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Dental Diseases are associated with increased odds ratio for Corona virus disease 19

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Corona virus disease 19 (COVID 19) risk factors are age, race, gender and preexisting conditions including cardiovascular, respiratory, and endocrine diseases (Wue et al., 2020). The severe acute respiratory corona virus 2 (SARS-CoV-2) binds to the angiotensin-converting enzyme 2 (ACE2) receptor for cellular entry and infects respiratory tract cells (Zou et al., 2020). Multiple organs, including kidneys, lungs, brain, and pharynxes are affected and account for increased morbidity (Puelles et al., 2020). ACE2 receptors are also present on the epithelial cells of oral mucosa, gingiva and alveolar bone, making the oral cavity a reservoir of viruses close to the respiratory tract (Xu et al., 2020). These receptors are downregulated in patients with periodontal disease (PD) (Queiroz-Junior et al., 2019). PD is associated with chronic state of inflammation (Merchant et al., 2016; Van der et al., 2016; Delange et al, 2018), and has been linked to several conditions which are known risk factors for COVID 19 including diabetes, respiratory and cardiovascular diseases (Van der et al., 2016). PD has been implicated as potential risk factor for COVID19 (Pitones-Rubio et al., 2020), however, this was not demonstrated.

We studied the association between COVID 19, periapical dental infection (PA), caries and PD. Using the University of Florida patient's registry, informatics for integrating biology and the bedside (*i2b2*), the odds ratio (OR) for COVID 19 infection in patients with oral diseases were assessed using logistic regression model. Because the oral diseases association with risk factors for COVID 19, we adjusted the OR for gender, race, age, smoking status and systemic conditions. The study was exempted from institutional review board (IRB) review as the data did not contain personal health information (PHI)

From a hospital population of 987,849 patients, 889 patients had a confirmed diagnosis of COVID 19. Seven (0.77%) patients were diagnosed with PD, 16 (1.7%) with PA and 31 (3.48%) with caries.

Patients with caries were 3.0 times (95% CI= (2.0, 4.4)) more likely to have COVID 19. The OR from 2.3 to 3.6 after adjusting for gender, age or race compared to caries free patients.

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Patients with PA were 7.0 times (95% CI= (4.7, 10.4)) more likely to have COVID 19 than people without PA. The adjusted OR from 2.7 to 4.1 after controlling for gender, age, race and a systemic condition one at a time. PD was not associated with Covid-19 status with OR=1.1 95% CI= (0.3, 4.2), however, after adjusting for smoking, patients with PD were 4.7 times more likely to have COVID 19 than patients without PD. African American had increased OR for both PA and caries (Table 1).

The present cross sectional study cannot be interpreted in the context of causality but can estimate the prevalence of the outcome of interest for a given population including exposure to risk factors at a specific point of time (Levin, 2006). Because the oral infection had preceded COVID 19 with reference to this study population, we suggest that oral diseases may play a role in susceptibility or transmission of SARS-CoV-2.

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Table 1:

Odds ratio for patients with certain oral diseases to develop Covid 19 infection using logistic regression model

