Rev. CENIC Cienc. Biol.; Vol. 55. (continuous publication).151-163. Year.2024. e-ISSN: 2221-2450.

RESEARCH ARTICLE

RELATIONSHIP BETWEEN PERIODONTITIS AND CEREBROVASCULAR DISEASE

RELACIÓN ENTRE PERIODONTITIS Y ENFERMEDAD CEREBROVASCULAR

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Received: April 10th, 2024; Accepted: May 28th, 2024;

ABSTRACT

Introduction: Periodontitis is a disease caused by the destruction of tooth support tissues due to the entry of pathogenic microorganisms. A high level of periodontopathogenic bacteria is linked to ischemic strokes, independent of the existence of other risk factors. However, the relationship between periodontitis and cerebrovascular disease from a clinical point of view is still insufficient to protocolize it as a risk factor for cerebrovascular disease. **Objective:** To analyze the behavior of the relationship between periodontitis and cerebrovascular disease in a stratum of the population treated at the Institute of Neurology and Neurosurgery in the period between May/2021-May/2023. **Materials and methods:** A descriptive cross-sectional study was carried out. The study universe consisted of patients of both sexes with a diagnosis of cerebrovascular disease, who attended the Neurology consultation in the time period established for the study. Data collection was carried out through the neurology and periodontal clinical history, which was carried out on a data collection form, and descriptive methods were used for statistical analysis. **Results:** The study predominated female patients, aged between 71-85 years. The most common type of cerebrovascular disease was the transient ischemic attack and in terms of severity, a greater number of patients without neurological deficit were observed. With respect to periodontitis, the incipient and moderate forms of this disease predominated. Incipient and moderate forms of periodontitis were found in patients with transient ischemia attack who did not present neurological deficit. **Conclusions:** Incipient or moderate forms of periodontitis predominated in the population studied and the most common type of cerebrovascular disease was the transient attack of ischemia.

Keywords: periodontitis, cerebrovascular disease, stroke, transient ischemia attack.

RESUMEN

Introducción: La periodontitis es una enfermedad causada por la destrucción de los tejidos de soporte del diente debido al ingreso de microorganismos patógenos. Un nivel elevado de bacterias periodontopatógenas, se vinculan con los accidentes cerebrovasculares de tipo isquémico, independiente de la existencia de otros factores de riesgo. Sin embargo, la relación entre la periodontitis y la enfermedad cerebrovascular desde el punto de vista clínico, es aún insuficiente para protocolizarla como factor de riesgo de la enfermedad cerebrovascular. **Objetivo:** Analizar el comportamiento de la relación entre periodontitis y enfermedad cerebrovascular en un estrato de la población atendida en el Instituto de Neurología y Neurocirugía en el período comprendido entre Mayo/2021-Mayo/2023. **Materiales y métodos:** Se realizó un estudio descriptivo de corte transversal. El universo de estudio estuvo constituido por pacientes de ambos sexos con diagnóstico de enfermedad cerebrovascular, que asistieron a la consulta de Neurología en el período de tiempo establecido para el estudio. La recolección de los datos se realizó mediante la historia clínica de neurología y la periodontal, lo que se llevó a un formulario de recolección de datos, y para su análisis estadístico se utilizaron métodos descriptivos. **Resultados:** En el estudio predominaron pacientes del sexo femenino, con edades entre 71-85 años. El tipo de enfermedad cerebrovascular más frecuente fue el ataque transitorio de isquemia y en cuanto a la gravedad se observó mayor cantidad de pacientes sin déficit neurológico. Con respecto a la periodontitis predominaron las formas incipientes y moderadas de esta enfermedad. Se encontraron formas incipientes y moderadas de periodontitis en los pacientes con ataque transitorio de isquemia que no presentaron déficit neurológico. **Conclusiones:** En la población estudiada predominaron las formas incipientes o moderadas de periodontitis y el tipo de enfermedad cerebrovascular más frecuente fue el ataque transitorio de isquemia.

Palabras clave: periodontitis, enfermedad cerebrovascular, ictus, ataque transitorio de isquemia.

INTRODUCTION

Periodontitis is a disease caused by the destruction of tooth support tissues due to the entry of pathogenic microorganisms, and may be induced by local and systemic factors (Tenesaca, 2020).

This condition occupies second place in the ranking of oral health problems, increasing the evidence for it to be considered an important public health problem at a global level (Pardo and Hernández, 2018). It harms 50% of young adults and 60% of the elderly, who are 65 years of age and older (López, 2021).

