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Menopause and Its Impact on Periodontal Tissues Epidemiological Survey

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Abstract

The menopause is one period during which various symptoms will be declared. Some can relate to the oral cavity, they are mainly the symptoms of oral discomfort, the gingivitis and the periodontitis. To study closely the relation between menopause and periodont, we carried out a bidirectional, transversal, analytical and epidemiological survey of nearly 60 menopausal women and 60 witnesses consulting within service of gynecology CHU of Casablanca. The goal of this investigation is to locate the level of the periodontal health among menopausal women compared to pilot subjects, as well as the repercussion of the menopause on the periodontal health. Our results showed: 1) An oral level of hygiene oscillating between the moderate one and the bad one. 2) A bad condition of teeth. The repercussion of the menopause on the periodontal health appeared by: 1) An increase in the degree of mobility; 2) An increase height of the gingival recessions; 3) An increase depth of the periodontal pockets. During the menopause, these three parameters are more and more accentuated. It is then necessary to classify menopausal women like a particular and priority case in any preventive action and therapeutic company to try to preserve and maintain its periodontal health.

Subject Areas

Dentistry

Keywords

Cytokines, Menopause, Periodontitis

1. Introduction

Menopause is not an illness, even though it marks the end of a woman's fertile period. Rather, it is a biological transformation (just like puberty) that occurs between sexual maturity and aging. It is a transitional period that a woman must go through before entering a period of life that is said to be one of the most serene of the various stages of existence.

During this period, hormonal changes occur, leading to organic and psychological changes [1] that manifest themselves through various symptoms (hot flashes, insomnia, irritability, dry mucous membranes, osteoporosis, etc.). Some of these symptoms are particularly noticeable in the oral cavity: sensations of dryness and burning [2] [3] that occur in the oral mucosa and constitute oral discomfort syndrome [4] [5], gingivitis [4] [6] [7] and periodontitis [8]-[10] that affect the bone and can be aggravated by the presence of systemic osteoporosis [11]-[15].

The aim of this study is to study the impact of menopause on periodontal tissues based on an epidemiological survey at the Ibn Rochd Gynecology Department, between an experimental group (menopausal women) and a control group (premenopausal women).

The objectives of this study are:

- To situate the level of oral health in postmenopausal women compared to a control subject.

- To assess the level of oral health prevention in postmenopausal women compared to a control subject.

- To assess the impact of menopause on oral health.

- To identify the various factors involved in oral health in postmenopausal women.

- To analyze and discuss the results to clarify the determinants of oral health in postmenopausal women.

- To suggest solutions to improve the current health situation.

2. Materials and Methods

We opted for a bidirectional, cross-sectional, analytical, and sample-based epidemiological survey. Our survey was conducted at the University Hospital (CHU), a gynecological consultation department where we examined the women included in the study. Our population consists of two groups:

- A primary group, called the experimental group, consists of women whose inclusion criteria are:
  - Postmenopausal women.
  - Women free of general pathologies.
- A secondary group, called the control group, consists of women whose inclusion criteria are:
  - Premenopausal women.
  - Non-pregnant women.
  - Women not taking oral contraceptives.

- Women free of general pathologies.
- Women over the age of 50.

The size of each group was previously set at 60 women per group.

Variables used:

CAD index.:

Plaque Index (PI) (LO and SILNESS)

Gingival Index (GI) (SILNESS and LO)

Gingival Recession

Periodontal Pockets

Tooth Mobility (Mühelemann Index)

Interradicular Lesion (Hamp Index)

Type of Periodontal Disease

Statistical Methods Used:

We performed a comparison between the "Experimental Group" and the "Control Group" using statistical comparison tests to examine the significance of the differences between the two groups.

3. Survey Results

3.1. Results of the Descriptive and Comparative Study between the Group of Postmenopausal Women and the Control Group

3.1.1. Distribution of Women within the Two Groups by Age

In our study, the results showed that:

In the control group:

- 98.3% of women were under 55 years of age.
- 1.7% of women were between 55 and 60 years old.
- 0% of women were over 60 years old.

In the experimental group:

- 48.3% of women were under 55 years old.
- 43.3% of women were between 55 and 60 years old.
- 8.3% of women were over 60 years old.

The ages of the women in the sample ranged from 47 to 75 years old, with a mean age of 49.9 years for premenopausal women and 54.7 years for postmenopausal women. More than 64.5% of women were under 55 years old.

The difference was statistically significant ($p = 0.005$), meaning the two groups differed in age (Figure 1).

3.1.2. Distribution of Women in the Two Groups According to the CAO Index

For the CAO index, the results showed:

In the control group:

- 0% of women had a CAO index below 15
- 8.3% of women had a CAO index between 15 and 20
- 91.7% of women had a CAO index above 20

In the experimental group:

- 8.3% of women had a CAO index below 15
- 20.0% of women had a CAO index between 15 and 20
- 71.7% of women had a CAO index above 20

Thus, the CAO index ranged from 0 to 32 affected teeth, with an average of 24.5 in the postmenopausal group and 24.4 in the control group, this minimal difference was statistically significant (P = 0.07). Therefore, the two groups differed in their CAO index (Figure 2).

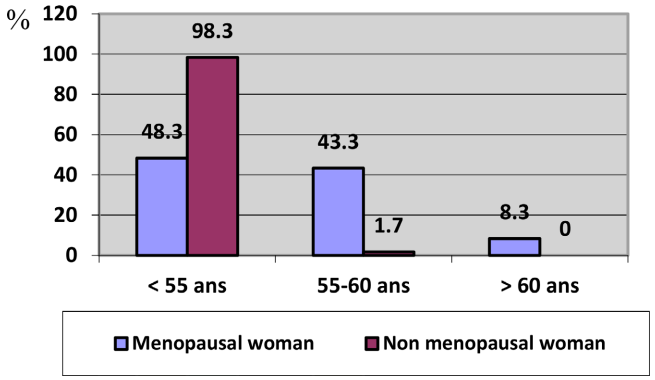

Figure 1. Distribution of women within the two groups by age category.

