

Descriptive Study About the Influence of General Health and Sociocultural Variables on the Periodontal Health of Early Menopausal Patients

Guillermo Machuca, Sonia Rodriguez, Maria-Angeles Martinez, Pedro Bullon, Carmen Machuca, Crispian Scully

Purpose: The purpose of the study was 1) to assess the periodontal condition of a population of early menopausal women and 2) to investigate the relationship between these and other variables such as demographics, oral hygiene and clinical variables. **Material and Methods:** A cross sectional study was developed at the outpatient section of a gynaecology department of a hospital in Seville, Spain, during one year. A sample of 67 menopausal women were periodontally evaluated. The periodontal variables studied were plaque index (PI), probing bleeding index (PBI), gingival level (GL), probing depth (PD) and clinical attachment level (CAL). The relationship with other demographic variables, oral hygiene and clinical variables were evaluated too. The statistical test used was ANOVA with post hoc test Bonferroni, multiple regression analysis and ANCOVA. The significance level was $p < 0.05$.

Results: The mean of PI was $69.3 \pm 3.07\%$. The PI was statistically significantly increased when frequency of brushing was lower ($p < 0.025$) and previous dental care was less frequent ($p < 0.0033$). The mean of PBI was $36.5 \pm 3.35\%$. The PBI was significant in relation to higher tobacco consumption ($p < 0.024$) and a less frequent previous dental care ($p < 0.014$). The mean of GL showed a gingival retraction of $-0.83 \pm 0.07\text{mm}$. The GL was significantly reduced in hypertensive patients ($p < 0.017$), in those on antihypertensive treatment ($p < 0.0097$) and in those who had had more than two previous pregnancies ($p < 0.0358$). The mean of CAL was $3.24 \pm 0.1\text{mm}$. The CAL was significantly reduced in individuals who smoked five to 20 cigarettes a day ($p < 0.005$). The mean of PD was $2.5 \pm 0.05\text{mm}$. This PD was correlated significantly with smoking five to 20 cigarettes a day ($p < 0.0003$).

Key words: provision of oral health; periodontal/epidermis; logical disease; periodontal/physiopathological disease; menopause/adverse effects

INTRODUCTION

Periodontists must acquire knowledge of relevant systemic conditions to interact meaningfully with medical colleagues and to know the modifying factors of periodontal disease. The emergence of sex-specific associations between periodontitis and certain systemic disorders has prompted researchers to investigate the possibility of associa-

tions between periodontitis and specific women's health issues (Krejci and Bissada, 2002). The menopause is a physiological process that takes place in the fourth to fifth decade of a woman's life, when permanent cessation of menstruation occurs. This process is based on hormonal changes that will result in a series of general clinical manifestations that have become particularly important because of women's increased life expectancy,

with the implication that most women will suffer these symptoms during the last third of their lives. Among the clinical manifestations that may be encountered at this stage of life is an increase in the symptoms of periodontal disease (Genco and Grossi, 1998), including the exhibition of more severe attachment loss than premenopausal women (Grossi, 1998), but the possible influence of some secondary effects of the menopause - such as osteoporosis/osteopenia - as modifying factors in loss of periodontal attachment is the subject of some debate (Jenkins and Kinane, 1989; Tarkkila et al, 2001; Tezal et al, 2000). In this sense, some findings are relevant that systemic bone mass may not be an important factor in the pathogenesis of periodontitis (Elders et al, 1992). It may be that other factors could have a more relevant role in the developing of periodontal lesions in postmenopausal patients than the generalized loss of bone mass. In this way, changes have been observed in gingival scores during the menstrual cycles of periodontally healthy women (Machtei et al, 2004), so the hormonal changes could play a relevant role at the moment of cessation of menstruation.

