







## Original Research Article

# Evaluation of oral health-related quality of life in a sample of Iraqi patients with rheumatoid arthritis: a case-control study

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**Abstract – Background:** Oral health-related quality of life (OHRQoL) has been investigated as a component of health-related quality of life (HRQoL) in recent years. However, there is a lack of local data using OHRQoL questionnaires to assess life quality in individuals rheumatoid arthritis (RA) at the present time. **Objectives:** to assess the OHRQoL of RA patients and explore any potential effects of various clinical indicators. **Methods:** A cross-sectional study compared 100 RA patients and 100 control individuals to assess and compare their OHRQoL. The study examined the Oral Health Impact Profile (OHIP-14) as one of the oral health factors under investigation, examining the association between the disease activity score of RA (CDAI and DAS28) and the OHIP. **Results:** Patients with RA had a median OHIP-14 of 14 (4–24.5), while controls had a median of 6 (2–18), yielding a significant difference ( $p = 0.005$ ). A significant positive yet weak correlation was observed between OHIP-14 and CDAI ( $r = 0.26, p = 0.009$ ). A weak positive correlation was seen between OHIP-14 and DAS28, although the correlation did not attain statistical significance ( $r = 0.15, p = 0.125$ ). **Conclusions:** Patients with RA reported a more unfavorable evaluation of their OHRQoL compared to those without RA.

## Introduction

Rheumatoid arthritis (RA) is a chronic autoimmune disease that primarily affects the joints, resulting in inflammation and subsequent damage. RA affects around 1% of the global population and is more prevalent in females than males. Although the precise causes of RA remain unknown, research indicates that a combination of genetic and environmental variables may play a role in its pathogenesis [1]. Recent studies have explored a possible relationship between oral health and RA. Specifically, periodontal disease, an inflammatory condition affecting the gums and supporting tissues of the teeth, has been proposed as a potential risk factor for RA. Periodontal disease is triggered by bacterial infection and is characterized by the loss of bone and connective tissue that support the teeth. The chronic inflammation associated with both RA and periodontal disease suggests a possible link between these two conditions [2,3].

Patients with RA reported having lower health-related quality of life (HRQoL) [4]. Due to pain and movement restrictions brought on by the general inflammatory process, disease consequences, and psychosocial effects, patients' HRQoL may be significantly lower in comparison to the healthy population [5].

One of the important sub aspects of HRQoL, oral health-related quality of life (OHRQoL), has been the subject of recent studies [6–10]. However, there is currently no local data employing OHRQoL questionnaires to evaluate the life quality of RA patients. Therefore, the objective of this study was to evaluate the OHRQoL of a sample of Iraqi RA patients and explore any potential effects of various clinical indicators, such as disease activity.

## Methods

### Design, settings, and participants

The Outpatient Clinic of the Rheumatology Unit at Baghdad Teaching Hospital, Iraq, participated in this cross-sectional case-control study between November 2022 and February 2023.

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Based on a 1% prevalence of rheumatoid arthritis (RA) and the goal of achieving a 95% confidence level with a 2% margin of error, the minimum sample size for the study was calculated to be around 96 people. The current study included a total of 200 people, with 100 individuals meeting the criteria for RA based on the 2010 ACR/EULAR terms of classification [11]. These individuals constituted the case group. The study excluded individuals who had been diagnosed with other rheumatic conditions, received periodontal disease therapy in the past six months, utilized orthodontic equipment, had a history of antibiotic usage within the previous 90 days, were pregnant or breastfeeding, or had malignancies. The control group consisted of 100 apparently healthy individuals; most of them were the attendants of the patients with no RA or any other rheumatic disorders, and the same exclusion criteria were adopted.

### Data collection and study tools

Patients' and controls' data was collected using a paper clinical study form via interviews and questionnaires. The questionnaires were divided into three sections: the first section contained socio-demographic information such as age, gender, highest educational level [illiterate, primary (6 yr), secondary (9 yr), high school (12 yr), bachelor's degree (college), and postgraduate], smoking status, and BMI. The formula  $BMI = \text{weight}/\text{height}^2$  was used to determine the body mass index (BMI).

