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RESEARCH ARTICLE

Awareness of the Relationship between Systemic and Periodontal Diseases among Physicians and Dentists in Saudi Arabia and Kuwait: Cross-sectional Study

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Abstract:

Background:

Previous studies have shown possible association between periodontal diseases and Diabetes Mellitus (DM), Cardiovascular Disease (CVD) and Adverse Pregnancy Outcomes (APO). Increasing the knowledge of physicians and dentists regarding the association between periodontal disease and systemic diseases should improve their ability to provide a high standard of treatment for the disease and prevent its consequences. In our study, we sought to identify knowledge gaps in the awareness of the relationship between systemic and periodontal diseases among dentists and physicians from the Kingdom of Saudi Arabia and the State of Kuwait.

Methods:

A cross-sectional study was performed with a convenient sample of selected physicians and dentists in Saudi Arabia and Kuwait using a self-developed structured questionnaire. Physicians' and dentists' awareness were assessed regarding current evidence of the relationship between systemic diseases and conditions (DM, CVD, APO) and periodontal diseases.

Results:

A total of 134 (21.5%) of the identified physicians and 485 (78%) of the identified dentists participated in this study. More than half of the participants (52.1% physicians and 67.5% dentists) agreed that there is a relationship between periodontal diseases and DM, CVD and APO. Dentists had a statistically higher level of awareness compared with the physicians. The findings related to the awareness of the dentist sub groups highlighted that periodontists were significantly more likely to have a good level of knowledge.

Conclusion:

Within the limitations of this study, we concluded that the awareness of physicians and dentists regarding the relationship between periodontal diseases and systemic diseases (DM, CVD, APO) is generally low. Therefore, improved collaboration between medical and dental health providers is recommended.

Keywords: Oral health, Periodontal disease, Systemic disease, Cardiovascular disease, Pregnancy outcomes, Diabetes mellitus.

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1. INTRODUCTION

Oral health is fundamental to overall health, wellbeing and quality of life. It is highly valued by society and individuals

and can impact the physical and psychosocial quality of life. Periodontitis, a leading cause of tooth loss in adults, is a complex, multifactorial, inflammatory disease of the supporting structures of the teeth [1]. Gingivitis and periodontitis, inflammatory types of periodontal disease, occur most frequently and are widely distributed in societies [2, 3].

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Globally, the presence of deep periodontal pockets (≥ 6 mm) varies from 10% to 15% in adult populations. However, the prevalence of periodontal disease varies with race and geographic regions [4]. Chronic periodontitis is regarded as the second most prevalent oral disease across the globe and is the sixth most frequent illness on the Global Disease Burden list [5]. This has been assumed to remain constant from 1990 to 2020 [6].

Oral health and general health are integral to each other, with a two-way relationship. The link between oral and systemic diseases is well documented in the dental and medical literature. As evidenced by several systematic reviews and meta-analysis, Diabetes Mellitus (DM) is a well-known risk factor for periodontitis and periodontitis adversely affects glycaemic control even in non-diabetic individuals leading to the development of type 2 diabetes [7, 8]. There is substantial evidence, especially with systematic reviews and meta-analysis, on the association between periodontitis and, Cardio-Vascular Disease (CVD) [9, 10], cerebrovascular disease [11], metabolic syndrome [12], arterial hypertension [13], chronic renal failure [14], obesity [15] and autoimmune disease such as rheumatoid arthritis [16] and systemic lupus erythematosus [17].

Apart from this, increased adverse pregnancy outcomes (APO), mainly the risk of preterm birth and low birthweight are linked to periodontitis [18]. Moreover, pregnancy complications, preeclampsia [19] and gestational diabetes mellitus [20] also show association with periodontitis. Presently, according to available evidence, there is a positive association between periodontal disease and oral cancers [21]. Systematic reviews and meta-analysis also demonstrate a significant association between anxiety, depression as well as erectile dysfunction and chronic periodontitis [22, 23].