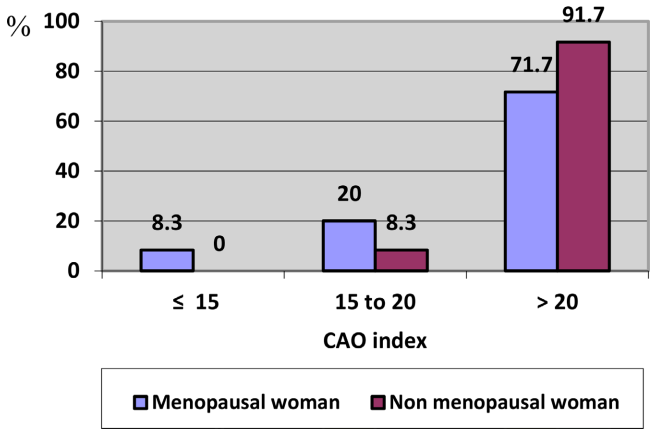

Figure 2. Distribution of women in the two groups according to the CAD index.

3.1.3. Distribution of Women in the Two Groups According to the Plaque Index

For the plaque index, the results showed:

In the control group:

- 16.7% of women had a plaque index PI < 1.
- 58.3% of women had a plaque index 1 < PI < 1.5.
- 8.3% of women had a plaque index 1.5 < PI < 2.
- 16.7% of women had a plaque index PI > 2.

In the experimental group:

- 25% of women had a plaque index PI < 1.
- 35% of women had a plaque index 1 < PI < 1.5.
- 11.7% of women had a plaque index of 1.5 < PI < 2.

- 28.3% of women had a plaque index PI > 2.

Thus, the plaque index ranged from 0 to 2.6, with an average of 1.3 for the control group and 1.43 for postmenopausal women. This difference was statistically significant. Therefore, the women in the two groups differed in their plaque index. (P = 0.03) (Figure 3).

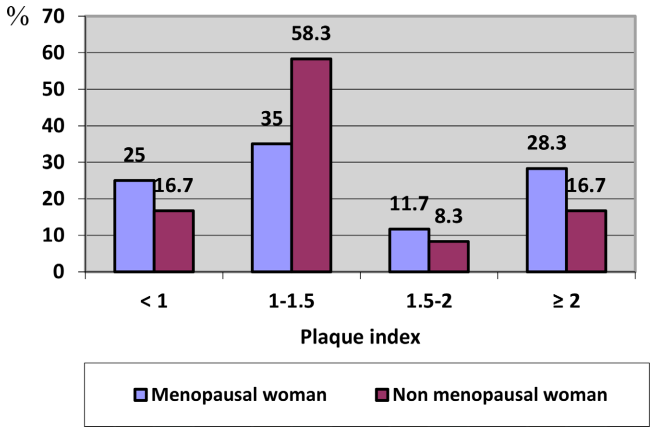

Figure 3. Distribution of women in the two groups according to plaque index.

3.1.4. Distribution of Women in the Two Groups According to Gingival Index

For the gingival index, the results showed:

In the control group:

- 11.7% of women had a gingival index (GI) < 1.
- 78.3% of women had a gingival index (GI) 1 < GI < 2.
- 10% of women had a gingival index (GI) > 2.

In the experimental group:

- 20% of women had a gingival index (GI) < 1.
- 66.7% of women had a gingival index (GI) 1 < GI < 2.
- 13.3% of women had a gingival index (GI) > 2.

Thus, the gingival index ranged from 0.5 to 2, with an average of 1.27 for the control group and 1.3 for postmenopausal women. This difference was statistically insignificant.

Therefore, women in the two groups did not differ in their gingival index (p = 0.3) (Figure 4).

3.1.5. Distribution of Women in the Two Groups According to Gingival Recession Depth

The results showed that the gingival recession depth ranged from 1 to 8 mm, with a mean of 3.88 mm, in the experimental group and from 1 to 5 mm, with a mean of 2.7 mm, in the control group. This difference was statistically significant (p = 0.005). Therefore, the two groups differed in the depth of their gingival recession (Figure 5).

3.1.6. Distribution of Women in the Two Groups According to Periodontal Pocket Depth

The results obtained following the periodontal probing showed that the periodontal

pocket depth ranged from 3 mm to 7 mm, with a mean of 4.4 mm, in the experimental group, and from 3 mm to 5 mm, with a mean of 3.7 mm, in the control group. This difference is statistically significant (p: 0.003) so the two groups differ in the depth of the periodontal pockets (Figure 6).

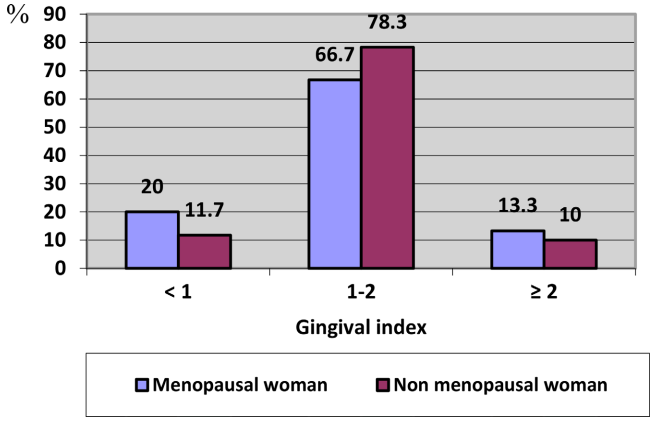

Figure 4. Distribution of women in the two groups according to gingival index.

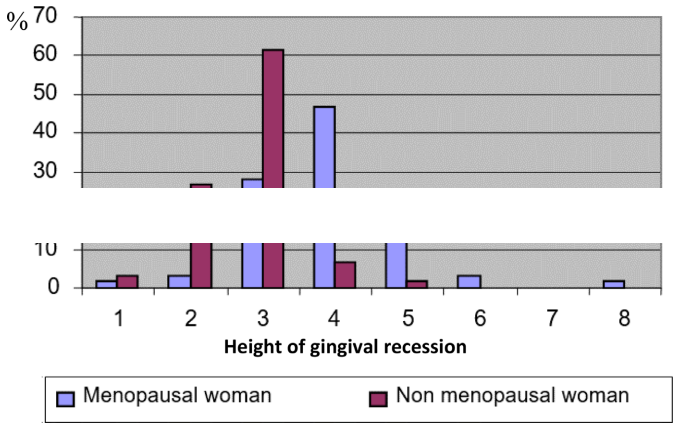

Figure 5. Distribution of women within the two groups according to gingival recession depth.