In the second section, there were clinical data about the disease's duration (in years), the erythrocyte sedimentation rate (ESR), the disease activity score in 28 joints (DAS28), the clinical disease activity index (CDAI), anti-citrullinated protein antibodies (ACPA), rheumatoid factor (RF), and medications, such as conventional disease-modifying anti-rheumatic drugs (cDMARDs), biologics, or both, non-steroidal anti-inflammatory drugs (NSAIDs), and steroids.

The Arabic version of the Health Assessment Questionnaire Disability Index (HAQ-DI) [12] has eight components: dressing and grooming, arising, eating, walking, hygiene, reach, grip, and activities. Each component has two or three questions, which is graded from 0 (no difficulty) to 3 (unable to do). The score assigned to each component is the worst score within that section, i.e., if one question is scored 1 and another 2, the section score is 2. Additionally, if an aiding device, equipment, or assistance from another person is required, the area must have a minimum score of 2. If the section score is already two or above, no changes are made. The total of the 8 scores from the 8 components was divided by 8. The outcome was the disability index (DI).

### Oral health-related quality of life evaluation

Participants' OHRQoL was assessed by adopting the Arabic edition of the Oral Health Impact Profile (OHIP-14) [13]. The OHIP-14 is composed of 14 items that fall into seven categories: functional limitation, physical discomfort, psychological discomfort, physical disability, psychological disability, social

impairment, and handicap. According to a Likert scale, each item's score is recorded: 0 for never, 1 for hardly ever, 2 for occasionally, 3 for fairly often, and 4 for very often. The total of all items, which range from 0 to 56, makes up the OHIP-14 sum score. Higher OHIP-14 sum scores imply a greater overall burden of OHRQoL.

### Ethics approval and consent to participate

In accordance with the Helsinki Declaration, informed consent was obtained from every participant in this study. The Medical Department's Ethics Committee, College of Medicine, Baghdad University, provided its consent in this regard.

### Statistical analysis

Data were displayed as a median (interquartile range) for continuous variables with a non-normal distribution and as a number (percentages) for categorical variables. For continuous variables, the Mann-Whitney test was employed, and for categorical variables, the Chi-square test was utilized. The correlation between OHIP-14 and RA disease activity was measured using Pearson's correlation. To evaluate the impact of patient sociodemographic and clinical variables on OHIP-14, multiple linear regression analysis was utilized. Statistical significance was defined as a P value less than 0.05. SPSS 27 (IBM Corp., USA, 2020) was used to perform all statistical analyses.

## Results

### Sociodemographic and clinical characteristics of RA patients and controls

The study encompassed a sample size of 200 individuals, with 100 participants diagnosed with rheumatoid arthritis (RA) and 100 individuals serving as controls. The median age of RA patients was 52.00 yr, with an interquartile range (IQR) of [26.00, 71.00], while the median age of the controls was 42.50 yr, with an IQR of [23.00, 70.00]. When the ages of the two groups were compared, the p-value was less than 0.001, indicating a statistically significant difference. On average, RA patients were older than the control group.

Females made up the majority of both RA patients (88.0%) and controls (93.0%). The p-value was 0.335, indicating that the gender distribution between the two groups was not statistically significant.