Periodontal treatment is pivotal in the management of many systemic diseases. A recent systematic review of randomised control trials shows that periodontal intervention can lower the risk of several systemic conditions, *viz.* adverse pregnancy outcomes, diabetes, pneumonia and chronic obstructive pulmonary disease [24]. A Cochrane review also suggests that periodontal treatment may reduce low birth weight (< 2500 g) however, the evidence is not strong [25]. Periodontal treatment ameliorates endothelial function and lowers biomarkers of atherosclerosis as well as reduces the inflammatory burden [26]. Non-respondents of periodontal treatment are at high risk of cardiovascular disease [27].

For many decades, it has been accepted that certain drugs make changes in the periodontium and cause, gingival overgrowth, gingival bleeding, inflammation and also periodontal disease progression [28]. Calcium channel blockers, anticonvulsants and immunosuppressants are well known for gingival overgrowth [29]. Prevalence of nifedipine-induced gingival overgrowth varies from 6-15% [30]. Oral contraceptives, hormone replacement therapy and antiplatelet agents cause gingival bleeding, whereas nonsteroidal anti-inflammatory drugs, anti-cytokine agents besides immunosuppressive agents may affect periodontal inflammatory processes. Moreover, periodontal breakdown may be affected by anti-cancer therapies, statins and bisphosphonates [28]. Apart from

this, knowledge of drug interaction is important for both dental and medical practitioners. Oral manifestations of systemic disease may be the first, sole or most severe feature in addition to the main focus of therapy [31].

The available literature shows an association between periodontal disease and systemic disease. This, together with the bidirectional treatment benefit, entails a need for good communication besides accurate evidence-based knowledge of perio-systemic link. Establishing good communication between dentists and physicians is important to promote health and to avoid serious complications [32]. This interdisciplinary interaction is essential in clinical counselling, health education, and disease prevention, mainly because periodontitis is a preventable and treatable condition, hence, it lowers the financial impact on healthcare systems and improves the quality of life [19, 33]. As a result, some professional bodies have published guidelines and also some accreditation bodies have included interdisciplinary interaction in their revised standards [34].

However, past studies have shown that medical professionals had limited education and knowledge regarding oral health [35, 36]. To our knowledge, only a few studies have been conducted in the Arabian Gulf Countries focussing on the knowledge of medical and dental health providers regarding the association between systemic and periodontal diseases [37, 38]. Therefore, more research is required to assess the awareness level among the medical and dental health providers in these countries. Thus, our study aimed to assess and compare the awareness of the relationship between systemic diseases and periodontal diseases among dentists and physicians and their sub groups in the Kingdom of Saudi Arabia and the State of Kuwait.

2. MATERIALS AND METHODS

This was a cross-sectional study conducted in the Kingdom of Saudi Arabia and the State of Kuwait. The study sample included a convenient sample of two groups of selected physicians and dentists in Saudi Arabia and Kuwait. Group 1 comprised of intern physicians, family/internal medicine specialists and other specialists while group 2 consisted of intern dentists, general dental practitioners, periodontists and other dental specialists. The sample size taken for dentists was 484 and for physicians it was 134. Prior to the initiation of the study, ethical approval was obtained from the Research Ethics Committee of RCsDP (registration number: PGRP/433310/1/45).

2.1. Data Collection

The data were collected by using a self-developed structured questionnaire. A pilot study was done to evaluate the response of the participants prior to the study. The survey was developed by using <http://www.surveymonkey.com>. Since the survey was online, the method of distribution and promoting the questionnaire was through social networking media, (facebook)[®], (twitter)[®], cell phones by using (WhatsApp)[®] application from Apple store[®]. All were used to increase the distribution rate among medical health providers. A link of the survey was sent through electronic mail to members of the Saudi Dental Society, Kuwait Dental Association, and dental

schools in Saudi Arabia and Kuwait. Follow-up e-mails were sent after one and two weeks.