	Odds Ratio	95% Wald	Confidence Limits	P Value
PA vs Non PA (Model PA not adjusted for any covariate)	7.006	4.739	10.356	<.0001
PA vs Non PA	4.128	2.474	6.89	<.0001
Gender Male vs Female (Model of PA adjusted -for gender)	0.915	0.8	1.045	0.1886
PA vs Non PA	3.482	2.121	5.715	<.0001
Age Group 18–34 vs 0–17 yrs	5.42	3.961	7.415	<.0001
Age Group 35–44 vs 0–17 yrs	3.531	2.482	5.025	0.0005
Age Group >=45 vs 0–17 yrs (Model of PA adjusted for age)	2.511	1.839	3.429	0.4317
PA vs Non PA	2.745	1.668	4.515	<.0001
Race Black vs Other	3.408	2.849	4.077	<.0001
Race White vs Other (Model of PA adjusted for race)	1.291	1.104	1.51	<.0001
PA vs Non PA	2.996	2.022	4.439	<.0001
Respiratory disease vs Non Respiratory disease (Model of PA adjusted for Respiratory disease)	8.372	7.295	9.606	<.0001
PA vs Non PA	1.865	1.027	3.389	0.0407
Any Endocrine diseases vs Non Any Endocrine disease (Model of PA adjusted for Endocrine disease)	4.348	3.808	4.963	<.0001
PA vs Non PA	0.982	0.439	2.199	0.9298
Obesity vs No Obesity (Model of PA adjusted for obesity)	5.643	4.854	6.562	<.0001
PA vs Non PA	2.098	1.122	3.923	0.0203
Diabetes vs No Diabetes (Model of PA adjusted for diabetes)	3.647	3.029	4.392	<.0001
PA vs Non PA	0.703	0.315	1.572	0.3911
Circulatory disease vs Non Circulatory disease (Model of PA adjusted for circulatory disease)	5.494	4.885	6.178	<.0001
PA vs Non PA	0.218	0.082	0.581	0.0023
Smoked vs Never Smoked (Model of PA adjusted for smoking status)	0.455	0.414	0.5	<.0001
Caries vs Caries Free (Model of Caries not adjusted for any covariate)	2.981	2.031	4.374	<.0001
Caries vs Caries Free	2.462	1.719	3.524	<.0001
Gender Male vs Female (Model of caries adjusted for gender)	0.889	0.778	1.016	0.084
Caries vs Caries Free	3.573	2.493	5.122	<.0001
Age Group: 18–34 vs 0–17yrs	6.497	4.649	9.081	<.0001
Age Group: 35–44 vs 0–17yrs	3.954	2.718	5.751	0.0013
Age Group:>=45 vs 0–17yrs (Model of caries adjusted for age)	3.077	2.205	4.295	0.6131
Caries vs Caries Free	2.328	1.618	3.348	<.0001
Race Black vs Other	3.265	2.729	3.905	<.0001
Race White vs Other (Model of caries adjusted for race)	1.238	1.06	1.447	<.0001
Caries vs Caries Free	1.22	0.83	1.794	0.3117
Respiratory disease vs Non Respiratory disease (Model of caries adjusted for Respiratory disease)	8.73	7.593	10.037	<.0001
Caries vs Caries Free	1.418	0.918	2.19	0.1153
Any Endocrine vs Non Any Endocrine Disease (Model of caries adjusted for endocrine disease)	4.393	3.846	5.018	<.0001

	Odds Ratio	95% Wald Confidence Limits	P Value
Caries vs Caries Free	1.614	1.054 2.472	0.0277
Obesity vs Non Obesity (Model of caries adjusted for Obesity)	5.681	4.889 6.603	<.0001
Caries vs Caries Free	3.299	2.347 4.635	<.0001
Diabetes vs Non Diabetes (Model of caries adjusted for Diabetes)	3.558	2.956 4.283	<.0001
Caries vs Caries Free	1.374	0.849 2.225	0.1963
Circulatory Disease vs Non Circulatory Disease (Model of caries adjusted for Circulatory disease)	3.173	2.766 3.64	<.0001
Caries vs Caries Free	3.469	2.432 4.948	<.0001
Smoked vs Never Smoked (Model of caries adjusted by smoking status)	1.032	0.874 1.218	0.713
PD vs Non PD (Model of PD without adjusted for any covariate)	1.05	0.262 4.204	0.945
PD vs Non PD	1.038	0.43 2.504	0.9345
Respiratory disease vs Non Respiratory disease (Model of PD adjusting for Respiratory disease)	8.613	7.5 9.892	<.0001
PD vs Non PD	1.927	0.86 4.318	0.1109
Any Endocrine vs Non Any Endocrine Disease (Model of PD adjusted for Endocrine disease)	4.221	3.697 4.818	<.0001
PD vs Non PD	1.838	0.821 4.117	0.139
Obesity vs Non Obesity (Model of PD adjusted for Obesity)	5.58	4.804 6.483	<.0001
PD vs Non PD	1.979	0.819 4.78	0.1294
Diabetes vs Non Diabetes (Model of PD adjusted for diabetes)	3.617	3.001 4.36	<.0001
PD vs Non PD	0.671	0.167 2.693	0.574
Circulatory disease vs Non Circulatory disease (Model of PD adjusted for Circulatory disease)	3.106	2.709 3.56	<.0001
PD vs Non PD	4.673	2.323 9.4	<.0001
Smokers vs Never Smoked (Model of PD adjusted for smoking status)	0.97	0.818 1.15	0.7258

PA periapical dental abscesses

PD periodontal disease