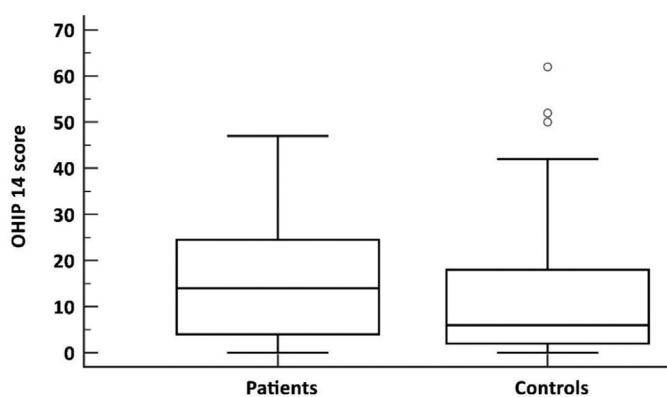
In terms of BMI, there was a statistically significant difference between the two groups; RA patients had a median BMI of 27.95 (IQR: [18.50, 46.90]), and the controls had a median BMI of 26.00 (IQR: [18.00, 49.00]). The p-value for this difference was 0.002. The distribution of smoking status (never, current, or ex-smoker) was provided for both groups. The p-value was 0.615, suggesting no statistically significant difference in smoking status between RA patients and controls.

A substantial difference in the distribution of education levels was observed between controls and RA patients (p-value < 0.001). The proportion of illiterate and postgraduate

**Table I.** Sociodemographic and clinical characteristics of RA patients and controls.

Variables	Patients ( <i>n</i> = 100)	Controls ( <i>n</i> = 100)	<i>p</i> -value
Age (years) Median (IQR)	52.00 [26.00, 71.00]	42.50 [23.00, 70.00]	<0.001
Gender (%)			0.335
Female	88 (88.0)	93 (93.0)	
Male	12 (12.0)	7 (7.0)	
BMI	27.95 [18.50, 46.90]	26.00 [18.00, 49.00]	0.002
Smoking (%)			0.615
Never	87 (87.0)	88 (88.0)	
Current	11 (11.0)	8 (8.0)	
Ex-smoker	2 (2.0)	4 (4.0)	
Education level (%)			<0.001
Illiterate	14 (14.0)	5 (5.0)	
Primary	40 (40.0)	36 (36.0)	
Secondary	14 (14.0)	23 (23.0)	
High school	22 (22.0)	10 (10.0)	
College	10 (10.0)	3 (3.0)	
Postgraduate	0 (0.0)	23 (23.0)	
Disease duration (years) Median (IQR)	10.00 [1.00, 30.00]		
CDAI Median (IQR)	19.00 [3.00, 43.00]		
DAS28 Median (IQR)	4.79 [2.03, 7.08]		
HAQ-DI Median (IQR)	1.27 [0.00, 2.88]	0.00 [0.00, 1.63]	<0.001
ACPA positive n (%)	51 (86.4)		
RF positive n (%)	65 (92.9)		
ESR	35.00 [2.00, 140.00]		
Biologics users n (%)	86 (86.0)		
DMARDs users n (%)	82 (82.0)		
NSAIDs users n (%)	5 (5.0)		
Steroids users n (%)	43 (43.0)		

ACPA, Anti-citrullinated protein antibodies; BMI, body mass index; CDAI, clinical disease activity index; cDMARD, conventional disease modifying antirheumatic drugs; DAS28, disease activity score 28; ESR, erythrocyte sedimentation rate; HAQ-DI, Health Assessment Questionnaire Disability Index; IQR, Interquartile range; NSAIDs, non steroidal anti inflammatory drugs; number; RF, rheumatoid factor; *P* value, probability value (<0.05).

**Fig. 1.** Comparison of OHIP-14 scores between patients and controls.

individuals was higher among RA patients compared to controls, who were more likely to have completed primary, secondary, high school, or college education. Notably, the median values of HAQ-DI between RA patients and controls differed significantly (1.27 [0.00, 2.88] vs. 0.00 [0.00, 1.63]), with a *p* value of less than 0.001.

Other clinical parameters for RA patients are presented in [Table I](#).