Unlike other parts of the body, the mouth is a habitat with various microorganisms that can become pathological. Knowledge of this microbial flora has led to the verification of various bacteria associated with periodontitis, which create an inflammatory condition that may be related with systemic diseases (Tenesaca, 2020).

Most studies confirm that there is a statistical association between this disease and premature births, low birth weight children, rheumatoid arthritis, cerebrovascular and cardiovascular diseases, among others (Martínez *et al.,* 2020).

Cerebrovascular disease refers to any disorder in which an area of the brain is temporarily or permanently affected by ischemia or hemorrhage (González *et al.*, 2018).

The risk factors that are most related to these diseases are: age, sex, race, family history of cerebrovascular disease, high blood pressure, heart disease (atrial fibrillation), diabetes mellitus, hypercholesterolemia, obesity and smoking (Barrios *et al.*, 2020).

The progressive aging of the world population is imposing new challenges on modern medicine, which brings with it a varied number of clinical and epidemiological problems associated with these ages, where neurological diseases occupy a predominant place (Piloto *et al.*, 2015). It has been considered one of the next epidemics, with a global incidence each year of 200 cases per 100,000 inhabitants and a morbidity of around 40 cases per 100,000 inhabitants (Anuario Estadístico de Salud, 2019).

It is known that a cerebrovascular event occurs every 53 seconds and one of these people dies every 3.3 minutes; one in ten people who suffer a stroke dies in the first attack, half of those who survive die within four to five years, and its recurrence is the most frequent cause of deaths from this pathology. Between 5 and 8 per 1,000 people over 25 years of age present disability in relation to a previous stroke, having repercussions in the psychological, economic and social sphere (González & Navarro, 2020).

In Cuba, statistics show that cerebrovascular diseases are the third cause of death after cardiovascular diseases and cancer, with the western and central provinces being the most at risk due to having the oldest population in the country (Anuario Estadístico de Salud, 2019). According to the statistical yearbook, in 2020 there were 10,821 deaths from this cause for a crude rate of 96.6 per 10,000 inhabitants (Anuario Estadístico de Salud, 2020). In 2021 it increased to 10,980 deaths for a crude rate of 98 per 10,000 inhabitants (Anuario Estadístico de Salud, 2021).

In Havana, it behaves the same as at the country level, and occupies third place among the causes of death with a total of 2,266 deaths from this cause, with a gross rate of 106.7 per 100 thousand inhabitants, which is higher than that of the country (Anuario Estadístico de Salud, 2019).

In recent years, there has been a considerable increase in the number of patients attending neurology consultations with a history of stroke without classic risk factors for this disease, which has led to the analysis of new candidates for risk factors, including periodontitis. Periodontopathogenic bacteria have the capacity to alter endothelial homeostasis, promoting a prothrombotic and proatherogenic state, which can produce ischemic cerebral infarctions (Gualtero, 2018).

Subgingival biofilms represent a large microbial load that continuously favors the proliferation of highly virulent anaerobic species; such as Porphyromonas gingivalis, which can "travel" to distant sites, reach and establish itself in the walls of large and medium-sized vessels, overexpressing adhesion molecules and transforming into foam cells characteristic of the atherogenic phenomenon and its consequent diseases. Simple procedures such as tooth brushing can facilitate these bacteremias (González, 2019).

A high level of periodontopathogenic bacteria is linked to ischemic strokes, independent of the existence of other risk factors such as age, sex, hypertension, smoking and alcohol habits, and history of coronary and cerebrovascular disease. It is curious how two diseases so different in terms of their clinical manifestations, severity and systemic impact, can have some relationship (González, 2019).

The results of the studies carried out to date are not yet conclusive to establish any link between both pathologies (periodontitis and cerebrovascular disease), so our objective in this work is to analyze the behavior of these diseases in a stratum of the population treated at the Institute of Neurology and Neurosurgery in the period between May/2021-May/2023.

MATERIALS AND METHODS

A descriptive cross-sectional study was carried out.

Universe or sample

The study universe consisted of patients of both sexes, aged between 30 and 85 years and diagnosed with cerebrovascular disease, who attended a Neurology consultation at the Institute of Neurology and Neurosurgery, in the period from May/2021 to May/2023, after signing their written consent to participate in the study.

Inclusion criteria

• Patients without severe disability that makes locomotion impossible or prevents performing oral hygiene maneuvers.
• Patients who demonstrate brushing efficiency of 0 to 20%.