In addition, the appearance of concomitant diseases at this stage of life raises questions as to what extent the principal ethiological factor and early sign of menopause (hormone, and particularly estrogen, deprivation) is a modifying factor in periodontal disease, compared with factors such as osteoporosis (Wactawski-Wende et al, 1996; Reinhardt et al, 1999), disturbances in calcium metabolism (Stashenko et al, 1991), cardiovascular disorders (Beck et al, 1996) or the increasing age of these patients (Pilot et al, 1986). The impact of cigarette smoking on periodontal status has been described in several papers (Hidebolt et al, 1997). Postmenopausal female smokers were more likely to lose alveolar bone height and density than non-smokers with a similar periodontitis, plaque and gingival experience (Payne et al, 2000). It is well known too that, even at such an early age, tobacco consumptions affects periodontal health (Machuca et al, 2000). In this sense, it may be relevant to know if periodontal parameters should be modified early at the beginning of the menopause, with a relationship with previous tobacco consumption.

The determinative influence of general health and sociocultural variables on the periodontal condi-

tions of several female situations, such as pregnancy, have been established. The alteration of hormonal levels may interact with parameters such as professional level, level of education or previous periodontal maintenance (Machuca et al, 1999). However, there are no studies about the significance of these parameters in early menopausal patients.

In an attempt to clarify factors responsible for the greater incidence of periodontal problems, this study has been designed with the following objectives: 1) to assess the periodontal condition of a population of early menopausal Spanish women and 2) to investigate the relationship between these and other variables such as demographic, oral hygiene and clinical variables.

MATERIAL AND METHODS

Study Population

A population of 67 early-post-menopausal women (within six to 12 months of permanent cessation of menstruation) attending the Dr Fleming Outpatient Department attached to the gynaecology department of the "Virgen del Rocío" University Hospital in Seville was studied. All were attending for the first time and were requesting a consultation because of the cessation of menstruation. The protocol was authorised by the Ethics Committee for Research at the University of Seville. All patients entered the study voluntarily, after its aims and objectives had been explained. The study period was of one year; during this time 69 women consulted for the first time about the cessation of menstruation, and only two refused to participate in the study. Participants completed an informed consent form, in which they were offered evaluation and treatment of their dental problems in the clinical section of the Seville Dental School.

The specific parameters for early menopausal women evaluated were as follows: more than six months of permanent cessation of menstruation; symptoms of climacteric syndrome; normal appearance on clinical gynaecological exploration; FSH levels of 4 mU/ml or more; normal levels of PRL; atrophic appearance of ovarian ultrasound scan.

Prior to periodontal evaluation, all patients were questioned about their sociocultural situation, in-

cluding their age and their economic/professional level and education. They were also asked about the regularity of their periodontal-dental examinations. Clinical histories were taken by the examiner, and data were recorded regarding the number of months since cessation of menstruation, as well as previous pregnancies, smoking, concomitant illnesses and current medication.

The parameters related to the demographic, medical and dental variables were selected in order to elucidate the general health and periodontal status of the sample.

Periodontal Examination and Assessment

All patients were examined by the same trained examiner. The number and type of erupted teeth present were noted, including third molars. A calibrated periodontal probe (Vivacare TPS Probe, Rigid Metal Tactile Sensor, VIVADENT®, Schaan, Liechtenstein) was used for probing four areas per tooth (mesial, vestibular, distal and lingual). The mesial and distal sites were probed from the buccal side.

The following measurements were also noted:

Plaque index (PI). The presence of dental plaque was noted in accordance with O'Leary's Plaque Index (O'Leary et al, 1972) (0=absence and 1=presence of bacterial plaque). Results are presented as the mean percentage of recordings in each area.

Probing bleeding index (PBI). The presence (1) or absence (0) of bleeding on probing to the most apical penetration of the probe was assessed, using the index of Van der Velden (Van der Velden, 1979). Records are presented as the mean percentage of registrations in each area.

Gingival level (GL). The distance from the cemento-enamel junction to the gingival margin was measured.

Probing depth (PD). The distance from the gingival margin to the most apical penetration of the probe was measured.

Clinical attachment level (CAL). This was calculated by adding recession to PD.