### Comparison of OHIP-14 scores between patients and controls

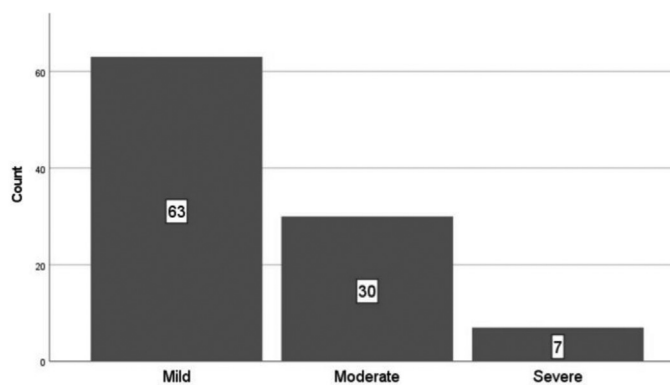
[Figure 1](#) showed a significant difference in the median (IQ) of OHIP-14 between RA patients and controls [14 (4-24.5) vs. 6 (2-18)] with a *p* value of 0.005.

### Severity of Oral Health Impact Profiling-14 in RA Patients

According to [Figure 2](#), out of 100 RA patients, 63 (63%) had mild, 30 (30%) had moderate, and 7 (7%) had severe OHIP.

### Correlation between OHIP-14 and RA disease activity

A substantial positive yet weak correlation was observed between the OHIP-14 and the CDAI. Additionally, OHIP-14 and DAS28 had a weak positive association; however, it did not reach statistical significance ([Fig. 3](#)).



**Fig. 2.** Severity of Oral health impact profiling in RA patients.

### Effect of sociodemographic and clinical characteristics on patients with OHIP-14

A multiple linear regression analysis was conducted to investigate the influence of sociodemographic and clinical factors on patients with OHIP-14, and there was no statistically significant effect of patients baseline sociodemographic and clinical characteristics on OHIP-14, as shown in [Table II](#) and explained below:

Age (standardized coefficient = 0.144,  $P$ -value = 0.489): the positive coefficient suggested a positive association between age and OHIP-14 scores, but it was not statistically significant ( $p$ -value > 0.05). This suggests that, in this analysis, age did not significantly affect the impact on oral health as determined by OHIP-14.

Gender (standardized coefficient = 0.103,  $P$ -value = 0.548): the positive coefficient indicated a positive relationship between gender and OHIP-14 scores, but it was not statistically significant. Therefore, the gender of the patients was not a significant predictor of oral health impact in this analysis.

BMI (standardized coefficient =  $-0.046$ ,  $P$ -value = 0.765): the negative coefficient suggested a negative association between BMI and OHIP-14 scores, but again, it was not statistically significant. BMI did not appear to be a significant predictor of oral health impact in this study.

Educational Level (standardized coefficient =  $-0.223$ ,  $P$ -value = 0.144): the negative coefficient implied a negative relationship between educational level and OHIP-14 scores, but it was not statistically significant. The educational level of the patients did not have a statistically significant impact on oral health in this analysis.

Smoking (standardized coefficient =  $-0.228$ ,  $P$ -value = 0.194): the negative coefficient suggested a negative association between smoking and OHIP-14 scores, but it was not statistically significant. Smoking did not emerge as a significant predictor of oral health impact in this study.

Disease Duration in Years (Standardized Coefficient =  $-0.171$ ,  $P$ -value = 0.355): the negative coefficient implied a negative relationship between disease duration and OHIP-14

scores, but it was not statistically significant. Disease duration did not seem to be a significant predictor of oral health impact in this analysis.

RF (standardized coefficient =  $-0.136$ ,  $P$ -value = 0.487): the negative coefficient indicated a negative relationship between RF positivity and OHIP-14 scores, but it was not statistically significant. RF positivity was not a significant predictor of oral health impact in this study.

ACPA (standardized coefficient = 0.097,  $P$ -value = 0.610): the positive coefficient suggested a positive association between ACPA positivity and OHIP-14 scores, but it was not statistically significant. ACPA positivity was not a significant predictor of oral health impact in this analysis.

HAQ-DI (standardized coefficient = 0.107,  $P$ -value = 0.493): the positive coefficient implied a positive relationship between HAQ-DI scores and OHIP-14 scores, but it was not statistically significant. HAQ-DI scores did not have a significant impact on oral health in this study.

