lung capacity, medication and the stress of their situation. Some of the patients with intraoral tumours suffer from intraoral pain, and others may have difficulties opening their mouth. All these conditions may influence their capability to cooperate in an intraoral radiographic examination (IO), thus impairing the image quality and the possibility of performing a correct diagnosis.

A dental radiographic examination is a crucial component to the clinical examination to diagnose dental diseases, monitor illness over time and choose the most appropriate treatment available and its effect in a long-term perspective. Still, a radiographic examination using intraorally placed detectors is the recommended radiographic technique in diagnosing the most common dental diseases. It may, however, require at least 18-20 images to fully cover the

dentate areas and adjacent bone in an individual with a complete dentition (32 teeth). This procedure is time-consuming and not always pleasant for the patient. Sometimes a panoramic radiograph (PX) is needed to complement the IO, for example when the intraoral technique is not feasible due to anatomical variants, reduced capacity to open the mouth, or pain secondary to intraoral tumours. When correctly performed, PX provides valuable information.

Since its introduction in the late 1990s, cone-beam computed tomography (CBCT) has gradually changed the concept of dental radiographic imaging with its availability and excellent tomographic images of the dentomaxillofacial region at a relatively low radiation dose compared to medical computed tomography (CT). These new CBCT devices perform, besides CBCT acquisition, panoramic and cephalometric imaging. This expanded range of applications has made them more accessible in general dentistry and may be an alternative radiographic method for patients who cannot tolerate intraorally placed detectors.

Lindfors and colleagues (2024)[1] from Sweden reported on a study that sought to compare the diagnostic agreement (unit of measure of agreement used was a Kappa score) of three radiographic modalities – IO, PX and CBCT – for diagnosis of dental disease in medically compromised patients.

METHODS

Three hundred medically compromised patients who were referred for a dental radiographic examination were invited to participate in the study. To be included, the patient had to be dentated or rehabilitated with dental implants, be able to sit in a chair without the support of a high neck rest, comprehend the patient information either by themselves or through an interpreter, and accept to participate.

All patients were referred to the Department of Maxillofacial Radiology to undergo radiographic examination. All patients were examined with IO and PX radiographs, according to the local standard protocol for this patient population. All patients who fulfilled the criteria for inclusion were then thoroughly informed of the study: the purpose, the increased radiation dose, how data would be stored and results presented. An additional CBCT scan was performed on those patients who accepted participation by signed confirmation.

The intraoral radiographic examinations (IO) were performed applying a parallel technique using a Focus, Instrumentarium radiographic equipment together with Sirona Schick 33 sensors (Sirona Dental). Exposure parameters used were 60kV, 7mA and exposure time varying between 0.16 and 0.25 seconds depending on dental region and patient size. The PX were obtained with an Orthophos XG 5 (Sirona Dental Systems). Scan time was 14.1 seconds and exposure settings varied between 8-15mA and 62-73kV depending on patient size. The CBCT examinations were performed using Veraviewepocs® 3D R 100 with a field-of-view (FOV) of 100mm × 80mm enclosing the complete dentition. The exposure settings were 85kV and 5mA and the scan time of 9.4 seconds was optimised for the diagnostic yield. The voxel size was 0.160mm. Quality assessment of radiographic examinations was continuously performed by an oral radiologist according to clinical procedures for the different imaging modalities, ie image area, projection geometry as regards intraoral imaging and panoramic radiographs, as well as FOV, and eventual presence of motion artifacts in CBCT-examinations. Retakes were made when necessary.

The observers were four senior board-certified specialists in dentomaxillofacial radiology in Sweden. The patients were divided among the observers as follows: observer 1 was allotted the first 60 consecutive patients, observer 2 the next consecutive 60 patients, and so on. Observer 4 (principal investigator) evaluated the 120 remaining consecutive patients.

The radiographic images were digitised and the images were displayed on two 21.3-inch colour LCD monitors. The CBCT examinations were viewed using software i-Dixel-3DX and the observers were able to use the software program to align the image planes to obtain the best visualisation for each diagnostic task and tooth/root.