Statistical Analysis

Descriptive statistics for continuous variables were calculated (mean and standard deviation). For descriptive variables, the frequency distribution was

calculated. Normality of the distribution of the variables PI, PBI, GR, PD and CAL was measured using the Kolmogorov-Smirnov test. The demographic and medical variables determined the sample size of subgroups, but the statistics tests developed take into account these circumstances. To compare between clinical indices and demographic characteristics, a one-way variance analysis (ANOVA) was used. If the ANOVA result was significant, the difference between categories was analysed using the Bonferroni test. In order to determinate the effect of independent continuous variables (age), a multiple regression analysis was developed. To determine the influence of ANOVA significant variables, an analysis of covariance (ANCOVA) was developed. Significance $p < 0.05$.

RESULTS

The demographic characteristics of the population are shown in Table 1. The average age was 52.07 ± 2.68 years, with a fairly homogeneous distribution of the sample into two groups, aged 46–52 years (49.3%) and 53–56 years (50.7%). The predominant economic/professional level was that of housewives (74.6%), who greatly outnumbered any type of paid work; 74.6% of the sample had only primary education, and of the remainder only a very few had higher education (10.4%). The average number of previous pregnancies was 2.47 ± 1.083 , and the number of multiparous patients was greater (53.7%).

Table 1 also shows that the majority of the sample said that they brushed their teeth at least twice a day (47.8%); only one patient (1.5%) said that she never brushed her teeth. Approximately half of the sample (49.3%) did not attend for periodic dental check-ups. The same table shows the distribution of the number of cigarettes smoked. Only 13.4% of the sample were smokers, with predominance of those who smoked between five and 20 cigarettes a day (7.5%).

As is shown in the same table, the majority of the women had a concomitant medical problem for which they were receiving treatment (59.7%), among whom we should note that 16.4% were suffering from more than one condition. The most common problems were arterial hypertension and osteoarthritis (20.9% in both cases). In addition, most of the women were taking some type of med-

Table 1 Demographic, medical and dental variables description of the sample (n=67).
 (*)= non-steroidal anti-inflammatory drugs.

VARIABLE	CASES	CASES (%)	Medical problems receiving treatment		
Age (years)			Yes	40	59.7
46–52	33	49.3	– One	29	43.3
53–56	34	50.7	– Two or more	11	16.4
Mean±SD	52.07±2.68		No	27	40.3
Economic/ professional level			Concomitant illnesses		
Workers with paid jobs	17	25.4	Arterial hypertension	14	20.9
* Manual worker	4	6.0	Osteoarthritis	14	20.9
* Employee	9	13.4	Digestive disease	3	4.5
* Technical executive	4	6.0	Endocrine disease	7	10.4
* Liberal professions	0	0	Psychiatric disease	2	3.0
Housewife	50	74.6	Respiratory disease	2	3.0
			Other diseases	10	14.9
Study level			Consumption of medication		
Illiterate	10	14.9	Yes	43	65.2
Primary education	50	74.6	– 1 medicament/ individual	24	35.8
Secondary-Higher	7	10.4	– 2 or more medicament/ individual	19	28.4
			No	24	35.8
Previous live births			Type of medication		
None	5	7.5	Antihypertensive	16	23.9
One or two	26	38.8	NSAIDs(*)	18	26.9
More than two	36	53.7	Antianxiety	9	13.4
Mean±SD	2.47±1.083		Hormones	6	9.0
			Calcium and derivates	3	4.5
Frequency of brushing			Corticoids	3	4.5
None	1	1.5	Anticoagulants	1	1.5
Once a day	21	31.3	Others	13	19.4
Twice a day	32	47.8			
Three or more times a day	3	19.4			
Previous periodontal maintenance					
Frequent	34	50.7			
Infrequent	33	49.3			
Tobacco consumption					
Smoker	9	13.4			
* <5 cigarettes/day	2	3.0			
* 5-20 cigarettes/day	5	7.5			
* >20 cigarettes/day	2	3.0			

Table 2 Indicators of periodontal disease (PI and PBI) in relation to clinical and demographic variables with statistical significance

