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IMPACT OF SYSTEMIC STATINS ON PERIODONTAL HEALTH: A RETROSPECTIVE STUDY IN A LEBANESE POPULATION

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Introduction: Statins, primarily used for cholesterol management, have shown potential in improving periodontal health due to their anti-inflammatory and bone-regenerative properties.

Methods: A retrospective study was conducted on 30 patients under statin medication. A control group of 30 non-statin users was selected using propensity score matching (PSM) to minimize bias. Data on pocket depth, attachment loss, and radiographic bone loss were collected at two time points: T0 and T1. Statistical analysis was performed using RStudio, with a significance threshold set at $p < 0.05$.

Results: The study revealed significant decrease in pocket depth ($p = 0.0027$), attachment loss ($p< 0.001$), and radiographic bone loss ($p < 0.001$) in the statin group compared to the control group from T0 to T1.

Conclusions: These findings suggest that systemic statins contribute to improved periodontal health. Further research is needed to confirm these effects and evaluate long-term clinical implications

Keywords: Statins, Periodontal health, Anti-inflammatory, Pocket depth, Attachment loss, Bone loss.

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Conflicts of interest:
The authors declare no conflicts of interest.

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IMPACT DES STATINES SYSTÉMIQUES SUR LA SANTÉ PARODONTALE: UNE ÉTUDE RÉTROSPECTIVE DANS UNE POPULATION LIBANAISE

Introduction: Les statines, principalement utilisées pour la gestion du cholestérol, ont montré un potentiel d'amélioration de la santé parodontale grâce à leurs propriétés anti-inflammatoires et régénératives osseuses.

Méthodes: Une étude rétrospective a été menée sur 30 patients sous statines. Un groupe témoin de 30 non-utilisateurs de statines a été sélectionné à l'aide du "propensity score matching" (PSM) pour minimiser les biais. Les données sur la profondeur des poches, la perte d'attache et la perte osseuse radiographique ont été recueillies à deux moments : T0 et T1. L'analyse statistique a été réalisée avec RStudio, avec un seuil de signification fixé à $p < 0,05$.

Résultats: L'étude a révélé une diminution significative de la profondeur des poches ($p = 0,0027$), de la perte d'attache ($p < 0,001$) et de la perte osseuse radiographique ($p < 0,001$) dans le groupe sous statines par rapport au groupe témoin entre T0 et T1.

Conclusions: Ces résultats suggèrent que les statines systémiques contribuent à l'amélioration de la santé parodontale. Des recherches supplémentaires sont nécessaires pour confirmer ces effets et évaluer les implications cliniques à long terme.

Mots-clés: Statines, Santé parodontale, Anti-inflammatoire, Profondeur de poche, Perte d'attache, Perte osseuse.

Introduction

Could the same medication that protects your heart, save your gums? Statins are a class of hypolipidemic drugs primarily used to reduce low-density cholesterol levels in the blood. Recently, their addition has been proposed as a promising complementary therapeutic strategy to conventional periodontitis treatment [1, 2]. Two methods of use have been suggested: systemic administration and local application of statins [1, 3, 4]. By reducing cholesterol, statins limit inflammation and oxidative stress while promoting the natural repair of periodontal tissues [5].

Moreover, statins have a triple action on bone: they increase osteogenesis, decrease bone resorption, and reduce osteoclastogenesis [1, 6, 7]. Furthermore, statins are effective in reducing tissue inflammation, including that of the periodontium. By minimizing this inflammation, they help decrease the destruction of periodontal tissues [1, 8-10].

In addition to their anti-inflammatory and osteogenic effects, certain statins, particularly simvastatin, possess an antimicrobial effect on Porphyromonas gingivalis (Pg) [11] and Aggregatibacter actinomycetemcomitans (Aa) [1], two key pathogens involved in periodontal diseases.

Finally, the use of statins significantly improves the osseointegration of implants, further reinforcing their potential role in implantology [12-16].

This study aims to evaluate the effects of the systemic administration of statins on periodontal health. The null hypothesis was that statin use has no significant effect on periodontal health parameters, including pocket depth, attachment loss, and bone loss.

Materials and Methods

Population

This study was conducted on a sample of 30 patients who underwent dental treatments at the Dental Care Center of Saint Joseph University, Beirut, Lebanon. Patient records were retrieved from the archives of the Faculty of Dental Medicine following approval of the study protocol by the research ethics committee of Saint Joseph University (Tfemd-2025-17). All patients meeting the inclusion and exclusion criteria were consecutively selected until the required number of subjects was reached.