The survey consisted of six pages: An introduction of the survey in English explaining the aim of the survey, importance of the topic and e-mail contact of the researcher in case any questions or clarification was required. The introduction served as consent for participation in the study. The second page contained detailed information regarding the gender, age, nationality, specialty and years of experience. The third page covered questions regarding the relationship between periodontal and systemic diseases in general. Fourth to sixth pages contained the questions regarding diabetes mellitus, cardiovascular diseases and pregnancy, respectively. The total number of questions was 24. The first eight questions covered the demographic data of the participants. The remaining questions were regarding the topic of research and were distributed as follows: two questions as general questions of the research topic, five questions for diabetes mellitus, four questions for cardiovascular diseases and four questions related to pregnancy.

2.2. Data Analysis

The data were entered into an Excel spreadsheet and analyzed using the Statistical Package for Social Science (SPSS), Version 18 for Windows. Descriptive analysis was undertaken to present an overview of the findings from this sample. Differences between groups were examined using Pearson *Chi-Square* test across the rated questions, and cross-tabulations to compare responses from different groups. The level of significance was set at $p \leq 0.05$.

3. RESULTS

A total of 713 of 803 (88.8% response rate) participants completed the questionnaire, but 91 questionnaires were excluded because participants selected both physicians and dentists in the same questionnaire. The final sample comprised of 622 participants. More than half (55%) were male and from the Kingdom of Saudi Arabia (56.5%). The majority (82.8%) of the medical health providers were under 40 years and 43.4% had less than 5 years of clinical experience. The total number of physicians was 134 (21.5%). Almost half of the physicians were internal and family medicine specialists and 11.2% were intern physicians. The sample size of the dentist group realized was 485 (78.0%). General dental practitioners represented the highest proportion (42.1%). Intern dentists and periodontists constituted 14.0% and 6.2% respectively (Tables 1 and 2).

The attitudes of the combined group related to visiting a dental clinic are summarized in Table 3. The majority of the physicians (70.1%) visited a dental clinic when they felt pain or when it was needed compared to 37.7% of the dentist group. Less than half of the dentist group (40.4%) visited a dental clinic every 6 months compared to 14.1% of the medical group; with the difference being statistically significant (p -value=0.000). Dentists are more likely to visit a dental clinic every 6 months. The relationship between the dentists subgroup specialties and their visit to a dental clinic was also significant (p -value=0.002); the interns and general dental practitioner groups were more likely to visit a dental clinic

every 6 months than other groups. Other specialist groups were more likely to visit a dental clinic when there is pain or when needed.

Table 1. Demographic data of participants (number and percentages)

Gender	–
Male	342 (55%)
Female	280 (45%)
Nationality	–
Saudi	267 (42.9%)
Non-Saudi	73 (11.7%)
Kuwaiti	243 (39.1%)
Non-Kuwaiti	39 (6.3%)
Age (years)	–
< 30	268 (43.1%)
30-40	247 (39.7%)
41-50	87 (14%)
>50	20 (3.2%)
Professional Experience (years)	–
< 5	270 (43.4%)
5-10	172 (27.7%)
11-15	71 (11.4%)
>15	109 (17.5%)
Place of Experience	–
State of Kuwait	271 (43.6%)
Central region of Saudi Arabia	214 (34.4%)
Eastern/Northern region of Saudi Arabia	44 (7.1%)
Western/southern region of Saudi Arabia	93 (15%)
Total	622

Table 2. Distribution of Physicians and Dentists specialty

Physician-Specialty	–
Interns/Trainee Physicians	15 (11.2%)
Internal and Family medicine specialists	66 (49.2%)
Others Specialties	53 (39.6%)
Total	134
Dentist-Specialty	–
Interns/Trainee Dentists	68 (14%)
General Dental Practitioners	204 (42.1%)
Periodontist	30 (6.2%)
Others Specialties	183 (37.7%)
Total	485