VARIABLE	MEAN±SD(%)	P VALUE	STATISTICAL DIFFERENCES
PI			
All population	69.3±3.07		
Frequency of brushing		<0.025	
1) None	75.0±0		
2) Once a day	79.5±5.6		1 vs. 3
3) Twice a day	67.8±3.9		
4) Three or more	55.87±7.6		
Previous periodontal m.		<0.0033	
1) Frequent	60.6±4.5		1 vs. 2
2) Infrequent	78.3±3.6		
PBI			
All population	36.5±3.35		
Tobacco consumption		<0.024	
1) Non-smoker	33.5±3.6		1 vs. 3
2) <5 cigarettes/day	25.1±5.5		
3) 5-20 cigarettes/day	63.3±4.6		
4) >20 cigarettes/day	66.8±4.3		
Previous periodontal m.		<0.0014	
1) Frequent	26.2±3.4		1 vs. 2
2) Infrequent	47.1±5.3		

ication for the treatment of these illnesses (65.2%). NSAIDs (26.9%) and antihypertensives (23.9%) were the most frequently used medications. Multiple regression analysis, with respect to age, did not show significant differences. Tables 2 and 3 show the periodontal disease indicators which are significantly related to the demographic and clinical variables. The mean PI (Table 2) was 69.3±3.07%, and was significantly higher ($p<0.025$) among those who brushed their teeth least. Previous dental care appeared to be a determinant in evaluation of the PI, in as much as patients who did not attend the dentist regularly had a PI significantly greater than those who attended routinely ($p<0.0033$). No signifi-

cant differences were detected in the categories of age, economic/professional level, educational level, number of previous pregnancies, smoking or the presence or absence of concomitant illnesses and their respective treatments.

The PBI (36.5±3.35) was significantly higher in smokers than in non-smokers ($p<0.024$), the main differences being between the non-smokers and those who smoked five to 20 cigarettes a day. The PBI was also significantly higher ($p<0.0014$) among those who did not have regular dental check-ups (Table 2).

Table 3 shows the results with regard to the variables that significantly influence the GL. There was a tendency to gingival recession in the sample

VARIABLE	MEAN±SD(%)	P VALUE	STATISTICAL DIFFERENCES
GL			
All population	-0.83±0.07		
Hypertensive disease		<0.025	
1) Yes	-0.5±0.1		1 vs. 2
2) No	-0.9±0.1		
Antihypertensive c.		<0.0097	
1) Yes	-0.5±0.1		1 vs. 2
2) No	-0.9±0.1		
Previous births		<0.0358	
1) None	-0.4±0.2		1 vs. 3
2) One or two	-0.7±0.6		
3) Two or more	-1.0±0.6		
PD			
All population	2.5±0.05		
Tobacco consumption		<0.0003	
1) Non-smoker	2.3±0.05		1 vs. 3
2) <5 cigarettes/day	2.3±0.05		
3) 5-20 cigarettes/day	3.1±0.12		
4) >20 cigarettes/day	3.0±0.3		
CAL			
All population	3.24±0.1		
Tobacco consumption		<0.005	
1) Non-smoker	3.1±0.1		1 vs. 3
2) <5 cigarettes/day	3.1±0.4		
3) 5-20 cigarettes/day	3.1±0.4		
4) >20 cigarettes/day	3.9±0.2		

Table 3 Indicators of periodontal disease (GL, PD and CAL) in relation to clinical and demographic variables with statistical significance

(0.83±0.07mm), which was significantly less among patients with hypertension ($p<0.017$) taking antihypertensives ($p<0.0097$). Gingival recession increased significantly in relation to the number of previous pregnancies, especially among multiparous women (-1.0±0.6mm, $p<0.0358$).

The results referring to the PD are also shown in Table 3. The mean PD for the sample was 2.5±0.05mm. Factors which significantly influenced the PD included smoking ($p<0.0003$), especially between five to 20 cigarettes a day, or not attending for regular dental check-ups

($p<0.048$). The relationship between PD and attending regular dental check-ups was not significant using the ANCOVA test.

The mean CAL of the population studied was 3.24±0.1mm. From Table 3 it can be seen that significant differences with regard to CAL were established only for smoking ($p<0.005$), so that those who had a lower CAL were mainly in the non-smoking group (3.1mm loss of clinical attachment), as opposed to smokers of between five to 20 cigarettes/day (4.5mm loss of clinical attachment).