NSAIDs (standardized coefficient =  $-0.216$ ,  $P$ -value = 0.169): the negative coefficient suggested a negative association between NSAID use and OHIP-14 scores, but it was not statistically significant. NSAID use was not a significant predictor of oral health impact in this analysis.

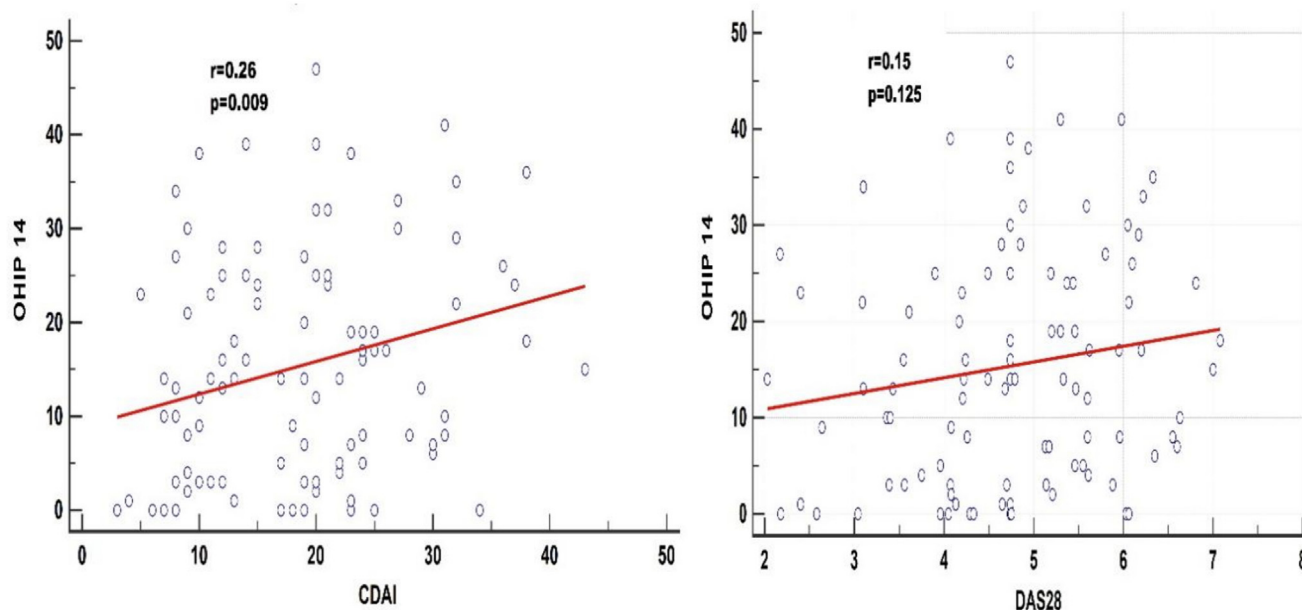
Steroids (standardized coefficient = 0.188,  $P$ -value = 0.211): the positive coefficient indicated a positive association between steroid use and OHIP-14 scores, but it was not statistically significant. Steroid use did not appear to be a significant predictor of oral health impact in this study.

cDMARDs (standardized coefficient = 0.030,  $P$ -value = 0.846): the positive coefficient implied a positive relationship between cDMARD use and OHIP-14 scores, but it was not statistically significant. cDMARDs use did not have a significant impact on oral health in this analysis.

Biologics (standardized coefficient = 0.075,  $P$ -value = 0.644): the positive coefficient suggested a positive association between biologics use and OHIP-14 scores, but it was not statistically significant. Biologics use did not appear to be a significant predictor of oral health impact in this study.

