

Does COVID-19 Affects the Success of Dental Implantation, On Patients with Various Medical Conditions; A Retrospective Study?

Yasser Nabil PhD (OMFS), MDS, FDSRCS England, FDSRCS Edinburgh, FDSRCS Glasgow^{1,2,3}

¹Head of the Oral and Maxillofacial Surgery Department, and Clinical director of the specialized dental teaching hospital, Cairo, Egypt.

²Professor of Oral and Maxillofacial Surgery MMA.

³Professor of Oral and maxillofacial surgery, Faculty of Dentistry, Delta University, Egypt.

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*Correspondence:

Yasser Nabil, Head of the Oral and Maxillofacial Surgery Department, and Clinical director of the specialized dental teaching hospital, Cairo, Egypt, Tel: 0226716681.

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ABSTRACT

The effect of COVID-19 on dental implant osteointegration was not studied thoroughly. In this retrospective study we compared the success rate of dental implants placed before and after the Pandemic, in patients with various medical conditions. The difference of both of immediate and delayed implantation in relation to COVID-19 was also investigated. Two groups of patients were retrospectively evaluated, the first group consisted of 325 patients who had dental implants before the epidemic of COVID-19, and for two years started from August 2017 till August 2019. The second group consisted of 406 patients who had implant placement after the epidemic from February 2020 to February 2022.

This study showed that COVID-19 infection affects the success of dental implantation, there was decrease in the success of implantation placed at the era of Corona virus pandemic. Immediate implantation showed more successful results. Diabetic and ischemic heart patients were more affected with corona pandemic, the success of dental implantation in this group was decreased. Patients with no previous medical conditions, were also affected with this pandemic. In this study the success of dental implantation was decreased in this group of patients, this could be due to the fact were asymptomatic and did not know they were infected previously, or due to the change in life style with decrease in physical activity and decrease in calcium intake and Vitamin D.

Keywords

COVID-19, Viral infections, Dental Implantation, SARS.

Introduction

By the end of 2019, a wild animal-derived pneumonia that outbreak in the city of Wuhan, in the province of Hubei in China., which is named COVID-19 or SARS COV2, actually it is not the first coronavirus infection that became epidemic in this century.

In November 2002, the first reported case of sever acute respiratory syndrome (SARS). Was reported from Guangdong province in China A novel coronavirus responsible for this disease (SARS-CoV1) was isolated in February 2003 [1]. The SARS epidemic affected 26 countries on all over the continents, until suddenly it was declared contained by the WHO by July of the same year [2].

In June 2012, Saudi Arabia reported the first cases of a SARS later named Middle East respiratory syndrome (MERS).The pathogen of this disease was isolated and proved to be SARS-CoV1 [3], luckily it was only found outside the middle east area in travelers recently visited the area, 80 % of the cases were found in one country which was Saudi Arabia [4].

In December 2019, t the fourth epidemic of corona virus in the 21 century started in the city of Wuhan, in china. On January 7, 2020, the International Committee on Taxonomy of Viruses named it “severe acute respiratory syndrome coronavirus 2” (SARSCoV-2), which spread to all the continents and the WHO named it coronavirus disease 2019 (COVID-19).

The major fear to dental professional is the virus small size, SARS-CoV-2 presents as a sphere of 0.06 to 0.14 mm in diameter

and may be found in saliva droplets, making airborne transmission is a possible, mainly in close areas. The good news there are no reported cases of virus transmission due to dental procedures, never the less it is not excluded [5]. Aerosols mix with saliva, blood, and other fluids from the patients could be the cause of dental associated infections with COVID-19, ultrasonic scaling machines are the major tool to be blamed in transmitting Aerosol generated infections [6,7]. It has been found that aerosols could remain in the air for up to 30 min after scaling, and the most contaminated area during ultrasonic scaling was the right arm of the doctor and the left arm of the assistant [8,9]. Therefore the use of acceptable PPE personal protective equipment's for dental professionals, good office ventilation, and the use of high suction devices are so important to reduce potential cross infection during dental treatments.

Other than respiratory symptoms, COVID-19 evokes cardiovascular, Gastrointestinal symptoms, hormonal changes, it is considered as a multi system inflammatory disease that affects both adults (MIS-A) and children. Multisystem inflammatory syndrome in children (MISC) is a serious consequence of COVID infection and is associated with morbidity and mortality, it could affect any system from the cardiovascular, gastrointestinal, and even Stroke and neurological involvement has been reported in 11% to 30% of patients [10].

This multi system inflammatory syndrome could affect bone healing and remodeling, even it has presented with atypical cutaneous, mucocutaneous, [Mucormycosis [11]. low bone mineral density BMD was a risk factor for intensive care unit (ICU) admission of COVID-19 patients [12].

