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ORIGINAL RESEARCH

ASSESSMENT OF HEALING OF DENTAL EXTRACTION WOUNDS IN RECOVERED COVID 19 PATIENTS

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ABSTRACT

Background: Wound healing is a physiological process that undergoes series of phases which is well connected. The sequence of the wound healing process is critical and influenced by varied factors that act locally and systemically. The systemic factors that influence the health can affect healing through local factors. Oral cavity is different in many aspects including its scarless healing which happens at a faster rate. SARS CoV2 may influence viability of salivary glands, taste, smell sensations, integrity of oral mucosa, the balance on the microbiota. Recent literature strives need for clarification on post covid effect in oral cavity.

Aim: An Observational Study to Identify influence of SARS Cov2 on Physiological process of Wound Healing after Dental Extraction.

Materials And Methods

Study population: Patients recovering from covid-19 undergoing Tooth extraction. Healthy patients undergoing tooth extraction unaffected by covid-19. 35 cases with history. 35 cases without history of covid were involved. After extraction patients were assessed clinically using Laundry et al criteria. VAS scale used to assess pain intensity.

Results:Covid positive patients on day 3 when assessed with Landry et al healing index for post extraction wound healing, scored 2(33) and 3(2). Bleeding on palpation was noticed on day 3. VAS scored around 1 and 2 for both the patients with, without history. Covid negative patients on day 3 when assessed for post extraction wound healing scored 3(35), bleeding on palpation was not evident on day 3. Covid positive patients on day 7 when assessed for post extraction wound healing, scored 3(16), 4(18), 1(1). Covid negative patients on day 7 when assessed for post extraction wound healing scored good and excellent.

Conclusions: We hypothesize there could be a prolonged early phase of wound healing in dental extraction wounds in patients with history of covid, which could be another feature of long covid syndrome in oral cavity.

Keywords: dental extraction, wound healing, extraction socket and covid 19

INTRODUCTION

Wound healing is a physiological process that undergoes a series of phases and events which is well connected. It involves 4 tightly, precisely arranged phases namely, haemostasis inflammation, proliferation and remodelling. The phases of wound healing are quite structured with the timing, duration and also the intensity. These four phases are found to overlap one another. The sequence of the wound healing process is very critical and can be influenced by varied factors that act locally and systemically. The systemic factors that influence the health as such can have effect on healing directly or indirectly through local factors [1,2]. Covid -19 caused by SARS-CoV-2 is the viral infection that affected about 41,86,50,474 cases in the span of two and half years worldwide(covid19.who.int). The virus causes immune dysfunction and secondary infection leading to respiratory failure. Covid -19 being a respiratory distress virus typically presents with systemic hypoxia and the immune response likely favors capillary dysfunction and also reduces tissue oxygen in the involved tissue [3]. Reduced Tissue hypoxia further induces inflammation which is a doubleedged sword. Oral cavity is a unique environment which stands alone from other tissues in many aspects including its scarless healing which also happens at a faster rate. The fastidious nature could be due to the early onset of inflammatory phase, decreased levels of immune mediators, rapid reepithelization and rapid fibroblast proliferation [4,5]. SARS CoV-2 exhibits neurotropism and mucotropism and may likely influence the viability of salivary glands, taste and smell sensations, integrity of oral mucosa, the balance on the microbiota [6]. Recent literature raising need for clarification on the post covid effect in oral cavity and the surrounding tissues. The possibility of dry socket and the spread of infections to the underlying bone may further impair the healthy healing of the tissue [7-9]. This current study is aimed at assessing the wound healing status of dental extraction in patients recovering from Covid 19. This study was designed and presented in the institutional review board and institutional ethical committee and the study was approved (IEC no: IGIDSIEC2022NRP47UGRKOPM). This study was an ICMR STS project done in the year 2023.