## Discussion

The main goal of this study was to compare the OHIP-14 scores between patients and controls. OHIP-14 is a validated questionnaire designed to evaluate the impact of oral health on an individual's life quality, with scores ranging from 0 to 56. Higher scores indicate a more substantial negative effect on OHRQoL. The analysis revealed that the median OHIP-14 score for patients with rheumatoid arthritis was 14 (interquartile range: 4–24.5), while for the control group, the median score was 6 ( $p$ -value: 0.005). These results reveal that individuals with RA experience a significantly higher impact on their OHRQoL compared to the control group. The higher median OHIP-14 score among RA patients (14) compared to controls (6) suggests that RA patients may encounter more challenges



**Fig. 3.** Correlation between OHIP-14 and RA disease activity.

**Table II.** Multiple linear regression analysis to assess the effect of sociodemographic and clinical characteristics of patients with OHIP-14.

Variables	Standardized coefficients beta	P-value
Age	.144	.489
Gender	.103	.548
BMI	-.046	.765
Educational level	-.223	.144
Smoking	-.228	.194
Disease duration in years	-.171	.355
RF	-.136	.487
ACPA	.097	.610
HAQ-DI	.107	.493
NSAIDs	-.216	.169
Steroids	.188	.211
cDMARDs	.030	.846
Biologics	.075	.644

ACPA, Anti-citrullinated protein antibodies; BMI, body mass index; cDMARD, conventional disease modifying antirheumatic drugs; HAQ-DI, Health Assessment Questionnaire Disability Index; NSAIDs, non steroidal anti inflammatory drugs; *n*number; RF, rheumatoid factor; *P* value, probability value (<0.05).

related to oral health, leading to a greater negative effect on their overall quality of life. These findings are consistent with a study by Parsaei *et al.* [6], which also demonstrated a significant difference between the two groups. The interquartile range of the OHIP-14 scores suggests that some patients and controls may experience varying degrees of impact on oral health within each group. Similar outcomes have been reported in various published studies [7,14,15].

Our exploration involved examining the correlation between score levels and disease activity, as measured by both CDAI and DAS28 scores, which revealed a weak positive correlation (Fig. 3). Additionally, multiple linear regression analyses were conducted to assess the influence of various risk factors on oral health.

The analysis demonstrated a positive yet weak relationship between age and OHIP-14 scores; however, this relationship did not achieve statistical significance (*p* > 0.05). This implies



that, within the studied sample, age plays a minor role in predicting oral health-related quality of life through OHIP-14. Interestingly, this finding contradicts the results of Branco *et al.*, who observed a statistically significant impact of age on the score despite a smaller sample size and a lower standard deviation of the mean age [7]. This suggests that age alone may not be an independent predictor of periodontal disease.

In line with age, gender exhibited a positive but weak prediction with OHIP-14 scores, yet this effect was not statistically significant ( $p > 0.05$ ). This suggests that, in this study, gender differences did not significantly predict oral health impact, aligning with the findings of Branco *et al.* and Kroese *et al.* [7,15].

Although BMI showed a negative prediction for OHIP-14 scores, the correlation was weak and statistically insignificant ( $p > 0.05$ ). Thus, BMI did not appear to predict a noteworthy impact on OHRQoL in this context. This finding contrasts with prior research suggesting a direct link between BMI and the extent of periodontitis in the general population [16], although the relatively small number of patients with a higher BMI in this study may have contributed to this outcome.

Education level displayed a negative prediction with OHIP-14 scores, indicating that higher education levels are associated with lower oral health impacts. However, the observed correlation failed to achieve statistical significance at the conventional level ( $p > 0.05$ ), suggesting that more data or a larger sample might be necessary to draw definitive conclusions. This finding aligns with numerous previously published studies [17].

Smoking exhibited a negative prediction with OHIP-14 scores, implying that smokers tend to report lower oral health impacts. Nonetheless, the relationship was not statistically significant ( $p > 0.05$ ), possibly due to the sample size or other factors. Smoking has consistently been linked to periodontitis in multiple studies [18,19].

Disease duration demonstrated a negative prediction with OHIP-14 scores, yet it was not statistically significant ( $p > 0.05$ ). This suggests that, within the sample, the duration of the disease does not significantly predict oral health. Other studies have observed similar differences between patients with longer disease durations and controls, although the impact might not be evident in the earlier periods after diagnosis [20].