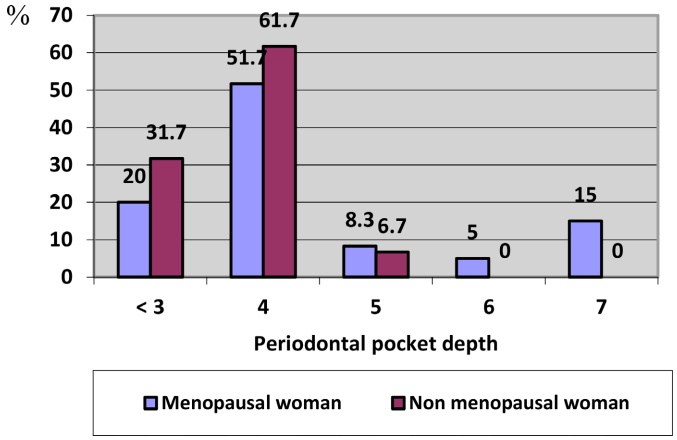

Figure 6. Distribution of women within the two groups according to periodontal pocket depth.

3.1.7. Distribution of Women in the Two Groups According to the Degree of Dental Mobility

For the degree of dental mobility, the results showed:

In the control group:

- 8.3% of women had a mobility level of 0.
- 28.3% of women had a mobility level of 1.
- 55% of women had a mobility level of 2.
- 8.3% of women had a mobility level of 3.
- 0% of women had a mobility level of 4.

In the group of postmenopausal women:

- 0% of women had a mobility level of 0.
- 10% of women had a mobility level of 1.
- 68.3% of women had a mobility level of 2.
- 18.3% of women had a mobility level of 3.
- 3.3% of women had a mobility level of 4.

Thus, the degree of dental mobility ranged from 1 to 4, with an average of 2.11 for the experimental group and from 0 to 3, with an average of 1.6 for the control group. The experimental group shows greater mobility than the control group, the difference is statistically significant (P = 0.0002). Therefore, we can conclude that the two groups differ in the degree of dental mobility (Figure 7).

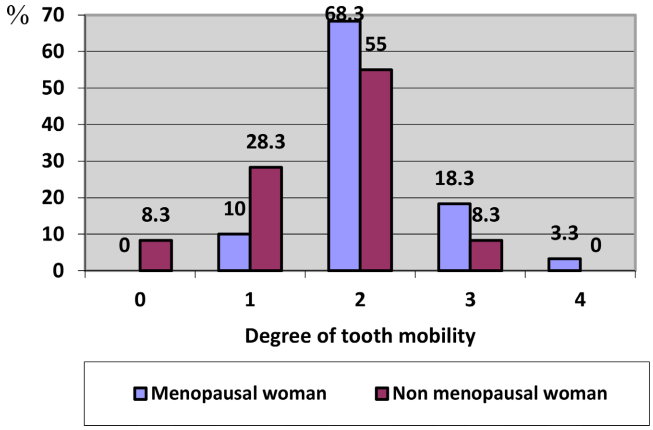

Figure 7. Distribution of women in the two groups according to the degree of tooth mobility.

3.1.8. Distribution of Women in the Two Groups According to Interradicular Lesions

The results showed that:

In the control group:

- 30% of women had no lesions.
- 25% of women had Class I lesions.
- 35% of women had Class II lesions.
- 10% of women had Class III lesions.

In the experimental group:

- 20% of women had no lesions.

- 11.7% of women had Class I lesions.
- 56.7% of women had Class II lesions.
- 11.7% of women had Class III lesions.

The majority of women with interradicular lesions were Class II. The average interradicular lesion degree was 1.2 for the control group and 1.6 for postmenopausal women. The difference was not statistically significant (p = 0.06). Therefore, the two groups did not differ in the degree of interradicular lesions (Figure 8).

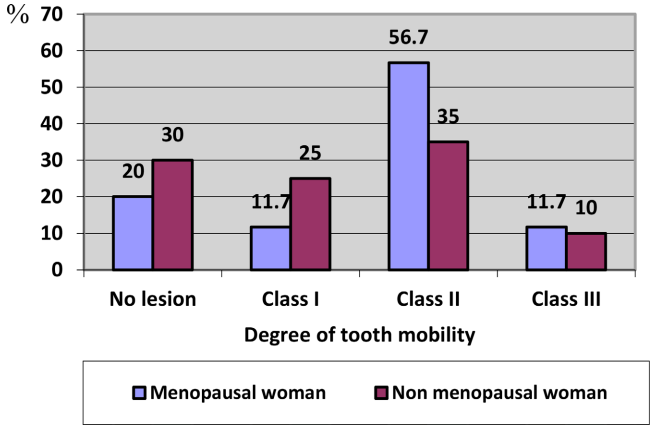

Figure 8. Distribution of women in the two groups according to the class of interradicular lesions.

3.1.9. Distribution of Women in the Two Groups According to the Type of Periodontal Disease

The results showed that:

In the control group:

- 0% of women had localized gingivitis.
- 15% of women had generalized gingivitis.
- 85% of women had periodontitis.

In the experimental group:

- 1.7% of women had localized gingivitis.
- 8.3% of women had generalized gingivitis.
- 90% of women had periodontitis.

Thus, 87.7% of the population had periodontitis. Both groups had a high rate of periodontitis: 90% for the experimental group and 85% for the control group. This difference remained statistically insignificant (p = 0.3). Therefore, the two groups did not differ in terms of the type of periodontal disease (Figure 9).

3.1.10. Distribution of Women within the Two Groups According to Brushing Method

The questionnaire revealed the following results:

In the control group:

- 11.3% of women brushed their teeth correctly.
- 88.7% of women brushed their teeth incorrectly.

In the experimental group:

- 7.7% of women brushed their teeth correctly.
- 92.3% of women brushed their teeth incorrectly.

Among the women who brushed their teeth, 90.5% did so incorrectly. 88.7% of women brushed incorrectly in the control group and 92.3% in the postmenopausal group. This difference remained statistically insignificant (p = 0.19). So both groups who brush their teeth do so incorrectly, whether they are postmenopausal or premenopausal women (Table 1).