Implants are considered one of the key stone in the replacement of missing teeth, several factors are contributed to the success of dental implants, the quantity and quality of the regenerated bone must be considered [13]. The type of bone density affects markedly the predictable success of dental implant, it has been suggested that type 4 and 1 bone are more likely to fail [14].

Block published his observation of increased implant failure among patients who had corona virus infection [15]. The aim of this study is to evaluate the influence of COVID19 infection, on the success of dental implants in patients with different medical conditions.

Results

Two groups of patients were retrospectively evaluated, the first group consisted of 325 patients who had dental implants before the epidemic of COVID-19, for two years started from August 2017 till August 2019. The second group consisted of 406 patients who had implant placement after the epidemic from February 2020 to February 2022. Both group had been operated by the same operators, utilizing flapless technique. Patients who had open flap technique for implant insertion, and or bone grafting were excluded from this study.

Inclusion criteria includes patients with controlled medical conditions, and those free from of any systemic condition. Exclusion criteria included patients under the age of 16 years, uncontrolled medical diseases such as diabetic patients, those taking chemotherapy and /or radiotherapy to the maxillofacial area, and patients on renal dialyses, and those taking bisphosphates for osteoporosis or other diseases.

Both groups were divided according to site of implantation into anterior maxilla, posterior maxilla, anterior mandible, and posterior mandible

The study was collected on 731 patients who had received 784 implants 451 of them were male and 280 were females, the age ranged from 19 years till 83 years 181 implants were placed in posterior maxilla, 66 of these had closed sinus elevation of a range between 2mm to 4 mm, other 64 were placed immediately at the upper posterior area, 205 implants were inserted at the upper anterior area, among those 31 had been immediately inserted. 192 implants were placed in the lower posterior area, 242 implants were placed at the time of extraction, 103 implants were placed at the lower anterior area, 33 were inserted immediately at the lower second incisor and canine area.

The most medical condition the patient have in this study were Hypertension in 91 patients, patients who are on 5mg of prednisolone for various medical conditions, such as bronchial asthma, and dermatological skin conditions were also included in the study in 49 cases. patients suffers from ischaemic heart disease received 73 implants, Controlled diabetic patients received 79 implants, those suffering from both diabetes and cardiac disease had 81 implants, the rest were free from systemic diseases in 266 patients.

All implants in both groups were operated by the same operators using flap less technique and the same implant manufacture, with the same specifications, type 4 implant with diameter ranged from 3.2 mm to 4.8 mm, and length varied from 8mm to 13mm.

Implant Technique

Flapless technique, with a torque of 800 rpm, 30 ncDm with external irrigation. Implant diameter varies between 3.2 mm and 4.8mm. The implant length varies between 8 mm to 14 mm.

COVID-19 Treatment

The medical regimen at that time ranged from paracetamol 500 mg three times per day, and chlorohexidine mouth wash and gargle three times a day, in moderate and severe cases antibiotics were given to grade against secondary infection which includes included Azithromycin 500mg taken once per day for 5 days, Anticoagulants were given to prevent thrombosis, the most commonly used was Rivarospire 20 mg once daily, glucocorticoid 20 mg prednisolone twice daily for a period of few days to a month, that were given to prevent or decrease cytokine storm.

Table 1: Comparing success and failure of immediate versus delayed implantation in different medical conditions in patient before the Pandemic of COVID-19.

Medical conditions	Group I	Immediate implantation	Successful implants	Failure implants	Delayed implantation	Successful implants	Failure implants
Cardiac, not on antiplatelet or anticoagulant	38	20	18	2	18	16	2
Cardiac patients, on antiplatelet or anticoagulant therapy	43	22	19	3	21	17	4
Patients on or less than 5mg corticosteroid	26	12	9	3	14	12	2
Controlled Diabetic	46	25	21	4	21	17	4
Controlled Diabetic and Cardiac patients on antiplatelet or anticoagulant	43	24	18	6	19	15	4
Medically free	129	66	58	8	63	54	9

Table 2: Comparing success and failure of immediate versus delayed implantation in different medical conditions in patient after the Pandemic of COVID-19.

Medical conditions	Group II	Immediate implantation	Successful implants	Failure implants	Delayed implantation	Successful implants	Failure implants
Cardiac not on antiplatelet or anticoagulant	66	36	30	6	30	21	9
Cardiac patients, on antiplatelet or anticoagulant therapy	47	22	18	4	25	20	5
Patients on or less than 5mg corticosteroid	40	19	13	6	21	14	7
Controlled Diabetic	60	33	25	8	27	19	8
Controlled Diabetic and Cardiac patients on antiplatelet or anticoagulant	70	37	27	10	33	23	10
Medically free	122	80	64	16	48	37	11

Discussion

There were limited information about the effect of COVID-19 on the success of dental implants. The biggest concern is the amount of bone formation around dental implants, with the placement of implants the amount of bone resorption should be decreased [15]. The coronavirus Spike protein links to the receptor of the human angiotensin-converting enzyme 2 (ACE2), that is essential for its entry to the victims cells [16]. This enzyme is anchored to the oral mucus epithelium, so transmission could be possible even in asymptomatic personals [17]. The influence of medical conditions including COVID-19 infection on the prognosis of implant osteointegration is needed to be studied thoroughly. It was postulated that the risk of implant failure is increased after COVID-19 infection [15].