Exclusion criteria

• Smoking patients.
• Patients who are receiving periodontal treatment or have been discharged in less than six months.
• Patients who have taken antibiotics in the last three months.
• Patients with diabetes mellitus.
• Edentulous patients.
• Abandonment or repeated absences from the Neurology consultation, or incomplete results of complementary examinations. (Table 1)

Table 1. Operationalization of variables

Variables	Clasification	Scale	Description
Age	Quantitative Keep going	30-44 years 45-59 years 60-70 years 71-85 years	Years of life completed
Sex	Qualitative Nominal Dichotomus	Female Male	According to reference biological sex
Severity of cerebrovascular disease	Qualitative Ordinal	0: non deficit 1: minimun deficit 2-5: mild 6-15: moderate 15-20: important deficit >20: serious	According to criteria of the National Institute of Health Stroke Scale (NIHSS) (Fernández *et al*, 2019)
Type of cerebrovascular disease	Qualitative Nominal Politomica	Ischemia -Leukoaraiosis -Transient ischemia -Cerebral stroke Haemorrhage -Cerebral (intraparenchymal, ventricular) -Subarachnoid	Depending on the duration of the neurological condition, physical examination and complementary examinations.
Presence and severity of periodontitis	Qualitative Ordinal	Code 8: Advanced periodontitis Code 6: Periodontitis incipient or moderate Code 2: Gingivitis Code 1: Mild Gingivitis Code 0: Healthy	According to criteria of the Russell periodontal index (Russell, 1956)

Information collection and processing methods

The collection of neurological data reported and evaluated by the Neurologist included the type of cerebrovascular disease and its severity.

The Periodontics specialists performed the clinical oral examination on the patients, in order to determine the carriers of chronic periodontitis according to criteria of the Russell Periodontal Index form revised World Health Organization (Subbappa et al., 2019) and subsequently the selected patients attended the consultation of Periodontics, where the Love Oral Hygiene Analysis Index (IAHB-Love) was performed (American Academy of Periodontology Research, Science, and Therapy Committee, 2005).

The Periodontal Clinical History recorded the severity of periodontitis according to criteria of the Russell Periodontal Index (Subbappa et al., 2019), as well as the treatment possibilities. Each of these patients received the dental care they needed according to their diagnosis.
The periodontal physical examination was performed with required instruments in a dental chair of the Periodontics department, with an adequate position that allowed the oral examination to be carried out according to the order established in the stomatological standards.

The collection or information models were the following

1. Clinical history of Neurology and Periodontology.
2. Patient informed consent records.
3. Russell periodontal index (Subbappa et al., 2019)
4. NIHSS Neurological Scale (Montaner & Alvarez, 2016)

Once the data was collected, the emptying table was created that allowed the analysis of the information. All information was reviewed, classified and subjected to different types of statistical analysis.

RESULTS

Table 2 show the distribution of patients by age and sex. Female patients predominated (58.8%) and in terms of age, patients between 71 and 85 years old (58.8%).

Table 2. Distribution by age and sex

	N	%
Age (years)		
30 – 44	1	2.0
45 – 59	5	9.8
60 – 70	15	29.4
71 – 85	30	58.8
Total	**51**	**100**
Sex		
Female	30	58.8
Male	21	41.2
Total	**51**	**100**

n number of patients

Table 3 shows the severity and type of cerebrovascular disease of patients included in this study. As can be seen, in terms of the severity of the cerebrovascular disease, patients without neurological deficit predominated (82.4%) and the type of cerebrovascular disease where it is observed that the transient ischemia attack was the most frequent (68.6%).

Table 3. Severity and type of cerebrovascular disease (CVD)

	N	%
CVD		
No déficit	42	82.4
Minimun déficit	9	17.6
Total	**51**	**100**
Type of CVD		
Transient ischemia attack	35	68.6
Cerebral stroke	10	19.6
Cerebral haemorrhage	2	3.9
Leukoaraiosis	4	7.8
Total	**51**	**100**

n number of patients

Table 4. Shows the severity of periodontitis. Regarding the severity of periodontitis, incipient or moderate forms were more common (78.4%)

Tabla 4. Severity of periodontitis

Severity of periodontitis	n	%
Incipient or moderate	40	78.4
Serious	11	21.6
Total	**51**	**100**

n number of patients

Table 5 shows the presence and severity of periodontitis according to age group. It is note how patients aged 70 and over with incipient and moderate forms of periodontitis predominated with a total of 22 for 73.3%.