The inclusion criteria are as follows: patients aged 35 to 80 years, both men and women, who have been using statin medications for at least six months. The use of statins, as well as their duration, was clearly documented in their medical records.

Exclusion criteria related to patients include: the presence of uncontrolled systemic diseases that may affect periodontal health such as uncontrolled diabetes, oral health conditions other than chronic periodontitis such as oral cancer or acute infections, and smoking. Regarding treatments, exclusions apply to the use of medications incompatible with the study, such as bisphosphonates and non-steroidal anti-inflammatory drugs, which have a significant impact on bone metabolism and periodontal inflammation. Additionally, patients should not have undergone surgical periodontal treatment.

Approximately 20,000 records from the archive between 2009 and 2022 were reviewed to identify eligible cases for inclusion in the study. Records were excluded based on medical contraindications or incomplete periodontal data, resulting in a final sample of 30 records of patients on statins with complete and usable data.

Treatment

The patients included in the study were required to have undergone two scaling sessions performed at two distinct times. During these sessions, periodontal pocket depths and gingival recessions were measured in millimeters on all teeth using a PCP15 periodontal probe and noted on the patients' records. The first measurements were taken at "time 0" (T0), and the second at "time 1" (T1), with an interval between T0 and T1 ranging from one to twelve years.

This approach allows the evaluation of periodontal parameters over time to reflect changes associated with statin use. During this time interval, which varies from patient to patient, statin medication use is confirmed.

Variables studied

Pocket depth

Pocket depth is the distance between the marginal gingiva and the bottom of the gingival pocket.

It was measured in millimeters (mm) using a graduated periodontal probe (PCP15) on each tooth. Values of 3 mm or less were not recorded, as they correspond to the physiological depth of the gingival sulcus rather than a pathological pocket [17].

Data on pocket depths were retrieved from patients' medical records, including the number of pockets with depths ranging from 4 to 5 mm, as well as those equal to or greater than 6 mm. This

was done to observe the evolution (increase or decrease) of the number of pockets for each interval between T0 and T1.

Attachment loss

Attachment loss level is the distance between the cementoenamel junction and the bottom of the gingival pocket [17]. Attachment loss in millimeters (mm) was calculated in two ways.

• In the absence of recession, attachment loss was calculated as follows:

Attachment loss (mm) = pocket depth (mm) – sulcus (mm). The sulcus, ranging from 1 mm to 3 mm, was estimated to be 2 mm on average to standardize the results. This average value of 2 mm was used to calculate all attachment losses in the absence of recession. Therefore, attachment loss (mm) = pocket depth (mm) – 2 (mm).

• In the presence of recession, attachment loss was calculated as follows:

Attachment loss (mm) = pocket depth (mm) + recession (mm). Data on pocket depths and recessions were retrieved from patients' medical records. Attachment losses were calculated and categorized into three intervals: 1 to 2 mm, 3 to 4 mm, and 5 mm or greater. This was done to observe the evolution (increase or decrease) of the number of attachment losses for each interval between T0 and T1.

Radiographic bone loss

Radiographic bone loss was measured on periapical radiographs by measuring the distance between the CEJ (Cemento-Enamel Junction) and the bone level [17].

This was done using 3 fixed landmarks for all patients at the first premolar, second premolar, and first molar interproximaly. The same landmarks were used for each patient at T0 and T1 to measure radiographic bone loss.

All periapical radiographs were taken using the same radiographic device. The radiographs were taken with an angulator to ensure they were orthogonal to the tooth axis. Measurements were performed using the same image processing software (Dürr Dental DBSWIN 5.6) to ensure consistency of the data. It is important to note that these measurements are not actual values, but approximations close to them. However, this level of precision is not critical for the study, as the main objective is to observe changes in values over time, rather than measuring exact distances.

The analysis focuses on variations in these values, allowing to observe the changes in bone level between the different measurement points (T0 and T1).

Statistics

Selection of the control group

To evaluate the effectiveness of statin treatment on periodontal health in the 30 subjects included

in the study, the progression of their periodontal state was compared with that of a control group.

This control group consisted of patients meeting the same inclusion and exclusion criteria, but who do not use statin medications. Data were collected identically for both groups at distinct time points: T0 and T1.

To select the sample for the control group, 90 patients were initially identified, three times the number of patients included in the study group. These 90 patients and the 30 subjects from the study group were then entered into a statistical program: Microsoft Excel (XLSTAT). The propensity score matching (PSM) function in Microsoft Excel (XLSTAT) was used to select 30 control patients who matched the 30 study patients.