Block suggested to possible pathophysiology that decrease osteointegration may occur when coronavirus-19 combines on the ACE2 receptor resulting in change the balance of osteoclast/osteoblast action causing more bone resorption than formation [18]. It is now well known, that patients who had Corona virus suffered inflammatory reaction Known as cytokine storm of various intensities, and hence the severity of the condition.

The inflammatory factors like IL-1b, IL-6, TNF-a, G-CSF, IP-10, MCP-1, MIP-1a have been detected in COCOVID 19 patients who were admitted to the intensive care units [17].

These factors may enhance bone resorption through the RANKL signaling pathway. In addition to the immunosuppressive state

of the patients, make them more vulnerable to oral bacterial infections [13]. The microvascular system of the COVID patients has dysfunction, the Vascular velocity is decreased as well as vascular density. This was almost exclusively small capillaries with diameters ranging from 4 to 6 micrometers, in the addition that it is suggested that due to the sever hyperinflammatory state of the micro blood vessels, thrombosis might occur [19,20]. The endothelial glycocalyx is also affected, with the fragmentation of vascular endothelial glycocalyx, which could be used as indicator of severity of the COVID-19 infection [21,22].

The presence of systemic diseases has been linked to the severity of symptoms in patients with COVID-19, it is multisystem inflammatory condition that could affect any system, cardiovascular inflammation is found especially in children, which is considered the most sever manifestation of multisystem inflammatory syndrome in children (MIS-C). Many different types of cardiovascular damage have been described, including dilated heart chambers, decreased myocardial contractility, and coronary inflammation [23,24]. Kidneys could get acutely injured, which could be related to the inflammation and dehydration of the patient especially in children [25]. Patients with medical conditions could be affected more with coronavirus infection, the risk of infection is greater due to the immune depressive state of the patient. It is suggested that type 2 diabetes mellitus and cardiovascular disease are linked to worsen COVID-19 prognosis [26,27]. In this study we compared the medical conditions of patients before and after the era of COVID-19 pandemic, and its relation to implant osteointegration. We found increase in implant failure in Diabetic patients, and

those having both cardiovascular and diabetes. It is suggested that hyperglycemia is linked with adverse outcomes of patient infected with corona virus. However, the specific mechanism of that infection on the regulation of glucose intolerance and insulin resistance and subsequently bone loss remains unknown [27]. It is reported that abnormal glucose metabolism is associated with skeletal loss [28].

Glucocorticoids was one of the therapies for severe cases, it could be linked to decrease bone formation due to hyperglycemia associated with it. In a recent study characterize the exaggerated effect of COVID-19 on abnormal glucose metabolism and bone-specific and systemic inflammatory response that result in glucose intolerance, and insulin resistance and subsequently causes bone loss [29].

In the present study there was increase in implant failure, in all medically compromised patients who received implants after the pandemic. The rate of failure also increased in patients who were claimed to be medically free from any systemic condition, that could be attributed to patients could get COVID-19 and they were asymptomatic. The other explanation is that during lockdown and decrease physical exercise, they get less sufficient calcium and vitamin D which results in decrease in bone maturation.

Patients get weight, and it is not surprising that increase body mass index increases the possibility of osteoporosis specially in women. Mature adipocytes had an inhibitory effect on osteoblasts, the distribution of fat cells affects bone formation. The fat cells between muscles and the bone marrow cavity are different from subcutaneous fat, which will injure the bones [30,31].

In this study method of implantation does affect the success rate of immediate implantation, there were no difference between both groups, in agreement with immediate survival rate of other studies [32,33], while in delayed implantation there were more failure in the post COVID-19 group, compared to those patients received implants before coronavirus pandemic. This could be related to less bone resorption with immediate implantation, it is well known that alveolar ridge volume decreases 3.8 mm horizontally and 1.24 mm vertically within 6 months of tooth extraction, this is not the case with immediate placement so it is used for socket preservation [32].

The results of this study showed that COVID-19 infection affects the success of dental implantation, there were decrease in the success of implantation placed at the era of Corona virus pandemic. Immediate implantation showed more successful results. Diabetic and ischemic heart patients were more affected with corona pandemic, the success of dental implantation in this group was decreased. Normal patients were also affected with this pandemic, in this study the success of dental implantation was decreased in this group of patients, this could be due to the fact were asymptomatic and did not know they were infected previously, or due to the change in life style with decrease in physical activity and decrease in calcium intake and Vitamin D.

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