Table 5. Presence and severity of periodontitis according to age group

Age (years)	Severity of periodontitis					
	Incipient or moderate		Serious		**Total**	
	n	**%**	**n**	**%**	**n**	**%**
30-44	1	100	0	0.0	**1**	**100**
45-59	4	80.0	1	20.0	**5**	**100**
60-70	13	86.7	2	13.0	**15**	**100**
71-85	22	73.3	8	26.7	**30**	**100**
Total	**40**	**78.4**	**11**	**21.6**	**51**	**100**

n number of patients

Table 6 shows the type of cerebrovascular disease according to age group. A predominance of transient ischemia attack in the group of patients aged between 71 and 85 years (23; 76.7%).

Table 6. Type of cerebrovascular disease according to age group

Age (years)	Type of cerebrovascular disease									
	Transient ischemia attack		Cerebral stroke		Cerebral haemorrhage		Leukoaraiosis		**Total**	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
30 - 44	0	0.0	1	100	0	0.0	0	0.0	**1**	**100**
45 - 59	2	40.0	2	40.0	0	0.0	1	20	**5**	**100**
60 - 70	10	66.7	2	13.3	2	13.3	1	6.7	**15**	**100**
71 - 85	23	76.7	5	16.7	0	0.0	2	6.7	**30**	**100**
Total	**35**	**68.6**	**10**	**19.6**	**2**	**3.9**	**4**	**7.8**	**51**	**100**

n number of patients

Figure 1 shows the severity of cerebrovascular disease according to the presence and severity of periodontitis. It is note how there was a greater number of patients (42) without neurological deficit, among whom the incipient or moderate forms of periodontitis predominated (40, 78.4%). Patients who presented a minimal neurological deficit also suffered from a predominance of incipient or moderate forms of periodontitis with 8 (88.9%).

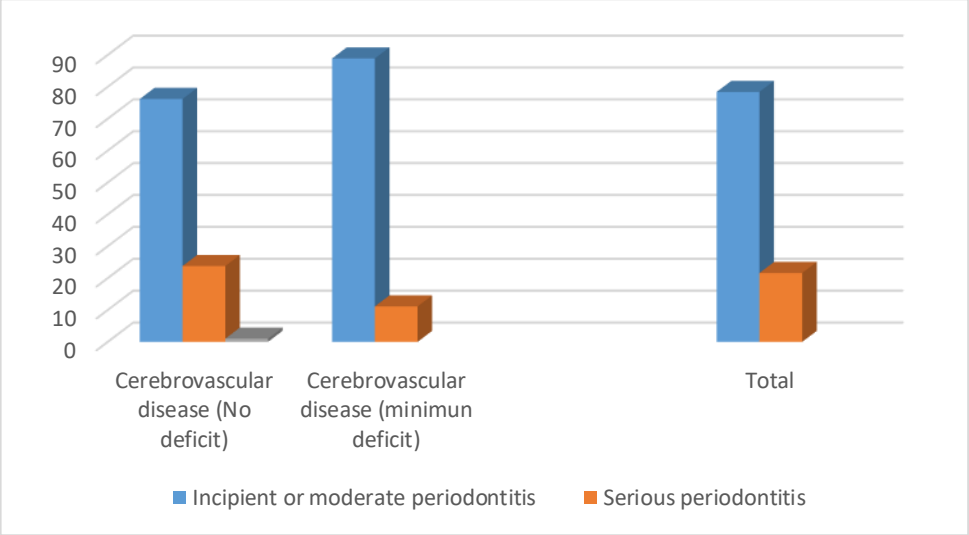

Fig. 1. *Severity of cerebrovascular disease according to the presence and severity of periodontitis.*

The Figure 2 shows how incipient or moderate forms of periodontitis predominated among patients without neurological deficit (32; 80%). Severe forms of periodontitis were also observed within the group without neurological deficit (10; 90.9%).