No clinical data was available for the observers. Initially and prior to the evaluation, the observers were calibrated. For each observer, the images on all the allotted patients were evaluated separately, ie first the intraoral radiographs on all patients, then the panoramic and, finally, the CBCT images on all patients. The assessment of the different imaging modalities was separated in time by at least 1 month.

To facilitate the recording of findings, a template was made using Microsoft Access Office 2010. Each observer had three different Access files – one for the basic number of patients (60 or 120 individuals) and two additional for calculating inter- and intra-observer agreement. Each Access file consisted of templates with all 32 teeth positions available with a corresponding square below for scoring. In every Access file, there were nine different templates, one for each modality and for the three different diagnostic tasks (periapical radiolucency, marginal bone level and caries lesions). For each patient, an overall assessment of the image quality for each radiographic method and all diagnoses was made. In total, 63,310 (63,198 teeth + 112 implants) scores were set in the main study and 432 to calculate inter- and intra-observer agreement.

The following variables were evaluated:

Periapical lesions: The unit was the tooth regardless of the number of roots. Impacted teeth were excluded and scored missing: 1, no disease (including widened periodontal ligament); 2, disease (periapical lesion irrespective of size and/or location); 3, not possible to evaluate due to artifact; 4, not possible to evaluate due to not depicted; 5, missing tooth.

Marginal bone level (Tooth): The unit was the tooth: 1, no disease (marginal bone level ≤ 5mm from the cemento-enamel junction (CEJ)); 2, disease (marginal bone level > 5mm from CEJ); 3-5 see periapical evaluation.

Marginal bone level (Dental implant): The unit was the implant: 6, no disease (marginal bone level ≤ 3mm apical to the reference point; 7, disease (marginal bone level > 3mm apical to the reference point); 8, not possible to evaluate due to artifact; 9, not possible to evaluate due to not depicted.

Caries lesions: The unit was the tooth: 1, no disease (no

caries lesion including the enamel); 2, disease (caries in the dentin and/or root surface and secondary caries); 3-5 see periapical evaluation.

For each patient and modality, regardless of diagnostic task, all observers evaluated the image quality according to a score: excellent (1), good (2), acceptable (3) and poor (4).

RESULTS

The highest agreement represented by the Kappa value was found diagnosing periapical radiolucency, comparing IO and CBCT (0.76). This sample group was also the largest with 6,856 assessments which means that 97.7% of all 7,020 teeth were assessable for diagnosis in this group. Diagnosing marginal bone level, the Kappa value varied between 0.58 and 0.60 comparing the different modalities. This group consisted of 6,534 assessable teeth (93.1%). When assessing marginal bone level at dental implants, the Kappa values when comparing CBCT and PX and IO and CBCT were low, 0.18 and 0.29, respectively, representing "none to slight agreement" and 0.43 comparing PX to IO representing "moderate agreement". In diagnosing caries, only 44.4% of all teeth were assessable in CBCT when compared to IO (Kappa value 0.68). The Kappa value for PX and IO and CBCT and PX in diagnosing caries was 0.54 and 0.57, respectively.

The intra-observer agreement, for all modalities and diagnoses, was for one of the observers an "almost perfect agreement" (Kappa values between 0.87 and 0.93). For the other observers, the agreement was considered "moderate" or "substantial" (Kappa values between 0.5 and 0.73).

Overall inter-observer agreement for each modality and diagnosis showed a variety from "moderate" to "almost perfect agreement" (Kappa value between 0.51 and 0.87).

CONCLUSION

The researchers concluded that intraoral radiography was the first-hand choice for diagnosing dental disease. For some rare cases where intraoral imaging is not possible, a dedicated panoramic image and/or CBCT examination is an alternative.

IMPLICATIONS FOR PRACTICE

IO radiography is available at almost all practices and should be the primary source of radiographic investigation for the presence of dental disease.

REFERENCE

1. Lindfors N, Ekestubbe A, Frisk F, Lund H. Is cone-beam computed tomography (CBCT) an alternative to plain radiography in assessments of dental disease? A study of method agreement in a medically compromised patient population. Clinical Oral Investigations. 2024 Jan 30;28(2):12