Propensity score matching is a statistical technique used to minimize bias in observational studies. It involves matching subjects from the treatment group with those from the control group based on similar characteristics [18]. In our case, the program identified for each study group patient a control patient with the most similar characteristics. These pairings were made considering four main covariables:

1. Patient age.
2. Time interval between T0 and T1.
3. Patient sex.
4. Initial periodontal status at time T0.

Using this method, 30 control subjects were selected from the initial 90 patients, ensuring that

both groups were comparable, which enhances the validity of the results obtained. Below is a

comparison of the distribution of the 30 subjects in each group for each covariable (Tables 1 to 4).

Table 1. Subject distribution by age in statin and control groups.

Age	Statin group	Control group
35 to 49 years	3	5
50 to 64 years	20	19
65 to 80 years	7	6

Table 2. Subject distribution by time interval between T0 and T1 in statin and control groups.

Time interval between T0 and T1	Statin group	Control group
1 to 4 years	21	20
5 to 8 years	7	7
9 to 12 years	2	3

Table 3. Subject distribution by sex in statin and control groups.

Sex	Statin group	Control group
Male	15	15
Female	15	15

Table 4. Subject distribution by initial periodontal status at T0 in statin and control groups.

Initial periodontal status at T0	Statin group	Control group
Gingivitis	2	2
Periodontitis stage 1	15	16
Periodontitis stage 2	11	9
Periodontitis stage 3	2	3

Statistical analysis

For the statistical analysis of the data collected in the study and control groups, the software RStudio (version 2024.09.1, Build 394) was used. The analyzed variables are continuous and independent, with a significance threshold set at $p < 0.05$.

To select the appropriate statistical tests, the normality of the data was assessed using the Shapiro-Wilk test:

- If the data were normally distributed, parametric tests such as the Student's t-test were used. In this case, the mean was considered the appropriate measure of central tendency, as it reflects the typical value in a dataset that follows a normal distribution. The Student's t-test compares the means of the two groups and determines whether any observed difference is statistically significant.
- If the data are not normally distributed, non-parametric tests like the Wilcoxon test were used. In this case, the median was used instead of the mean to represent the central tendency. The median is more appropriate for non-normally distributed data because it is less affected by extreme values or asymmetrical data, making it a more reliable indicator of the typical value in such datasets. The Wilcoxon test compares the median values between the two groups and assesses whether any observed difference is significant.

A p-value lower than 0.05 ($p < 0.05$) indicates a statistically significant difference between the two groups. This difference is unlikely to be due to chance. However, a p-value greater than 0.05 ($p > 0.05$) indicates a non-significant difference between the two groups.

Results

Pocket depth (Figures 1 to 3)

Pockets of 4-5 mm

For pockets of 4-5 mm, a statistically significant difference between the statin group and the control group was observed (p-value=0.0065). The median of the control group was 0, while the median of the statin group was -8.5. This result reveals a decrease of 8.5 pockets measuring 4 to 5 mm in the statin group compared to the control group at T1.

Pockets of ≥6 mm

For pockets of ≥6 mm, no statistically significant difference between the two groups was found (p-value=0.1199). The medians for the groups were 0 for the control group and -1 for the statin group. This result reveals a decrease of 1 pocket measuring ≥6 mm in the statin group compared to the control group at T1.

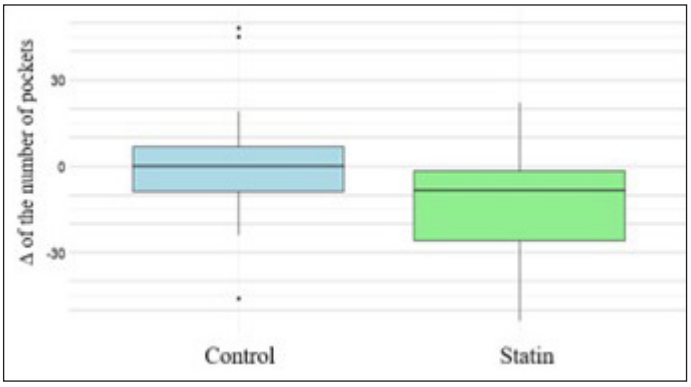

Figure 1. Boxplot illustrating the variation of the number of 4-5 mm pockets between T0 and T1.