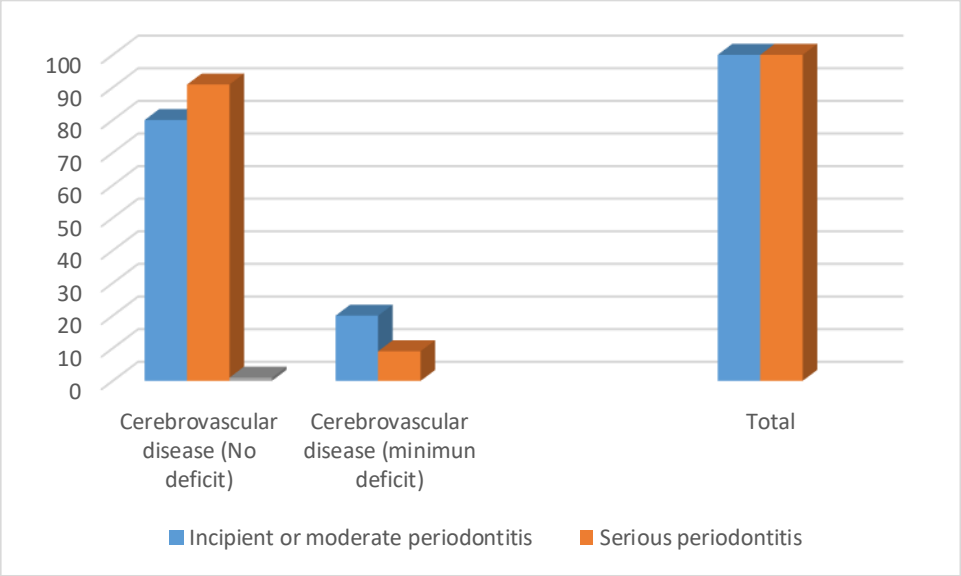

Fig. 2. *Presence and severity of periodontitis according to the severity of cerebrovascular disease.*

Figure 3 shows the type of cerebrovascular disease and presence and severity of periodontitis. It is note how there was a greater presence of transient ischemia attack in patients with incipient or moderate forms of periodontitis (27; 77.1%). Cerebral infarctions, cerebral hemorrhages and leukoarayosis also showed a predominance of incipient or moderate forms of periodontitis

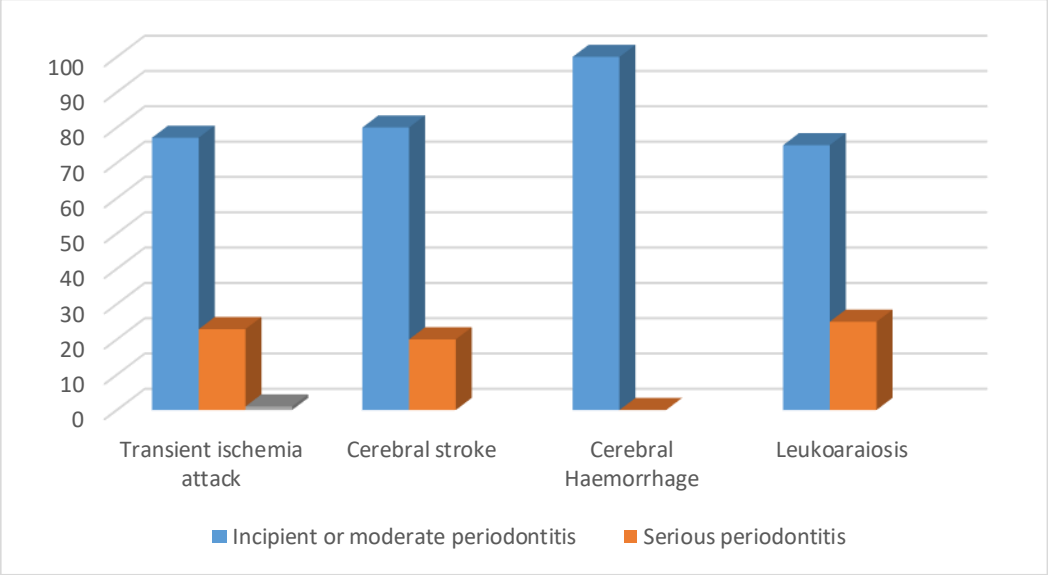

***Fig. 3**. Type of cerebrovascular disease and presence and severity of periodontitis.*

DISCUSSION

In this work, the demographic characteristics of the population studied revealed a predominance of the group aged between 71-85 years and a greater frequency of the female sex.

Worldwide, among chronic diseases, cerebrovascular disease is the third cause of death and the second cause of disability, mainly affecting older adults (Barrera & Cabezas, 2021).

With increasing age, the presence of diseases such as hypertension, diabetes and dyslipidemia predominates. Inadequate lifestyles with little physical movement, obesity and smoking are becoming more frequent, contributing to diseases such as cerebrovascular disease (Botero et al., 2021).