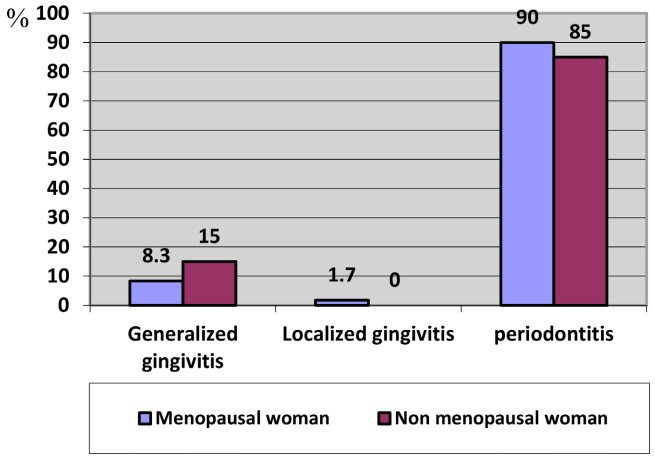

Figure 9. Distribution of women in the two groups according to the type of periodontal disease.

Table 1. Distribution of women in the two groups according to brushing method.

Brushing methods	Menopausal woman		Non menopausal woman		Global results	
	Eff.	T %	Eff.	T %	Eff	T %
Correct	4	7.7%	6	11.3%	10	9.5%
Incorrect	48	92.3%	47	88.7%	95	90.5%

3.2. Results Concerning the Study of the Interdependence of Variables

3.2.1. Distribution of Women in the Two Groups According to Age and CAO index

The results showed that:

In the control group:

For a CAO index between 15 and 20:

- 100% of women are under 55 years old
- 0% of women are between 55 and 60 years old
- 0% of women are over 60 years old.

For a CAO index above 20:

- 98.2% of women are under 55 years old
- 1.8% of women are between 55 and 60 years old

- 0% of women are over 60 years old.

In the group of postmenopausal women:

For a CAO index ≤ 15:

- 100% of women are under 55 years old
- 0% of women are between 55 and 60 years old
- 0% of women are over 60 years old.

For a CAO index between 15 and 20:

- 41.7% of women are under 55 years old
- 50% of women are between 55 and 60 years old
- 8.3% of women are over 60 years old.

For a CAO index above 20:

- 44.2% of women are under 55 years old
- 46.5% of women are between 55 and 60 years old
- 9.3% of women are over 60 years old.

Thus, in the control group, the mean CAO index (24.5) is the same for both age groups. In the group of postmenopausal women, the average CAD index showed no change and varied between 23.5 and 24.5.

Therefore, the CAD index cannot be linked to increasing age (Table 2).

Table 2. Distribution of women in the two groups according to age and CAO index.

Non menauposal	Civil age categories	CAO index						Total	
		≤15		15 to 20		>20			
		Eff.	T %	Eff.	T %	Eff.	T %	Eff.	T %
	≤55 years old	0	0%	5	100%	54	98.2%	59	98.3%
	55 - 60 year old	0	0%	0	0%	1	1.8%	1	1.7%
	>60 year old	0	0%	0	0%	0	0%	0	0%

Menopausal woman	Civil age categories	CAO index						Total
		≤15		15 à 20		>20		
		Eff.	T %	Eff.	T %	Eff.	T %	Eff.	T %
	≤ 55 years old	5	100%	5	41.7%	19	44.2%	29	48.3%
	55-60 years old	0	0%	6	50%	20	46.5%	26	43.3%
	> 60 years old	0	0%	1	8.3%	4	9.3%	5	8.3%

3.2.2. Distribution of Women in the Two Groups According to Age and Type of Periodontal Disease

Our results showed:

In the control group:

For women with generalized gingivitis

- 100% of women were under 55 years old
- 0% of women were between 55 and 60 years old
- 0% of women were over 60 years old.

For women with periodontitis

- 98% of women were under 55 years old
- 2% of women were between 55 and 60 years old
- 0% of women were over 60 years old.

In the group of postmenopausal women:

For women with generalized gingivitis

- 80% of women were under 55 years old
- 20% of women were between 55 and 60 years old
- 0% of women were over 60 years old.

For women with localized gingivitis

- 100% of women were under 55 years old
- 0% of women were between 55 and 60 years old
- 0% of women were over 60 years old.

For women with periodontitis

- 44.4% of women were under 55 years old
- 46.3% of women were between 55 and 60 years old
- 9.3% of women were over 60 years old.

The type of periodontal disease did not follow any particular pattern with age in the control group, however, in the group of postmenopausal women, the average age increased from 50 to 54 years old. This difference is statistically insignificant, so the type of periodontal disease is not related to age (Table 3).

Table 3. Distribution of women within the two groups according to age and type of periodontal disease.

Non menopausal woman	Civil age categories	Type of periodontal disease						Total	
		Generalized gingivitis		Localized gingivitis		periodontitis			
		Eff.	T %	Eff.	T %	Eff.	T %	Eff.	T %
	≤55 years old	9	100%	0	0%	50	98%	59	98.3%
	55 - 60 years old	0	0%	0	0%	1	2%	1	1.7%
	>60 years old	0	0%	0	0%	0	0%	0	0%
Menopausal woman	**Civil age categories**	**Type of periodontal disease**						**Total**	
		Generalized gingivitis		Localized gingivitis		periodontitis			
		Eff.	T %	Eff.	T %	Eff.	T %	Eff.	T %
	≤55 years old	4	80%	1	100%	24	44.4%	29	48.3%
	55 - 60 years old	1	20%	0	0%	25	46.3%	26	43.3%
	>60 years old	0	0%	0	0%	5	9.3%	5	8.3%

3.2.3. Distribution of Women within the Two Groups According to Plaque Index and Gingival Index

The results of our survey showed:

For the control group

- For a plaque index < 1, the gingival index had an average of 1.15.
- For a plaque index of 1 - 1.5, the gingival index had an average of 1.2.
- For a plaque index of 1.5 - 2, the gingival index had an average of 1.2.
- For a plaque index > 2, the gingival index had an average of 1.27.