The majority of the participants (92.5% of the physician group and 98.3 of the dentist group) agreed that there is a relationship in general between periodontal and systemic diseases. More than half of the participants (52.1% physicians and 67.5% dentists) agreed that there is a relationship between periodontal diseases and DM, CVD and APO (p -value=0.002); more dentists agreed that such a relationship exists. Regarding the relationship between Periodontal Disease (PD) and DM, the majority of the physicians and dentists agreed that periodontal disease is a complication of DM (88.0%); diabetic patients should be routinely referred to a dentist (93.7%); active PD has

an influence on the glucose level of the diabetic patient (60.6%); and periodontal treatment has an effect on the glucose level of the diabetic patient (48.2%). Only the responses to the statement that diabetic patients should be routinely referred to a dentist differed significantly with dentists more likely to agree than physicians (p -value=0.000).

Approximately, one-third of the physician group (31.1%) and half of the dentist group (51%) agreed that periodontitis is an independent risk factor to develop myocardial infarction (MI) (p -value=0.000). Dentists were more likely to agree with the statement. The majority of the physicians' group (66.4%) and the dentists' group (79.4%) agreed that periodontal treatment has an effect on reducing systemic inflammatory markers. Dentists were more likely to agree with the statement (p -value=0.013). Just over a quarter (27.4%) of the physicians' group and 50.4% of the dentists' group agreed that active PD may cause pre-term delivery and low birth weight. The responses differed significantly with dentists more likely to agree (p -value=0.001).

A high proportion (94.1%) of the physicians group and 61.2% of the dentists group agreed that HbA1C is the most accurate laboratory test to determine the level of long-term DM control. The difference was significant with physicians more likely to agree than dentists (p -value = 0.000).

More than three-quarters of the dentists' group (76.0%) and 43.1% of the physicians' group thought that gingival enlargement is the most frequent intraoral manifestation for calcium channel blocker, nifedipine .

Assessment of the knowledge regarding dental procedures while taking cardioprotective aspirin revealed that 58.3% of the dentists group and 33.6% of the physicians group agreed that

dental treatment should proceed without stopping aspirin. The responses differed significantly in favour of the dentists (p -value=0.000). In addition, half of the physicians group (50.1%) and 34.8% of the dentists group thought that aspirin should be stopped three days or more before dental treatment (p -value=0.000).

The majority of both the dentists group (93.2%) and the physicians group (70.8%) agreed that pregnancy increases the severity of gingival inflammation. The difference is significant with dentists more likely to agree than physicians (p -value=0.000). The majority (88.0%) of the dentists group and 38.1% of the physicians group agreed that the second trimester of pregnancy is the best period to perform elective dental treatment. The responses differed significantly with dentists more likely to agree (p -value=0.000). More than three quarters of both the physicians (77.9%) and the dentists group (85.2%) agreed that paracetamol is the drug of choice for pregnant women who have severe dental pain. Dentists were more likely to agree (p -value=0.004).

3.1. The Physician Group's Awareness of the Relationship between PD and DM, CVD and APO

The majority of the physicians sub groups (interns 86.7%, internal and family medicine specialists 97.0% and other specialists 88.7%) acknowledge the relationship between periodontal and systemic diseases. Focusing on DM, CVD and APO, 41.7% of the intern physicians, 54.2% of the internal /family medicine physicians and 52.2% of the other physicians agreed that such a relationship exists. The physician sub groups' awareness of the relationship between periodontal diseases (PD) and systemic diseases has been summarized in Tables 4 and 5.