DISCUSSION

Many studies have attempted to establish a relationship between the variables that indicate periodontal disease (PI, PBI, GL, PD and CAL) and radiological examinations of varying degrees of sophistication that show bone density (Shrout et al, 2000) or loss of bone mass, including alveolar bone mass (Pilgram et al, 2000), in an attempt to establish the fact that menopausal women have a higher incidence of periodontal problems than the general population. Thus assessment has been made of the possible role played by osteoporosis, which is intimately related to the menopause, in the triggering of periodontal disease, although results have been contradictory. Some researchers conclude that osteoporosis is directly related to the height of the alveolar crest and to the teeth lost in postmenopausal women (Wactawski-Wende et al, 1996). Hidebolt et al (2002) concluded that there was a relationship between the alveolar crest height and the hormonal level. On the other hand, Klemetti et al (1994) observed that loss of teeth was unrelated to loss of bone density, and that the development of periodontal disease did not depend on bone density.

These discrepant results mean that other factors must be evaluated, such as the prescription of hormonal agents (Reinhardt et al, 1999; Shrout et al, 2000), oral hygiene and sociocultural factors.

When the age groups most frequently found in this study are analysed, it appears that the mean age is within the natural limits during which menopausal symptoms begin in women; none of the cases in this study could be classified as having an early menopause. However, the mean age is slightly lower than that of other studies, and more homogeneous (Tezal et al, 2000; Shrout et al, 2000; Reinhardt et al, 1998). This is due to the fact that the patients in the present study were examined when they attended for the first gynaecological consultation. In any case, although the fact that the subjects of this paper are young postmenopausal women must be taken into account when evaluating the periodontal condition, this variable did not have a significant influence on the variables indicative of periodontal health.

Evaluation of the sociocultural characteristics of this patient group also yields important information. The patients in the present study came from an urban area with limited economic and cultural

resources, and 74.6% of them were unpaid workers (housewives), among whom only half the sample (50.7%) regularly attended for dental check-ups, although the majority said that they brushed their teeth between once (31.3%) and twice (47.8%) a day. It should be mentioned that approximately 89% of the sample had received only primary education or were illiterate. These data are similar to other findings recorded in the last Oral Health Study 2000 (Llodra et al, 2002). In that paper the cultural level of the sample of this age group is very similar to the findings at the present paper (they found approximately 93% of individuals with only primary education or illiterates). This low sociocultural level has some influence on the findings of this study, in view of the fact that although the only variable that appears to be directly related to the periodontal condition is previous attendance for dental check-ups, the ability to attend for such appointments is directly related to the patients' financial and cultural resources. In any way, it has to be taken into account that the sample size of certain subgroups is not very high, and the extrapolation of data may be considered carefully.

Several hormonal factors have been associated with some periodontal changes. The effects of a deficiency of 17-beta-oestradiol have often been related to processes of inflammatory resorption of alveolar bone, although this relationship is not entirely clear (Payne et al, 1997), particularly because of the lack of longitudinal studies evaluating the clinical signs of gingival inflammation and the progression of periodontitis (Reinhardt et al, 1999). Significant results have been encountered which relate oestrogen deficiency to loss in bone mass (osteoporosis) in postmenopausal women (Tilakaratne et al, 2000a; Tilakaratne et al, 2000b). Similarly, Payne et al (1999) concluded that oestrogens increase bone density, while their absence causes a reduction in the density of the alveolar crest. Furthermore, Reinhardt et al (1999) concluded that treatment with oestrogens is associated with a reduction in gingival inflammation and in the frequency of loss of periodontal attachment in osteoporotic postmenopausal women. This information is particularly relevant in two ways: on the one hand, with regard to the number of previous live births, which appears to lead to a tendency to gingival recession, possibly related to previous episodes of periodontitis. On the other

hand, it could be important in relation to previous endocrine diseases and hormonal treatment. However, in the present study there does not appear to be an association between the small percentage of patients suffering from such diseases (10.4%), or receiving treatment for them (9%), and the clinical variables. It is noticeable, on the other hand, that the only variable associated with the periodontal variables is hypertension, or its treatment with antihypertensives, with regard to GL. The explanation would seem to lie in the demonstrated effect of some of these drugs (e.g. calcium channel blockers) in increasing gingival size (hyperplasia), described in numerous studies (Bullon et al, 1995; Bullon et al, 1996; Seymour et al, 2000), and completely independent of the hormonal situation of the women in the study.