For the group of postmenopausal women

- For a plaque index < 1, the gingival index had an average of 1.22. For a plaque index of 1 - 1.5, the gingival index has an average of 1.26.
- For a plaque index of 1.5 - 2, the gingival index has an average of 1.5.
- For a plaque index > 2, the gingival index has an average of 1.27.

Thus, in the control group, the average gingival index varies between 1.15 and 1.27 and increases slightly as the plaque index increases. The same is true for the experimental group, where it varies between 1.22 and 1.27, thus yielding a significant difference ($p = 0.005$).

Thus, the gingival index is dependent on the plaque index in both groups (Table 4).

Table 4. Distribution of women within the two groups according to plaque index and gingival index.

Non menopausal woman	Plaque index	Gingival index						Total	
		<1		1 - 2		≥2			
		Eff.	T %	Eff.	T %	Eff.	T %	Eff.	T %
	<1	6	85.7%	4	8.5%	0	0%	10	16.7%
	1 - 1.5	1	14.3%	34	72.3%	0	0%	35	58.3%
	1.5 - 2	0	0%	5	10.6%	0	0%	5	8.3%
	≥2	0	0%	4	8.5%	6	100%	10	16.7%
Menopausal woman	**Plaque index**	**Gingival index**						**Total**	
		<1		**1 - 2**		**≥2**			
		Eff.	T %	Eff.	T %	Eff.	T %	Eff.	T %
	<1	11	91.7%	0	0%	4	10%	15	25%
	1 - 1.5	0	0%	0	0%	21	52.5%	21	35%
	1.5 - 2	0	0%	1	12.5%	6	15%	7	11.7%
	≥2	1	8.3	7	87.5%	9	22.5%	17	28.3%

3.2.4. Distribution of Postmenopausal Women According to Age at Menopause and CAO Index

From the clinical examination, the following results were obtained:

For a CAO index ≤ 15:

- 40% of women reached menopause at an age less than 45 years.
- 60% of women reached menopause at an age between 45 and 59 years.
- 0% of women reached menopause at an age over 50 years.

For a CAO index between 15 and 20:

- 23.1% of women reached menopause at an age less than 45 years.
- 61.5% of women reached menopause at an age between 45 and 59 years. 15.4% of women reached menopause at an age over 50.

For a CAO index > 20:

- 26.2% of women reached menopause at an age under 45.
- 54.8% of women reached menopause at an age between 45 and 59.
- 19% of women reached menopause at an age over 50.

If we proceed by classification, we find that women between 45 and 59 years of age have the highest average CAO index of 24.2, followed by those under 45 with a CAO index of 23.8, and those over 50 with a CAO index of 23.7. However, the difference remains non-significant ($p = 0.5$).

In conclusion, the dental condition of postmenopausal women does not depend on the age of menopause (Table 5).

Table 5. Distribution of postmenopausal women by age at menopause and CAO index.

Age of menopause	CAO index						Total
	≤15		15 - 20		>20		
	Eff.	T %	Eff.	T %	Eff	T %	T
≤45 years	2	40%	3	23.1%	11	26.2%	16
45 - 49 years	3	60%	8	61.5%	23	54.8%	34
≥50 years	0	0%	2	15.4%	8	19%	10

3.2.5. Distribution of Postmenopausal Women According to Gingival Index and Duration of Menopause

During our survey, the clinical examination revealed the following results:

For a menopause duration ≤ 5 years, we have:

- 45.5% of women have a gingival index < 1.
- 27.3% of women have a gingival index between 1 and 2.
- 27.3% of women have a gingival index ≥ 2.

For a menopause duration between 6 and 10 years, we have:

- 30.8% of women have a gingival index < 1.
- 46.2% of women have a gingival index between 1 and 2.
- 23.1% of women have a gingival index ≥ 2.

For a menopause duration > 10 years, we have:

- 50% of women have a Gingival Index < 1.
- 30% of women have a Gingival Index between 1 and 2.
- 20% of women have a Gingival Index ≥ 2.

Women who have a menopausal age duration of ≤ 5 years have a mean Gingival Index of 1.3.

Women who have a menopausal age duration of 6 to 10 years have a mean Gingival Index of 1.6.

Women who have a menopausal age duration of >10 years have a mean Gingival Index of 1.26.

Thus, the mean index does not follow any particular trend with menopausal duration and varies between 1.26 and 1.6. This difference is statistically insignificant (p = 0.3) (Table 6).

Table 6. Distribution of postmenopausal women according to gingival index and duration of menopause.

Menopause duration	Gingival indexes						Total	
	<to 1		1 - 2		≥2			
	Eff.	T %	Eff.	T %	Eff	T %	Eff.	T%
≤ 5 years	5	45.5%	12	30.8%	5	50%	22	36.6%
6 - 10 years	3	27.3%	18	46.2%	3	30%	24	40%
>10 years	3	27.3%	9	23.1%	2	20%	14	23.3%

3.2.6. Distribution of Postmenopausal Women According to Duration of Menopause and Depth of Gingival Recession

During our survey, the clinical examination revealed the following results:

For a duration of menopause ≤ 5 years:

- 50% of women have a 2 mm recession.
- 52.9% of women have a 3 mm recession.
- 33.3% of women have a 4 mm recession.
- 22.2% of women have a 5 mm recession.
- 50% of women have a 6 mm recession.
- 33.3% of women have an 8 mm recession.

For a menopause duration of 6 to 10 years:

- 50% of women have a 2 mm recession.
- 47.1% of women have a 3 mm recession.
- 37% of women have a 4 mm recession.
- 33.3% of women have a 5 mm recession.
- 0% of women have a 6 mm recession.
- 33.3% of women have an 8 mm recession.

For a menopause duration > 10 years:

- 0% of women have a 2 mm recession.
- 0% of women have a 3 mm recession.
- 29.6% of women have a 4 mm recession.
- 44.4% of women have a 5 mm recession.
- 50% of women have a 6 mm recession.
- 33.3% of women have an 8 mm recession.

Women who have been in menopause for ≤ 5 years have a mean recession height of 3.6 mm.

Women who have been in menopause for 6 to 10 years have a mean recession height of 3.6 mm.

Women who have been in menopause for > 10 years have a mean recession height of 4.7 mm.