Table 3. Percentage of physicians and dentists visiting the dental clinic

-	Every 6 Months (%)	Every Year (%)	When there is Pain/When Needed (%)
Physicians	14.1	15.7	70.1
Interns	0	20	80
Internal/family medicine	19.7	13.6	66.7
Other physicians	11.3	17	71.7
Dentists	40.4	21.9	37.7
Interns	58.8	13.2	27.9
General dental practitioners	44.6	22.5	32.8
Periodontists	26.7	26.7	46.7
Other dentists	31.1	23.5	45.4

Table 4. Awareness of the physicians (sub groups) regarding the relationship between periodontal diseases and systemic conditions.

-	Answer	Interns %	Internal/Family Medicine %	Other Physicians %
Is periodontal disease a complication of diabetes mellitus?	Yes	58.3	88.9	79.6
Should diabetic patients be routinely referred to a dentist?	Yes	58.3	87.3	77.3
Does active periodontal disease have an influence on the glucose level of the diabetic patient?	Yes	33.3	62	63.6

(Table 6) contd.....

	Answer	Interns %	Internal/Family Medicine %	Other Physicians %
Does periodontal treatment have an effect on the glucose level of the diabetic patient?	Yes	8.3	50.8	47.7
Is HbA1C the best and most accurate lab test for control of diabetes mellitus patients?	Yes	91.7	98.4	88.6
Is periodontitis an independent risk factor to develop myocardial infarction?	Yes	16.7	27.9	39.6
Does periodontal treatment have an effect in reducing systemic inflammatory markers?	Yes	50	68.9	67.4
Is gingival enlargement the most common oral manifestation for Nifedipine?	Yes	16.7	57.4	30.2
Can dental treatment be proceeded without stopping aspirin?	Yes	71.9	39.3	23.3
Do you have to stop aspirin (≥ 3 days) before proceeding with dental treatment?	Yes	33.3	54.1	51.2
Do you believe that active periodontal disease may lead to preterm delivery and low birth weight?	Yes	8.3	29.5	30.0
What is the best trimester of pregnancy to perform elective dental treatment?	Second	25.0	71.0	30.0

Table 5. Awareness of the dentists (sub groups) regarding the relationship between periodontal diseases and systemic conditions.

	Answer	Interns	GP*	Periodontists	Other Dentists
Is periodontal disease a complication of diabetes mellitus?	Yes	91.9	93.0	75.0	87.2
Should diabetic patients be routinely referred to a dentist?	Yes	96.8	97.3	96.4	97.1
Does active periodontal disease have an influence on the glucose level of the diabetic patient?	Yes	62.9	61.0	92.9	54.1
Does periodontal treatment have an effect on the glucose level of the diabetic patient?	Yes	48.4	47.6	89.3	44.2
Is HbA1C the best and most accurate lab test for control of diabetes mellitus patients?	Yes	69.3	56.1	85.7	60.0
Is periodontitis an independent risk factor to develop myocardial infarction?	Yes	50.8	56.9	46.2	45.3
Does periodontal treatment have an effect in reducing systemic inflammatory markers?	Yes	70.5	82.8	88.5	77.6
Is gingival enlargement the most common oral manifestation for Nifedipine?	Yes	78.7	78.2	96.2	70.2
Can dental treatment be proceeded without stopping aspirin?	Yes	60.7	63.8	46.2	53.4
Do you have to stop aspirin (≥ 3 days) before proceeding with dental treatment?	Yes	29.5	32.8	50.0	36.6
Do you believe that active periodontal disease may lead to preterm delivery and low birth weight?	Yes	48.3	47.6	84.6	48.4
What is the best trimester of pregnancy to perform elective dental treatment?	Second	86.2	93.5	80.8	86.2

3.2. The Dentist Group's Awareness of the Relationship between PD and DM, CVD and APO

The majority (96.0%) of the combined dentists' group agreed that there is a relationship between PD and systemic diseases. Knowledge of a relationship between PD and DM, CVD and APO in the dentists' subgroups was also high (interns 63.0%, general dental practitioner 67.7%, periodontists 68% and others dentists 69%).

The dentists' subgroups' awareness of the relationship between periodontal diseases (PD) and systemic diseases has been summarized in Table 5.