Approximately 4 to 5% of adults over 50 years of age and 8 to 10% of those over 65 years of age are affected by this disease (Botero et al., 2021).

Knowledge and modification of the main risk factors: high blood pressure, smoking and diabetes mellitus is of vital importance, through health education and primary prevention in the entire population (Botero et al., 2021).

It is stated that this disease increases its incidence more frequently when the atherosclerotic processes reach their maximum expression, therefore, the increase in the average age of the Cuban population determines the increase in the percentage of strokes (Piloto et al., 2020).

In summary, there is a great relationship between cerebral vascular disease and aging, which is a biological process in which physiological changes occur in vascular structures, which predisposes them to occlusive events (De la Garza et al., 2018).

Regarding the predominance found in the female sex, it coincides with the results of Flores et al, which have shown that women have a longer life expectancy, after the age of 50 they lose the protective role of estrogens on the vascular system and it is from this age onwards that the highest incidence of cerebrovascular disease exists (Flores et al., 2008).

The results of this research also agree with González et al, who found a predominance of the female sex in patients with cerebral infarction. These authors report that in recent decades an increase in morbidity and mortality due to cerebral infarction in women has been observed, which is explained because their average age has also increased in accordance with important changes in their lifestyles, and some authors cite as another cause the consequences of the cessation of ovarian functioning mentioned previously (González et al., 2018).

According to Pérez et al, approximately three quarters of deaths in women due to this disease occur in the age groups of 70-79 years and older, coinciding in terms of sex and age with the results of this study (Pérez et al., 2019).

With respect to severity, it´s noted that ischemic patients register a similar mortality in both sexes; the same authors state that the majority of female deaths have been due to ischemic causes, aspects that agree according to sex and severity with those of the present investigation (Pérez et al., 2019).

The vascularization, the gingiva, the periodontal ligament, the cementum and the alveolar bone change as age advances, thus increasing the prevalence of periodontitis as age increases (Vivas et al., 2018).
A 56% prevalence of chronic periodontitis has been observed in female patients 40 years of age or older as a result of the loss of estrogen resulting from menopause, results that agree with what was found in this study (Vivas et al., 2018).
Regarding severity, a predominance of patients without neurological deficit was found, with the most frequent type being the transient ischemic attack.
The term cerebrovascular disease and stroke refer to an alteration in cerebral blood flow that results in a transient or permanent change in the function of one or more regions of the brain (Moreira et al., 2018).
Ischemic stroke is due to a lack of blood supply to a given area of the brain parenchyma, while hemorrhagic stroke is caused by the rupture of a cerebral blood vessel, with extravasation of blood into the vascular bed. Strokes are ischemic in 85% of cases, and the rest are hemorrhagic (Moreira et al., 2018).
Given the various subtypes of stroke, variations in disease progression profile, topographic features, differences in underlying mechanism and etiology, a wide number of terms can be used to describe cerebrovascular disease; being of great importance to correctly identify the causal mechanism in order to choose the most appropriate treatment and apply effective secondary prevention (Moreira et al., 2018).
The majority of all cases are of ischemic origin. Regarding the transient attack of ischemia, it should be noted that, although the term "transient" indicates a benign nature, which leaves no sequelae, these episodes should be considered an important warning sign of a cerebral infarction or other cardiovascular complications (Moreira et al., 2018).
Transient attacks of ischemia are mostly due to cerebral emboli originating from ulcerated atherosclerotic plaques located in the carotid or vertebral artery at the cervical level, or less frequently, from cardiac mural thrombi. Some cases are secondary to a brief decrease in blood flow through narrowed arteries (Guzmán et al., 2021).
Transient ischemic attacks always last less than 24 hours. Differentiation through the clinical method cannot be the only thing used to diagnose ischemic cerebrovascular disease, since there are many similarities with other forms of this and neurological conditions, so diagnostic means must be used (Guzmán et al., 2021).
Approximately 15% to 30% of all cerebral infarctions are preceded by a transient attack of ischemia, 17% of patients presenting with cerebral infarction may have had a transient ischemic attack on the same day, 9% on the previous day, and 43% during the previous seven days. Furthermore, patients who have suffered a transient attack of ischemia also have a poor long-term prognosis. Which has given rise to a new temporal definition of the transient ischemic attack as the ischemic event that causes a neurological deficit that lasts less than an hour and is not associated with cerebral infarction in neuroimaging studies, being one of the most frequent events (Salas et al., 2019).
The transient attack of ischemia is a premonitory sign of cerebral infarction according to Guzmán et al, with data from the BASIC Project of Southeast Texas, the presence of a cerebral infarction was observed in the majority of patients 90 days after the transient ischemic attack (Guzmán et al., 2021).
Cerebral infarction is considered a vascular epidemic in developed countries; in recent decades it has been identified as the second cause of death in the world population. In Cuba, mortality from cerebral infarction has increased in the last 30 years (Guzmán et al., 2021).
Today, transient ischemia attack should be considered a medical emergency. Each of them has its own pathophysiology, clinical picture and prognosis and, therefore, treatments differ. In summary, patients with transient ischemia attack should be considered a high vascular risk group (Moreira et al., 2019).
Another result of this work was the fact that the majority of patients with cerebrovascular disease included in the study, who did not present neurological deficits, had incipient and moderate forms of periodontitis.
The group investigated was fundamentally an elderly population, this could have influenced the results, it cannot be argued that advanced age is a necessary reason to suffer from this type of disease, but it is known that among its epidemiological characteristics is its close relationship with age. This could explain the behavior of the periodontal status in the subjects studied.
Special mention deserves the levels of oral hygiene in these advanced ages, which are deteriorate by psychological and motor dysfunctions typical of this age group, effects of xerostomic treatments, and other medications that can influence the increase in the prevalence of periodontal disease. The presence of supragingival plaque is another factor to take into account to explain the presence of this disease.
At the local level, the microorganisms in dental biofilms exhibit their virulence factors, such as the ability to adhere and evade, decrease or neutralize defense mechanisms. They cause direct damage by lytic enzymes, cytotoxic substances and inflammatory stimulants (González & Morales, 2016).