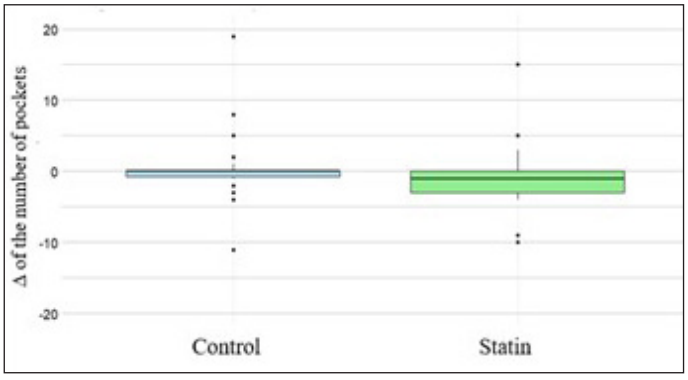

Figure 2. Boxplot illustrating the variation of the number of pockets ≥6 mm between T0 and T1.

Overall Pocket depth

When analyzing all pocket depths, a significant difference between the groups was observed (p-value=0.0027). The median of the control group was 0, while the median of the statin group was -3. This reveals a decrease of 3 pockets in the statin group compared to the control group at T1.

Attachment loss [Figures 4 to 7]

Attachment loss of 1-2 mm

For attachment loss of 1-2 mm, a significant difference between the two groups was observed (p-value=0.0299). The mean for the control group was +0.37 (the median is -0.5), while for the statin group, it was -7.43 (the median is -5.5). This shows a decrease of 7.43 attachment losses measuring 1 to 2 mm in the statin group, compared to an increase of 0.37 in the control group at T1.

Attachment loss of 3-4 mm

For attachment loss of 3-4 mm, a significant difference between the groups was observed (p-value=0.0135). The mean for the control group was +2.3 (the median is +1), while for the statin group, it was -3.4 (the median is -5). This shows a decrease of 3.4 attachment losses measuring 3 to 4 mm in the statin group, compared to an increase of 2.3 in the control group at T1.

Attachment Loss ≥5 mm

For attachment loss ≥5 mm, a marginally significant difference was observed (p-value=0.0633). The medians for the control and statin groups were 1 and 0, respectively. This shows an increase of one attachment loss measuring ≥5 mm in the control group compared to the statin group at T1.

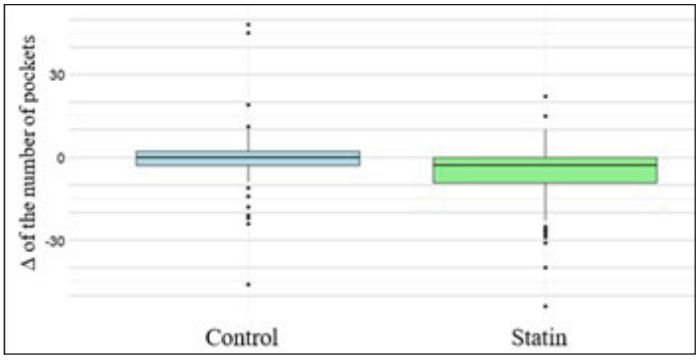

Figure 3. Boxplot illustrating the variation of the total number of pockets between T0 and T1.

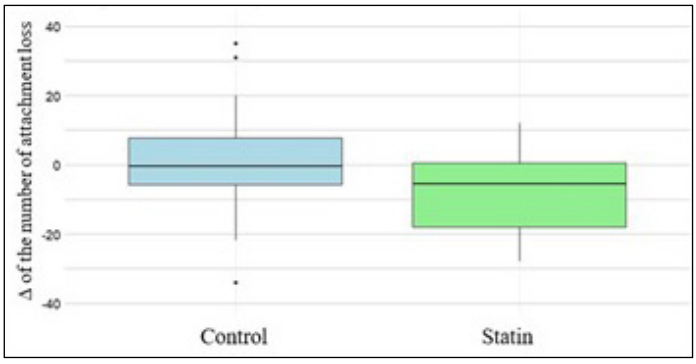

Figure 4. Boxplot illustrating the variation of the number of attachment losses of 1-2 mm between T0 and T1.