With regard to the analysis of periodontal clinical variables, account must be taken of the method of measurement (a controlled-pressure probe) used, which permits more reliable measurement of gingival recession and overgrowth and greater reproducibility of the PBI. Although the use of different measuring methods makes it difficult to compare the various studies, the fact that practically all studies analysed use controlled-pressure probes (Tezal et al, 2000; Hidebolt et al, 1997; Pilgram et al, 2000) means that we can be more confident about comparing the data.

Data concerning the periodontal condition of this sample are similar to other data recorded at the last Oral Health Study 2000 (Llodra et al, 2002). In that paper only 11% of the subjects of this age group had a pocket depth of 3mm or more. In the present paper, the mean probing deep is about 2.5mm. In the same way, the most prevalent clinical attachment level is situated between 3-4mm in Llodra et al's study (2002), a situation very similar to the findings of the present paper (3.24mm). In both studies the periodontal situation is related to periodontal maintenance and socio-cultural level (Llodra et al, 2002).

Some results in relation to the periodontal condition of the study population are interesting and should be highlighted. As can be seen from Tables 2 and 3, the PI and PBI were found to be directly related to previous dental care, but the PD and CAL were not. These findings confirm that the role of dental care depends directly on the accumulation of bacterial plaque, which can lead to gingival bleeding, as described originally by Silness

and Löe (1964). In any case, the relationship with loss of periodontal attachment, in the sense of an unequivocal cause-effect development, remains unclear (Attström and Van der Velden, 1994). What is clear is that poor oral hygiene and the accumulation of plaque will result in the possibility of developing some kind of periodontal lesion. It appears, in the light of this study, that gingivitis is the principal clinical manifestation of periodontal disease in these patients, but it is difficult to determine if this represents a tendency to periodontal destruction, in view of the fact that mean losses of clinical attachment are not so considerable – 3.24mm – although it appears that the determining factor influencing their appearance is smoking, especially of five to 20 cigarettes a day or more, which causes greater BOP, not established in all of the studies (Prever and Bergström, 1985; Danielsen et al, 1990; Axelsson et al, 1998), and greater depth on probing and loss of attachment (4.5mm on average), which is indeed confirmed in the majority of the studies, both in menopausal women (Hidebolt et al, 1997; Reinhardt et al, 1998; Hidebolt et al, 2000) and in other patient groups whose ages and situations are very different (Axelsson et al, 1998; Machuca et al, 2000; Haber et al, 1993; Martínez-Canut et al, 1995).

In view of the results of this and other studies (Klemetti et al, 1994; Hidebolt et al, 2000), it appears that in this particular population, factors already known to modify periodontal disease appear to be more important than the early signs of the estrogens reduction and developing of menopause in triggering periodontitis. Despite the fact that other factors not evaluated in this study (such as osteoporosis or hormone replacement therapy) may have some importance in the development of the periodontal disease process (Reinhardt et al, 1999), the fundamental role of the factors analysed in this study should not be discounted. This is why the establishment of periodontal preventive measures and the monitoring of some habits (smoking), of the ingestion of some drugs (calcium antagonists), or of some sociocultural variables will have extremely beneficial consequences for the periodontal health of women at this stage of their lives (Friedlander, 2002). In addition, the establishment of preventive programmes could be a simple way to avoid the development of more serious periodontal problems.

CONCLUSIONS

In this particular population, factors already known to modify periodontal disease appear to be more important than the early signs of estrogen reduction and developing menopause in triggering periodontitis. The establishment of periodontal preventive measures, the monitoring of smoking and the consumption of certain drugs or the knowledge of some sociocultural variables could have beneficial consequences for the periodontal health of menopausal women.

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Reprint requests:

Prof. Dr. Guillermo Machuca,
University of Seville
Faculty of Dentistry
c/ Avicena s/n
41009-Seville
Spain
E-mail: gmachuca@us.es