Ranked, women who have been in menopause for more than 10 years have the greatest recession height, with a mean of 4.7 mm, followed by those who have been in menopause for 6 to 10 years and those who have been in menopause for less than 5 years, who have the same mean of 3.6 mm. This difference is statistically significant (p = 0.025), meaning that the higher the age of menopause, the greater the gingival recession (Table 7).

Table 7. Distribution of postmenopausal women according to menopause duration and gingival recession depth.

Menopause duration	Height of gingival recession (mm)												Total	
	2 mm		3 mm		4 mm		5 mm		6 mm		8 mm			
	Eff.	T %	Eff.	T %	Eff.	T %	Eff.	T %	Eff.	T %	Eff.	T %	Eff.	T%
≤5 years	1	50%	9	52.9%	9	33.3%	2	22.2%	1	50%	1	33.3%	23	38.3%
6 -10 years	1	50%	8	47.1%	10	37%	3	33.3%	0	0%	1	33.3%	13	21.6%
>10 years	0	0%	0	0%	8	29.6%	4	44.4%	1	50%	1	33.3%	14	23.3%

3.2.8. Distribution of Postmenopausal Women According to Menopause Duration and Periodontal Pocket Depth

During our survey, the clinical examination revealed the following results:

For a menopause duration ≤ 5 years:

- 54.5% of women have a pocket depth of 3 mm.
- 38.7% of women have a pocket depth of 4 mm.
- 28.6% of women have a pocket depth of 5 mm.
- 33.3% of women have a pocket depth of 6 mm.
- 25% of women have a pocket depth of 7 mm.

For a menopause duration of 6 to 10 years:

- 27.3% of women have a pocket depth of 3 mm.
- 35.5% of women have a pocket depth of 4 mm.
- 42.8% of women have a pocket depth of 5 mm.
- 66.7% of women have a pocket depth of 6 mm.
- 50% of women have a pocket depth of 7 mm.

For a menopause duration > 10 years:

- 18.2% of women have a pocket depth of 3 mm.
- 25.8% of women have a pocket depth of 4 mm.
- 28.6% of women have a pocket depth of 5 mm.
- 0% of women have a pocket depth of 6 mm.

25% of women have a pocket depth of 7 mm. Women who have been in menopause for ≤ 5 years have an average pocket depth of 4.13 mm.

Women who have been in menopause for 6 to 10 years have an average pocket depth of 4.7 mm.

Women who have been in menopause for > 10 years have an average pocket depth of 4.2 mm.

Ranked, women who have been in menopause for 6 to 10 years have the deepest periodontal pocket on average, followed by those who have been in menopause for more than 10 years, and then those who have been in menopause for less than 5 years. This difference is statistically insignificant (p = 0.2) (Table 8).

Table 8. Distribution of postmenopausal women according to menopause duration and periodontal pocket depth.

Menopause duration	Periodontal pocket depth (mm)										total	
	3 mm		4 mm		5 mm		6 mm		7 mm			
	Eff.	T %	Eff.	T %	Eff.	T %	Eff.	T %	Eff.	T %	Eff.	T %
≤5 years	6	54.5%	12	38.7%	2	28.6%	1	33.3%	2	25%	23	38.3%
6 - 10 years	2	27.3%	11	35.5%	3	42.8%	2	66.7%	4	50%	22	36.6%
>10 years	3	18.2%	8	25.8%	2	28.6%	0	0%	2	25%	15	25%

3.2.9. Distribution of Postmenopausal Women According to Menopause Duration and Degree of Tooth Mobility

The results showed:

For mobility level 1:

- 20% of postmenopausal women have a menopause duration of ≤5 years.
- 80% of postmenopausal women have a menopause duration of 6 to 10 years.
- 0% of postmenopausal women have a menopause duration of >10 years.

For mobility level 2:

- 40% of postmenopausal women have a menopause duration of ≤5 years.
- 35% of postmenopausal women have a menopause duration of 6 to 10 years.
- 25% of postmenopausal women have a menopause duration > 10 years.

For mobility level 3:

- 36.4% of postmenopausal women have a menopause duration ≤ 5 years.
- 27.3% of postmenopausal women have a menopause duration 6 to 10 years.
- 36.4% of postmenopausal women have a menopause duration > 10 years.

For mobility level 4:

- 25% of postmenopausal women have a menopause duration ≤ 5 years.
- 25% of postmenopausal women have a menopause duration 6 to 10 years.
- 50% of postmenopausal women have a menopause duration > 10 years.

The average degree of tooth mobility does not change significantly with menopause duration and varies from 1.4 to 2.0 depending on the duration of menopause. This difference remains statistically insignificant (p = 0.16) (Table 9).

3.2.10. Distribution of Postmenopausal Women According to Menopause Duration and Type of Periodontal Disease

During our survey, the clinical examination revealed the following results:

For women with gingivitis:

- 60% of postmenopausal women had a menopause duration of 5 years.
- 20% of postmenopausal women had a menopause duration of 6 - 10 years.
- 20% of postmenopausal women had a menopause duration of >10 years.

For women with periodontitis:

- 34.5% of postmenopausal women had a menopause duration of ≤5 years.
- 38.2% of postmenopausal women had a menopause duration of 6 - 10 years.
- 27.3% of postmenopausal women had a menopause duration of >10 years.

The prevalence of periodontitis increased with increasing menopause duration (the majority of women with periodontitis had a menopause duration of more than 6 years (65.5%)) (Table 10).

Table 9. Distribution of postmenopausal women by menopause duration and degree of tooth mobility.

Menopause duration	Degree of tooth mobility								total T
	1		2		3		4		
	Eff.	T %	Eff.	T %	Eff.	T %	Eff.	T %	
≤5 years	1	20%	16	40%	4	36.4%	1	25%	22
6 - 10 years	4	80%	14	35%	3	27.3%	1	25%	22
>10 years	0	0%	10	25%	4	36.4%	2	50%	16

Table 10. Distribution of postmenopausal women by menopause duration and type of periodontal disease.

