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study

Periodontitis and cognitive impairment

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Background

Cognitive impairment or dementia has increased rapidly in recent years and become a worldwide issue. In the United States, the adjusted prevalence of dementia in 2015 was 8.24%. Age seems to be a very important factor, but there are also many chronic diseases that contribute to cognitive decline.

There is research available on the relationships between cognitive functions and chronic diseases including stroke, cardiovascular disease, and metabolic syndrome through various mechanisms such as microvascular disease, irregular glycation end-products, and chronic inflammation.

Periodontitis is a common, chronic inflammatory oral disease associated with risk indicators – such as cardiovascular disease and metabolic syndrome – similar to those for cognitive impairment. Outcomes of several studies have indicated a correlation between dementia and the number of remaining teeth or a faster change in the Alzheimer's Disease Assessment Scale (ADAS-cog) score in participants with periodontitis over an observation time of six months.

A possible relationship between periodontitis and cognitive impairment may be explained by the following main mechanisms:

a) periodontitis is associated with impaired systemic arterial endothelial function, which in turn is associated with cerebral white-matter hyperintensities, vascular dementia, and Alzheimer's disease; b) periodontitis results in elevated systemic inflammation, which is directly associated with the pathogenesis of cognitive impairment.

In the USA, the National Health and Nutrition Examinations Survey (NHANES) III used three validated cognitive tests – the simple reaction-time test (SRTT), the symbol-digit substitution test (SDST), and the serial digit learning test (SDLT) – to investigate the relationship between cognitive impairment and obesity, liver disease, and all-cause mortality.

However, research on the direct association between cognitive-function tests and periodontitis is limited.

Aims

The aim of the present study was to investigate the direct association between cognitive impairment and periodontitis by analysing the NHANES III database after adjusting for potential confounding factors.

Materials & methods

- Data were obtained from NHANES III, a cross-sectional study conducted from 1988 to 1994. NHANES was used to investigate the overall health and nutritional status of a non-institutional population in the United States.
- In total, 4,663 participants aged between 20 and 59 years who had received full-mouth periodontal examination and undergone cognitive functional tests were enrolled.
- The grade of periodontal disease was categorised as severe, moderate, or mild (Table 1). Cognitive-function tests – SRTT, SDST, and SDLT – were used to evaluate cognitive impairment.
- In addition, other covariates were collected including age, social-network index, race/ethnicity, gender, education, physical activity, blood pressure, smoking status, and medical conditions (e.g. stroke and congestive heart failure).

Table 1

Definitions of subjects according to different severity of periodontitis

Subject	Definition
No periodontitis	No evidence of mild, moderate, or severe periodontitis
Mild periodontitis	≥two interproximal sites with attachment loss (AL) ≥3mm and <4mm and ≥two interproximal sites with probing depth (PD) ≥4 mm not on the same tooth, or one site with PD ≥5mm
Moderate periodontitis	≥two interproximal sites with AL ≥4mm and <6mm not on the same tooth or ≥two interproximal sites with PD ≥5mm not on the same tooth
Severe periodontitis	≥two interproximal sites with AL ≥6mm not on the same tooth and ≥one or more interproximal sites with PD ≥5mm

Results

- Subjects with mild and moderate to severe periodontitis had higher SDST and SDLT scores, indicating decreased cognitive function compared with the no-periodontitis group.
- After adjusting for demographic factors, education, smoking, cardiovascular diseases, and laboratory data, periodontitis was significantly correlated with elevated SDST and SDLT scores.
- Although there was an increased SRTT score in subjects with moderate to severe periodontitis, no significant differences were shown between the groups.
- All investigated variables – including age, gender, education, race/ethnicity, stroke, ideal physical activity, smoking, and blood-examination values – were significantly associated with periodontitis, except for social-network index and congestive heart failure.

Limitations

- All parameters were assessed cross-sectionally and in a cohort of young subjects aged 20-59 years.
- It is plausible that subjects with impaired cognition tend not to maintain an adequate level of oral hygiene and oral health. But objective oral-hygiene assessment and plaque indices of the investigated subjects were not collected in NHANES III.
- The possibility of missing residual confounding factors cannot be excluded.

Conclusions & impact

- Periodontal status was associated with cognitive impairment in a nationally representative sample of US adults.
- SDST and SDLT scores were significantly higher in individuals with mild and moderate to severe periodontitis. SRTT scores showed no statistically significant difference between patients with periodontitis and those without the disease.
- Individuals with dementia require special attention in overall healthcare. Furthermore, the diagnosis of cognitive impairment or dementia should lead to a dental examination followed by dental treatment, if necessary.

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