4. DISCUSSION

The study was conducted to assess the awareness of the relationship between systemic diseases (SD) and periodontal disease (PD) of dentists and physicians in Saudi Arabia and Kuwait. The attitude and practices of dentists and physicians will determine the advice they offer patients [39]. In terms of their practices, 40.4% of the dentists visited the dental clinic every 6 months and 37.7% only when in pain or when required, with most of the physicians (70%) consulting a dentist only when in pain or when needed. This is in contrast to Merchant *et*

al. (2002) [39] who reported that 67.1% of non-dentist health professionals in the USA visited a dentist for routine check up 5 to more than 7 times in the last 5 years. In addition, Cohen *et al.*, (2015) [40] found that 71.6% of obstetricians and/or gynecologists in France visited dentists every year or more frequent.

The majority of the participants (97.3%) agreed that there, is in general, a relationship between periodontal and systemic diseases. However, more dentists (67.5%) compared to physicians (52.1%) agreed that a relationship between PD and these disorders, DM, CVD and APO existed. The evidence related to the chosen diseases is relatively strong and supported by the Joint Workshop on Periodontitis and Systemic Diseases between AAP and EFP in 2013. The study found that the physicians sub-groups' knowledge about the relationship between PD and DM, CVD and APO is relatively insufficient. Internal and family medicine specialists had the highest percentage (54.2%) among other subgroups. The dentists had a higher level of knowledge as the knowledge of the subgroups ranged from 63% to 69%.

The relationship between PD and DM is highly supported in the current literature; therefore, both physicians and dentists

should be aware about pathophysiological processes, complications and treatment for these two chronic diseases. The FDI World Dental Federation with the International Diabetes Federation encouraged, enhanced awareness of the association between DM and oral health among medical health providers (International Diabetes Federations, 2007). Improving the knowledge of health professionals will improve their attitudes and decisions in the management of diabetic patients (Al-Khabbaz *et al.*, 2011) [37]. The majority (80%-97%) of the dentist and physician groups had a high level of awareness (dentists were more aware) of considering PD as a complication of DM and to refer diabetic patients to a dentist. Among the physicians and dentists subgroups, internal and family medicine, intern dentists and general dental practitioners had the highest level of awareness regarding the current evidence of considering PD as a complication of DM and in referring patients with DM routinely to a dental clinic. Mealy (2008) [41] reported that dentists do not communicate with diabetic patients and their physicians. The evidence generated in the study could support efforts to improve collaboration between physicians and dentists in educating and referring diabetic patients.

Our data showed that 61%-63% of internal family medicine, other groups of physicians, intern dentists and GPs had relatively good awareness that active PD influence the glucose level of diabetic patients. However, intern physicians and other dentists had the lowest level of awareness level. The findings related to physicians' awareness are similar to Asa'ad *et al.* (2014) [36] who reported that only 10.0% of Saudi medical interns agreed that PD is more prevalent in patients with diabetes. In addition, 61.0% of medical interns in India did not know that PD is a risk factor for DM (Gur and Marga, 2011) [42]. In contrast, Quijano *et al.* (2010) [43] found that almost all physicians interns' in their study agreed that PD is more prevalent in diabetic patients.

In terms of the effect of PD treatment on the glucose level of diabetic patients, all the physician and dentist subgroups had insufficient knowledge except for periodontists who had a significantly high level of knowledge. In contrast, in terms of using HbA1c to test for diabetic control, the physician subgroup displayed better knowledge than the dentist subgroup. In the dentist subgroup, periodontist had the highest level of knowledge.