Menopause duration	Types of periodontal disease				Total T
	gingivitis		periodontitis		
	Eff.	T %	Eff.	T %	
≤5 years	3	60%	19	34.5%	22
6 - 10 years	1	20%	21	38.2%	22
>10 years	1	20%	15	27.3%	16

4. Discussion of Results

Several studies have demonstrated the effects of menopause on periodontal health, but the etiopathogenesis of these periodontal diseases has remained unclear; indeed, several authors [16]-[18] have shown that, in addition to dental plaque, there are oral, biological, behavioral, and social factors that have important implications for oral health during menopause. It is interesting to highlight the impact of these factors on the periodontal health of our population, as the role of these determining or contributing factors in the genesis of periodontal disease during menopause cannot be ruled out and will inevitably overlap with that of menopause [19].

4.1. Oral Factors and Periodontal Status

Although they play a secondary role in etiology, there are oral factors that can modulate the pathogenesis of periodontal disease. Oral factors, such as the condition of the teeth and the state of the periodontal environment (tartar, anatomical

features, overhanging fillings, orthodontic appliances, prostheses, etc.), promote mechanical retention and therefore plaque accumulation and also modify the periodontal microenvironment [19].

- **CAO and periodontal status**

According to our results, the average CAD index was 24.5 in the postmenopausal group and 24.4 in the control group. This difference is statistically significant (P = 0.07). Therefore, the two groups differ in the condition of their teeth. This difference between the two groups is due to the number of missing teeth, which is higher in the experimental group than the control group. The results of the dental examination showed that the number of missing teeth ranged from 1 to 25, with an average of 12 missing teeth in postmenopausal women, and from 0 to 23 in premenopausal women, with an average of 9.5 missing teeth.

This difference is statistically significant (p = 0.0028). Therefore, the two groups differ in the number of missing teeth. This may be related to the higher age of the experimental group.

These results remain higher than the average CAO index of adults obtained in the national survey [4] *i.e.* 12.48 in both groups (the experimental group and the control group). They are also higher than the average CAO index obtained in the epidemiological survey [20] on pregnancy and the periodontium, *i.e.* 14.22 in the group of pregnant women and 11.18 in the control group. But they remain lower than the average CAO index obtained in another epidemiological survey [21] on oral contraceptives and the periodontium, which found an average CAO index of 28.7 in women taking oral contraceptives and 26.48 in the control group.

- **Dental brushing**

Our study showed that the control group and the group of postmenopausal women brushed with the same frequency, which was generally irregular and incorrect. These results may be due to age, socioeconomic status, or lack of information on oral health prevention.

4.2. Menopause and Periodontal Status

- **Index plaque**

The plaque index did not differ between the two groups and was independent of education level. Its mean value ranged between 1.2 and 1.37, indicating an average level of oral hygiene.

Comparing these results with those found in the epidemiological survey on pregnancy and periodontitis, it was found that the two groups did not differ in their plaque index and had a mean index between 1 and 2, indicating an average level of oral hygiene. However, in the epidemiological study on the effects of orals contraceptives on the periodontium [21], the results showed that the experimental group had a higher plaque index (2.08) than the control group (1.66). This is likely related to the higher motivation level in the control group.

- **Gingival index**

Postmenopausal women showed a slightly higher gingival index (1.3) than the

control group (1.27), this difference was statistically insignificant.

The results concerning oral contraceptives and the periodontium showed a relationship between oral contraceptive use and inflammation (control group (1.02), experimental group (2.02)). Similar results were obtained in the epidemiological survey on pregnancy and periodontium, which showed that the group of pregnant women had a higher gingival index (1.44) than the control group (1.12). Gingival recessions.

The height of gingival recession is significantly higher in the group of postmenopausal women (3.88 mm) than in the control group (2.7 mm).

The results of the survey on oral contraceptives and periodontium [21] found no significant difference between the two groups.

Regarding the epidemiological survey on gravid state and periodontium, the results showed no significant difference between the two groups.

The results of our survey showed that periodontal changes most often manifest as gingival recessions, which may be related to the atrophy of the oral epithelium caused by hormonal changes during menopause (LEIMOLA-VIRTANEN) [22].

- **Gingival Index and Plaque Index**

In the control group, the average gingival index varies between 1.15 and 1.27 and increases slightly when the plaque index increases, the same for the experimental group where it varies between 1.22 and 1.27 thus giving a significant difference ($p = 0.005$).

Thus the gingival index is dependent on the plaque index in both groups.

The impact of the plaque index on the periodontal state of our population was materialized by this result which is very important and which shows an obvious and very significant relationship between plaque index and gingival index in both groups this can be explained by the low socioeconomic level of the two groups as well as the irregularity of brushing and the lack of information on prevention via the dental surgeon. In the epidemiological survey on pregnancy and the periodontium, the results showed a highly significant relationship between plaque index and gingival index in the control group, while this relationship was not significant in the experimental group. This difference was explained by the impact of pregnancy on gingival health.

In the epidemiological survey on the effects of orals contraceptives on the periodontium [21], the results showed a highly significant relationship between plaque index and gingival index in both groups.

- **Tooth mobility**

The degree of tooth mobility ranged from 1 to 4, with a mean of 2.11 for the experimental group, and from 0 to 3, with a mean of 1.6 for the control group. The experimental group showed greater mobility than the control group. The difference was statistically significant (P: 0.0002). Therefore, the two groups differed in the degree of tooth mobility. These results are superior to those found in the epidemiological survey on pregnancy, where the average degree of dental mobility was 1.62 for pregnant women and 0.68 for the control group; this difference is

statistically significant. However, the degree of mobility in the group of women taking oral contraceptives [21] exceeded that of the control group, but the difference is statistically insignificant.

- **Periodontal pockets**

The results obtained following the periodontal survey showed that the depth of periodontal pockets ranged from 3 mm to 7 mm, with an average of 4.4 mm for the experimental group, and from 3 mm to 5 mm, with an average of 3.7 mm for the control group. This difference was statistically significant ($p = 0.003$). Therefore, the two groups differed in the depth of their periodontal pockets. The epidemiological study on the effects of contraceptives on the periodontium [21] revealed significantly greater periodontal pocket depths in the experimental group (4.58 mm) than in the control group (3.82 mm).

The study conducted on pregnancy showed greater periodontal pocket depths in the experimental group (1.82 mm) than in the control group (1.08 mm). This difference is statistically insignificant. These averages remain much lower than those found in postmenopausal women.