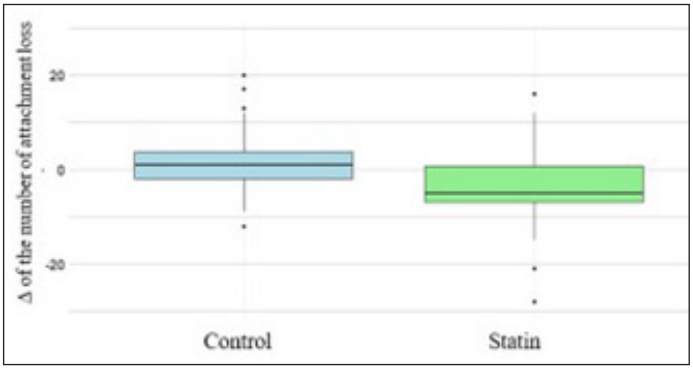

Figure 5. Boxplot illustrating the variation of the number of attachment losses of 3-4 mm between T0 and T1.

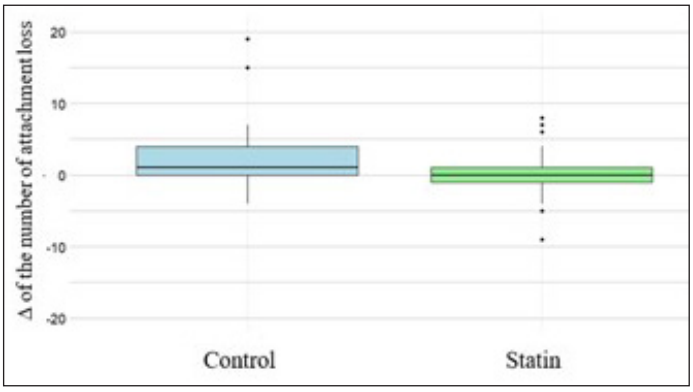

Figure 6. Boxplot illustrating the variation of the number of attachment losses ≥5 mm between T0 and T1.

Overall attachment loss

For overall attachment loss, a significant difference between the groups was observed (p-value < 0.001), indicating that the reduction in the number of attachment losses is significantly greater in the statin group than in the control group. The median of the statin group was -2, while the median of the control group was 1. This result reveals a decrease of 2 attachment losses in the statin group, compared to an increase of 1 attachment loss in the control group at T1.

Radiographic alveolar bone loss (Figure 8)

The analysis of bone loss showed a significant difference between the two groups (p-value < 0.001), with a median bone loss of +0.2 mm for the control group and 0 mm for the statin group. This indicates a bone loss of 0.2 mm in the control group compared to the statin group at T1.

Discussion

This study aimed to evaluate the effect of systemic statins on periodontal health by comparing changes in pocket depth, attachment loss, and bone loss between statin users and a control group.

The results provide the following insights:In patients treated with statins, a notable decrease in the number of pockets measuring between 4 and 5 mm was observed. In contrast, a slight reduction in the number of pockets measuring 6 mm and above was noted.

For attachment loss, similar results were observed. In patients on statins, a significant decrease in the number of attachment losses measuring between 1 and 2 mm and between 3 and 4 mm was seen compared to the control group. On the other hand, a slight decrease in the number of attachment losses measuring 5 mm and above was noted. These observations suggest that the effect of systemically administered statins is more pronounced on periodontal pockets of less severe depth and on minor to moderate attachment losses.

However, a study conducted by Killeen et al. [4] examined the effect of locally applied simvastatin on sites with pocket depths measuring between 6 and 9 mm. The results revealed a significant improvement in pocket depths and severe attachment losses in the treated group compared to the control group. This can be explained by the local application of statins, which indicates that a higher concentration of the drug reached the periodontal site affected by severe attachment losses.

Nevertheless, a decrease in the number of pockets measuring between 4 and 5 mm could indicate progression to deeper pockets (≥6 mm), which would not reflect an improvement in periodontal health. On the other hand, an increase in the number of pockets measuring between 4 and 5 mm could indicate a reduction in deep pockets (≥6 mm), which would indicate an improvement in periodontal condition.

To eliminate any confusion, a global analysis of the total number of periodontal pockets was conducted. The results show a significant decrease in the total number of pockets between the two groups. Similarly, a global analysis of the total number of attachment losses revealed a significant decrease in this number in the statin group compared to the control group. These observations highlight the anti-inflammatory effects of statins. By acting mainly on cytokines, statins reduce inflammation of periodontal tissues, limiting the progression of periodontal pockets and the destruction of the tooth's attachment system, preserving the integrity of periodontal and bone tissue. This suggests that statins not only slow the progression of periodontal disease but also