Our findings highlight a concern regarding the level of knowledge of the relationship between CVD and PD. Both dental and physician subgroups had a low level of knowledge related to PD, with PD being an independent risk factor to develop myocardial infarction. Despite this low awareness level, the majority of the participants knew that performing non-surgical periodontal treatment has an effect on reducing systemic inflammatory mediators which increased the probability and risk of developing CVDs. Our results are similar to the study by Gur and Majra (2011) [42] who reported that only 12%-16% of medical interns thought that PD may be a possible risk factor to develop CVD or cerebral infarction. However, our results are in contrast to other studies (Asa'ad *et al.*, 2014, Quijano *et al.*, 2010) [36, 43] who found that the majority of medical interns agreed that poor oral health may increase the

risk of CVD.

More dentists than physicians and periodontists knew that the most frequent oral manifestation for nifedipine is gingival enlargement. In the dental subgroups, periodontists had the highest level of knowledge. In addition, physicians had a low level of knowledge of proceeding with dental treatment without stopping aspirin (Nooh, 2009) [44] as almost half of the physicians group indicated that aspirin should be stopped for three days or more before the dental treatment. This is important as an incorrect clinical action has been shown by Perry *et al.* (2007) [45] to increase the risk of developing CVD in patients at risk. Al-Mubarak *et al.* (2007) [46] recommended performing dental surgery without stopping aspirin and to control bleeding by applying firm pressure or suturing.

There was a very low level of knowledge related to active PD possibly being a risk for preterm delivery and low birth weight. Our results are supported by Gur and Majra (2011) [42] but in contrast to Asa'ad, *et al.* (2014) [36] who reported some awareness in medical interns. In contrast to our study, Cohen *et al.* (2015) [40] in their study of obstetricians and/or gynecologists, found that majority had correct knowledge of the role of bacteria in periodontal diseases. In our study, the majority of physicians and dentists agreed that pregnancy increases the severity of gingival inflammation. Other studies conducted with obstetricians and/or gynecologists (Rocha *et al.*, 2011, Morgan *et al.*, 2009, Wilder *et al.*, 2007) [47 - 49] reported relatively good to excellent awareness of the influence of pregnancy on periodontal health such as bleeding gums and also that PD influence the risk of preterm birth. In terms of the best trimester for performing elective dental treatment, more dentists knew that the second trimester is preferred. The internal/family medicine subgroup and general dental practitioners had the highest level of knowledge than the physician and dentists sub-groups.

Dentists' and primary health care physicians' level of communication regarding the oral and systemic conditions of patients is generally poor. Kunzel *et al.* (2002) [50] found that only 15.0% of general dentists in the Northeastern United States frequently communicate with the physician, and general dental practitioners are infrequently involved in the management of patients with diabetes. Our results support the importance of collaboration between physicians and dentists. Enhancing communication between medical and dental health-care providers is essential to share knowledge between the two specialties and to establish professional treatment modalities for medically compromised patients. Morgan *et al.* (2001) [48] stated that most of the hospital doctors (77.0%) in their study, did not feel that they had sufficient training or felt confident to examine an oral cavity. We believe that lack of communication between physicians and dentists, insufficient knowledge or training in medical and dental schools, or lack of continuing education programs result in improper management of serious chronic diseases in dental clinics as well as the neglect of oral health by physicians.

Our results confirm the need for effective communication between physicians and dentists by referring their patients between the specialties. Improving the awareness and updating the knowledge of medical professionals can be achieved

through a review of curricula in medical and dental schools and conducting continuous educational programs.

CONCLUSION

With the limitations of this study, we can conclude that physicians' and dentists' awareness regarding relationship between periodontal diseases and systemic diseases (DM, CVD and APO) is generally low and improved collaboration between medical and dental health providers is suggested.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical approval was obtained from the Research Ethics Committee of RCsDP (registration number: PGRP/433310 01/45)

HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All research procedures followed were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2008.

CONSENT FOR PUBLICATION

The participants provided written informed consent to be involved in this study.

AVAILABILITY OF DATA AND MATERIALS

The data sets analyzed during the current study are available from the corresponding author (Fathima F. Farook) on request.

FUNDING

None.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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