- **Interradicular lesions**

The majority of women with interradicular lesions belong to class II. The mean degree of interradicular lesion is 1.2 for the control group and 1.6 for postmenopausal women. The difference is statistically significant ($p = 0.06$). Therefore, the two groups differ in the degree of interradicular lesions. The average rate of interradicular lesions in the epidemiological survey on pregnancy and the periodontium was 0.16 for both groups. However, for the survey on the effects of contraceptives on the periodontium [21], the average rate of interradicular lesions was 0.02 for the experimental group, while the control group did not present any interradicular lesions. Therefore, we note that in our results, the average rate of interradicular lesions is much higher in both groups, with a higher rate in the experimental group. This may be related to the advanced age of both groups, with an implication of hormonal changes that occur during menopause.

These three results confirm the studies conducted by MARIOTTII [23], which showed that an increase in tooth mobility can occur in the absence of any inflammation of the marginal periodontium, which would reinforce the idea of a hormonal etiology. This is also confirmed by several recent studies [24] [25] which show that an estrogen deficiency affects both the bones of the body and the jawbone, thus causing a loss of bone density which aggravates pre-existing periodontitis and consequently an increase in mobility as well as the depth of periodontal pockets.

4.3. Menopause and Types of Periodontal Disease

The results showed that 87.7% of the population had periodontitis. Both groups had a high rate of periodontitis, with 90% in the experimental group and 85% in the control group. This difference remained statistically insignificant (p: 0.3). Therefore, the two groups did not differ in the type of periodontal disease [24]

[25].

In the epidemiological survey of the effects of orals contraceptives on periodontal health [21], the results showed that 100% of women in the experimental group had periodontal disease, compared to 88% in the control group. This difference remained statistically insignificant.

In the epidemiological survey of pregnancy on periodontal health, the results showed that fewer women in the control group (80%) had periodontal disease than the experimental group (86%). This difference was statistically insignificant. Therefore, the two groups do not differ in the type of periodontal disease.

4.4. Menopause Parameters

4.4.1. Age of Menopause

Women who reached menopause between 45 and 59 years of age had the highest mean CAO index, which was 24.2, followed by those under 45 years of age with a CAO index of 23.8, and those over 50 years of age with a CAO index of 23.7. However, the difference remains non-significant.

4.4.2. Duration of Menopause

- **Gingival Index**

The mean gingival index does not show any particular trend with menopause duration and varies between 1.26 and 1.6. This difference is statistically insignificant ($p = 0.3$).

Similar results were found in the pregnancy survey, where the gingival index was significantly unrelated to pregnancy duration. However, in the contraceptive survey, the gingival index increased significantly as the duration of oral contraceptive use increased.

- **Periodontal Pocket Depth**

The results showed that women who had been in menopause for 6 to 10 years had the deepest periodontal pockets, with an average of 4.7 mm, followed by those who had been in menopause for more than 10 years (4.2 mm) and then those who had been in menopause for less than 5 years (4.13 mm). This difference was statistically insignificant ($p = 0.2$).

In the epidemiological survey of pregnancy on periodontal status, the results showed that women in the first trimester had the deepest periodontal pockets, averaging 2.75 mm, followed by 1.85 mm in the third trimester, and 1.31 mm in the second trimester. However, this difference was statistically insignificant. In the epidemiological study of the effects of oral contraceptives on periodontal health [21], the results showed that the depth of periodontal pockets ranged from 0 to 9 mm, with an average of 4.2 mm. The experimental group showed an average depth of periodontal pockets (4.58) that exceeded that of the control group (3.82).

- **Height of gingival recession**

Women who had been in menopause for more than 10 years had the greatest recession height, with an average of 4.7 mm, followed by those who had been in menopause for 6 to 10 years and those who had been in menopause for less than

5 years, who had an identical average of 3.6 mm. This difference was statistically significant (p = 0.025), meaning that the higher the age of menopause, the greater the gingival recession. This may also be due to changes in the oral mucosa during hormonal changes occurring during menopause, as well as the advanced age of postmenopausal women.

- **Tooth mobility**

The average degree of tooth mobility does not change with the age of menopause and varies from 1.4 to 2 depending on the duration of menopause. This difference remains statistically insignificant (p = 0.16).

In the epidemiological survey of pregnancy on periodontal status, the results showed a non-significant difference, although the degree of tooth mobility increases from 1.25 to 1.77 with increasing pregnancy duration. In the epidemiological investigation of the effects of orals contraceptives on periodontal status [21], the results showed that the degree of dental mobility ranges from 0 to 4 with an average of 0.91, the experimental group revealed an average degree of mobility (0.94) which exceeds that of the control group (0.88). This difference is not statistically significant. Thus, the two groups do not differ in the degree of dental mobility [24] [25].

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5. Conclusions

It is currently well accepted that menopause plays an important role in the onset

and/or worsening of periodontitis through the action of female sex hormones on various body systems.

However, the mechanisms of action of these hormones remain poorly understood. The psychological context in which a woman experiences menopause should not be overlooked, as it can influence the severity of the various symptoms that appear in the oral cavity: oral discomfort, menopausal gingivitis, and periodontitis. Several clinical and biochemical studies and research have proven that menopause plays a secondary role in the genesis of periodontitis, which can be avoided or at least mitigated by establishing good plaque control.

However, other studies have attributed responsibility to sex hormones in the onset of this periodontitis.

At the end of our investigation, we attempted to identify the determinants of periodontal health by comparing a group of postmenopausal women to another control group. We found that oral hygiene, the condition of the teeth, the periodontal environment, and the physiological state of menopause are the main factors responsible for periodontitis.

However, due to the association of etiological factors, the incrimination of hormonal etiology as a triggering factor should therefore be very cautious. Thus, during the menopausal transition in women and throughout the menopause period, the dental surgeon must pay particular attention to the patient's oral health and any symptoms she may experience.

For women experiencing oral symptoms during menopause, once psychological factors and local irritants have been eliminated, the dental surgeon should refer them to a doctor for a hormonal assessment. The results obtained will allow for the implementation or otherwise of general hormonal treatment.

Patients should be informed of the specifics of their condition and its impact on the oral cavity in general and the periodontium in particular.

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Conflicts of Interest

The authors declare no conflicts of interest.

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