Specific bacterial factors such as lipoteitoic acid, lipopolysaccharides and surface-associated material induce bone resorption and are capable of causing indirect tissue damage through antigenic stimulation and activation of the alternative complement pathway (González & Morales, 2016).

There is increasing evidence that the inflammatory response plays a fundamental role in cerebral ischemia (González & Morales, 2016).

The endothelium performs important functions, which are advantageous in ensuring adequate maintenance of vascular tone in conditions where one of the vasoactive factor-mediated responses is compromise and favors a vasoconstrictive, prothrombotic and pro-inflammatory state (Kim et al., 2020).

Healthy vascular endothelium has an anti-inflammatory action, damaged endothelium is characterized by an imbalance between the bioavailability of vasodilators and recruitment factors derived from the endothelium that could be an initial step towards cardiovascular disease (Kim & Cáceres, 2020).

Products of inflammation, such as C-reactive protein (CRP), interleukin (IL)-1α, IL-1β, IL-6, tumor necrosis factor (TNF-α), prostaglandins (PGE2), and metalloproteinases, are thought to matrix (MPM), expressed in periodontitis, are released into the systemic circulation and can stimulate endothelial cells to produce other inflammatory markers that induce or exacerbate endothelial dysfunction (Leira et al., 2019).

Among the mechanisms that associate periodontitis with endothelial dysfunction, it is also believed that inflammatory markers, such as TNF-α and IL-6, which are expressed and increased in periodontitis, may reduce the production or bioavailability of nitric oxide, with an impact negative on vascular endothelium function and endothelium-dependent vasodilation (Leira et al., 2019).

In the systematic review carried out by Teeuw et al. (2014), it´s mentioned that periodontal treatment reduces biomarkers of atherosclerotic disease and could improve endothelial function.

Periodontal therapy does not have an effect on endothelial function over a period of three months. However, six months after periodontal therapy, it is associated with an improvement in mean dilation due to flow in the brachial artery, which is a method to evaluate endothelial function (Kim & Cáceres, 2020).

In the reviewed works, it was found that the treatment of periodontitis significantly decreases the CD34+ count (marker of primitive hematopoietic stem cells), as well as benefits after non-surgical periodontal treatment with respect to blood markers of vasodilation (Kim & Cáceres, 2020).

There are authors who believe that the association between periodontal and cerebrovascular disease lies in the secretory capacity of monocytes. These mediators play a fundamental role in the pathogenesis of periodontal disease, the increase and development of atherosclerotic lesions and thromboembolytic events (Kim & Cáceres, 2020).

Lin et al. (2019) in their study demonstrated that patients with periodontitis have a higher risk of complications and mortality associated with the occurrence of stroke. This risk was reduced after non-surgical periodontal treatment.