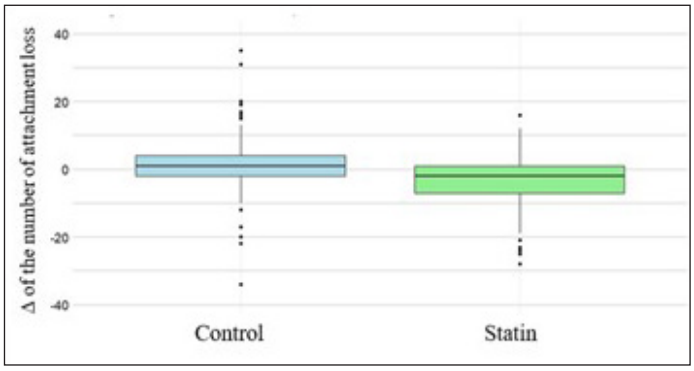

Figure 7. Boxplot illustrating the variation of the total number of attachment losses between T0 and T1.

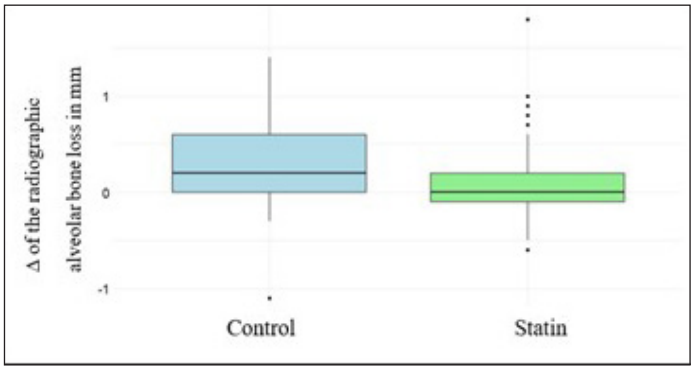

Figure 8. Boxplot illustrating the variation in radiographic alveolar bone loss between T0 and T1.

contribute to the improvement of periodontal health [1, 8-10].

The study by Killeen et al. [4] did not reveal any significant difference in bone level between the group receiving a local application of simvastatin and the control group. However, in this study, a reduction in bone loss was observed in the statin group compared to the control group. This is demonstrated by the measurement of the distance between the CEJ and the bone level, which shows an increase in this distance of 0.2 mm in the control group compared to the statin group, where the distance seems to remain stable. These results are consistent with the study by Shirke et al. [19], where the distance between the CEJ and the bone level increased in the control group and decreased in the group receiving atorvastatin, showing an improvement in bone level with the use of statins. Statins act on bone metabolism by modulating several key biological processes. They stimulate osteogenesis, leading to the formation of new bone tissues. Similarly, they reduce osteoclastogenesis, thereby decreasing bone resorption. Thanks to this dual action, statins help maintain the balance of bone remodeling. This could not only slow down bone loss but also promote the regeneration of the tooth's supporting tissues [1, 6, 7]. These effects are also observed around dental implants. Indeed, statins promote closer contact between the implant and the bone by stimulating bone formation around the implant surface, thereby improving osseointegration [12-16].

A systematic review and meta-analysis conducted by Bert et al. [20] demonstrated an improvement in periodontal parameters, including bone level and attachment loss, after the use of statins, whether administered systemically or locally. These results are consistent with this study, where systemic statins had a positive effect on pocket depths, attachment losses, and bone loss, leading to better periodontal health.

The limitations of this study are mainly related to its retrospective nature. Firstly, pocket depth and recession measurements were taken at two different times by two different clinicians, which may create measurement bias. It should be noted that all radiographic bone loss measurements were performed by the same clinician. However, these measurements were limited to teeth for which radiographs were most available. Although incisors and molars are optimal choices for studying bone loss, it was necessary to adapt to the available radiographs, hence the choice of premolars and molars for these measurements. Another limitation due to the retrospective nature of the study is the absence of follow-up on participants' behavioral factors influencing periodontal health, such as oral hygiene.

Finally, although the administration of statins during the studied time interval is documented in the participants' records, it was not possible to confirm that each patient adhered to the daily treatment throughout this period, which is an additional limitation.

Conclusion

In conclusion, this study highlights the beneficial effects of statins on periodontal health. The results show a significant improvement in periodontal parameters, including a reduction in the number of periodontal pockets, attachment loss, and bone loss in the statin group. These findings suggest that statins could play a beneficial role in addition to periodontal treatments, beyond their usual use in cholesterol management. Further studies will be necessary to confirm these results and evaluate their long-term clinical relevance.

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