Both RF and ACPA exhibited a negative prediction with OHIP-14 scores, but the effect was weak and statistically insignificant ( $p > 0.05$ ). Hence, seropositivity did not appear to predict a noteworthy impact on OHRQoL in this context. Other published studies, however, have reported a much stronger prediction [19], and this difference may stem from a limitation of the current study, as not all patients had their serologies tested due to a lack of laboratory supplies.

It is important to note that, among these factors, HAQ-DI demonstrated notable implications. The HAQ-DI scores indicated a median of 1.27 (interquartile range: 0.00 to 2.88) for patients and 0.00 (interquartile range: 0.00 to 1.63) for controls, with a p-value of  $<0.001$  (Tab. I). This indicates a statistically significant difference in HAQ-DI scores between

the two groups. While the HAQ-DI showed a weak positive impact on OHIP-14 scores, the relationship was not statistically significant ( $p > 0.05$ ). This suggests that disability levels, as measured by HAQ-DI, do not significantly predict OHRQoL in the studied sample, which contradicts a lot of published studies [7,14], possibly due to the higher percentages (63%) and (30%) of patients with mild or moderate OHRQoL, respectively (Fig. 2).

Regarding medications, NSAIDs demonstrated a negative prediction with OHIP-14 scores, although the connection was not statistically significant ( $p > 0.05$ ). Conversely, steroid use, DMARDs, and biologics exhibited weak positive predictions with OHIP-14 scores, yet the relationships were not statistically significant ( $p > 0.05$ ). Previous studies have identified a negative correlation between the use of biologics and DMARDs and gingival inflammation [21]. However, the mentioned study assessed baseline scores for patients and was not a cross-sectional study. Other studies have found lower gingival scores among patients using anti-inflammatory medications, suggesting that their use might alleviate gum inflammation [22]. Some studies have discovered no correlation between drugs and periodontal diseases [23].

This study has certain limitations that need to be highlighted. The relatively small sample size and its case-control design precluded the establishment of causal relationships. However, the calculation of sample size power has been performed. The inclusion of a power level exceeding 80% in our study lends validity to the findings [24]. Also, there is a lack of oral and dental clinical examinations for periodontal disease. Despite its limitations, research has shown that self-reported measures like the OHIP-14 can be valuable tools for assessing oral health-related quality of life, especially when comprehensive dental exams are not feasible. The OHIP-14 has demonstrated acceptable reliability and validity in capturing individuals' perceptions of their oral health status [25]. Moreover, the lack of age matching between the patient and control groups and the age difference between these two groups might introduce potential biases, influencing the overall OHIP score difference. However, we addressed this limitation by conducting multiple linear regression analyses, which are less sensitive to the assumption of normality. Future studies may consider age matching to further explore the impact of age on oral health impact assessment.

Overall, the findings suggest that, among the studied variables, none of them possess statistically significant effects on the OHIP-14 scores of patients. However, some variables demonstrate weak predictions that may warrant further exploration with larger sample sizes or different study populations. Additionally, it is crucial to consider other potential factors not encompassed in this analysis that could predict OHRQoL in patients with RA.

## Conclusion

A statistically significant difference in the median value of OHIP-14 between RA patients and the control group showed that patients with rheumatoid arthritis exhibit a significantly

higher impact on their OHRQoL compared to those without RA. Consequently, there is a pressing need for increased knowledge and attention towards oral care within this patient population.

Additionally, a noteworthy positive, albeit weak, correlation was identified between the OHIP-14 and the CDAI.

#### Funding

No funding was provided for the research.

#### Conflicts of Interest

The authors declare having no conflict of interest in relation to this article.

#### Data availability statement

The current study's datasets are available upon reasonable request from the corresponding author.

#### Ethics approval

The Medical Department's Ethics Committee, College of Medicine, Baghdad University, provided its consent in this regard.

#### Informed consent

In accordance with the Helsinki Declaration, informed consent was obtained from every participant in this study.

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