According to the research carried out by Vivas et al. (2018) fibrinogen levels are the only hematological parameter for which there is homogeneity of criteria in which mechanical debridement in the treatment of periodontitis manages to significantly reduce serum values, reducing the risk of cerebrovascular disease secondary to atherosclerotic process.

So this seems to be one of the most easily modifiable parameters through periodontal treatment, regardless of the systemic health status. Therefore, periodontal therapy can reduce the risk (Vivas et al., 2018).

Serum CRP levels have been increased in patients with periodontitis and its concentration has been proposed as a risk marker for atherosclerotic cerebrovascular disease. In the absence of inflammation, CRP levels of 3 mg/ml imply approximately double the cerebral cardiovascular risk (Vivas et al., 2018).

Regarding cytokines, the literature consulted indicates that a significant decrease in serum levels of IL-6 was obtained after non-surgical periodontal treatment compared to standard stomatological treatment (Vivas et al., 2018).

Fibrinogen is an important risk factor in atherosclerotic cerebrovascular disease; high levels indicate systemic inflammation. High amounts of fibrinogen increase blood viscosity, activate platelet aggregation and promote the migration and proliferation of smooth muscle cells. Periodontal treatment regarding serum fibrinogen levels significantly reduces its plasma concentrations (Vivas et al., 2018).

In a study carried out by Leyva et al, in patients with cerebrovascular disease and periodontitis, corroborates that the greatest statistical difference was recorded between the population group with ischemic stroke, being 1.721 mm ($p<0.0001$) for probing depth, and 2.134 mm ($p<0.0001$) for the clinical insertion level (Leyva et al., 2012).

Leyra et al reported a significant association between periodontitis and ischemic stroke in cohort studies (RR 2.52, 95% CI 1.77-3.58) and in case-control studies (OR 3.04, 95% CI 1.10-8.43) (Leyra et al., 2017).

Pradeep et al., studied 200 subjects, 100 cases (infarcted) and 100 controls, found that periodontal disease was more severe in the case group than in the control group, and proved by logistic regression that pocket depth was a risk factor, of highest significance among the other risk factors, followed by high blood pressure and tobacco consumption (Pradeep et al., 2010).

A retrospective cohort study carried out in the population of Taiwan determined that the risk of developing ischemic stroke was higher in participants with periodontitis. A similar result was obtained from a study carried out in the United States, where 10,362 people were selected, of which 6,736 were diagnosed with periodontitis and of them 299 presented ischemic stroke in a period of 15 years of follow-up (Andrade, 2023).

Subjects with periodontitis have 2.8 times the risk of suffering an ischemic stroke than those who do not have periodontitis (Leyra, 2023).

The chronic immuno-inflammatory response of periodontitis would trigger a prothrombotic state of hypercoagulability and vascular endothelial dysfunction that can increase the risk of both embolic and thrombotic events at the brain level (Leyra, 2023).

A significant reduction in the risk of cerebrovascular events (ischemic and hemorrhagic) has been observed in relation to different oral health interventions, including regular visits to the stomatologist (Leyra, 2023).

The association between periodontitis and dementia in subjects with periodontitis have 1,7 times the risk of suffering from Alzheimer's dementia than those who are periodontally healthy, demonstrating once again the relationship between this disease and brain conditions secondary to the atherosclerotic process (Leyra, 2023).

Individuals with periodontitis achieve worse results than periodontally healthy individuals in different neuropsychological tests for the evaluation of cognitive function (Leyra, 2023).

Periodontal disease and cerebrovascular disease risk factors, acting individually or synergistically, accelerate cerebral vascular damage. There is consensus on the benefit that primary prevention would provide, carrying out timely diagnosis and treatment in risk groups, that in specialized centers for the care of this type of conditions, including stomatological treatment would contribute to reducing the risk of complications and recurrence of these pathologies.

Greater knowledge of this association, starting with the medical profession, will allow prevention and treatment strategies for both diseases to be adequately transmitte to the population, representing a challenge and commitment for Stomatology that in this way would be providing quality of life to the population.

In this case, it is appropriate to continue researching and working towards the prevention of periodontal disease, emphasizing strategies that reduce its prevalence.

CONCLUSSION

In the patients studied, incipient or moderate forms of periodontitis predominated and the most common type of cerebrovascular disease was the transient attack of ischemia.

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CONTRIBUTION STATEMENT

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The authors declare that there is no conflict of interest.