MATERIALS AND METHODS

Study population

Patients recovering from covid-19 undergoing Tooth extraction. Healthy patients undergoing tooth extraction unaffected by covid-19. The patients who visit the Oral and Maxillofacial Surgery department for dental extractions were explained about the study. The patients who were willing to participate in the study, satisfying the exclusion and inclusion criteria were selected and included in the study as study participants. Topical anesthetic gel followed by injection of local anesthetic agent on the specific area to be anesthetized is given for an uneventful extraction. Extraction of the tooth is done using elevator and extraction forceps and once the tooth is pulled out of the socket, the socket should be compressed for minimizing the bleeding, and facilitate clot formation. Post extraction instructions will be given. After the extraction the patients were assessed clinically on the first, third and seventh day [9]. Healing index of Landry, Turnbull and Howley was applied for day 3 and day 7 [10,11]. Pain intensity will be assessed using a 10-degree visual analogue scale (VAS) on all 3 days of observation [12]. Data obtained will be tabulated and inferential statistics would be used for analysis of the data. Chi square test would be used to compare the wound healing status on 3rd and 7th day after extraction among covid and non-covid groups. Detailed proforma with all the details will be filled and documented for each study participant for future References.

Inclusion criteria:

Patients recently recovered from covid-19 undergoing dental extraction, healthy patients undergoing extraction without history of covid.

Exclusion criteria:

Smokers and alcoholics, Diabetics, obese patients, poor nutritional status, patients on medications such as steroids, birth control pills, chemotherapeutic drugs will be excluded since these factors have a role on wound healing.

Sample size calculation:

Sample size calculated using the formula
n = Z21- α /2P(1-P) d2
z (standardization) = 1.96
n = sample size, 35
p (Estimated Proportion) = 9
α (Alpha)=0.05,
d (Estimated error) = 1
N= sample size - 35 cases in study group and 35 cases in control group.

The proportion is derived from the Number of covid positive cases from the covid19dashboard.py.gov.in (127734 reported cases out of 1247953).

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RESULTS

Day 3

Table 1. Comparison of post extraction wound healing status of covid recovering individuals and non-covid healthy individuals

	POOR	GOOD	TOTAL
POSITIVE	33(94%)	2(6%)	35(100%)
NEGATIVE	0(0%)	35(100%)	35(100%)
TOTAL	33(47%)	37(53%)	70(100%)
α^2 =62.43, P<0.001			

Day 7

Table 2. Comparison of post extraction wound healing status in covid recovering and non-covid individuals

	GOOD	VERY GOOD	EXCELLENT	TOTAL
POSITIVE	16(46%)	18(51%)	1(3%)	35(100%)
NEGATIVE	0(0%)	24(69%)	11(31%)	35(100%)
TOTAL	16(23%)	42(60%)	12(17%)	70(100%)
α^2 =25.19, P<0.001				

Day 3

Table 3 Contingency

Covid positive patients on day 3 when assessed with Landry et al healing index for post extraction wound healing, scored 2(33) and 3(2), bleeding on palpation was noticed on day 3. VAS scored around 1 and 2 for both the patients with and without history. Covid negative patients on day 3 when assessed with Landry et al healing index for post extraction wound healing scored 3(35), bleeding on palpation was not evident on day 3.

Contingency Tables				
		DAY 3		
HISTORY OF COVID		2	3	Total
Positive	Count	33.00	2.00	35.00
	% within row	0.94	0.06	1.00
Negative	Count	0.00	35.00	35.00
	% within row	0.00	1.00	1.00
Total	Count	33.00	37.00	70.00
	% within row	0.47	0.53	1.00
CHI SQUARE TEST				
	Value	df	P	
X^2	62.43	1	2.76e - 15	
N	70			

Day 7 Table 4. Contingency

Covid positive patients on day 7 when assessed for Landry et al healing index for post extraction wound healing, scored 3(16), 4(18), 1(1). Covid negative patients on day 7 when assessed with Landry et al healing index for post extraction wound healing scored good and excellent.

Contingency Tables					
		DAY 7			
HISTORY OF COVID		3	4	5	Total
Positive	Count	16.00	18.00	1.00	35.00
	% within row	0.46	0.51	0.03	1.00
Negative	Count	0.00	24.00	11.00	35.00
	% within row	0.00	0.69	0.31	1.00
Total	Count	16.00	42.00	12.00	70.00
	% within row	0.23	0.60	0.17	1.00
CHI SQUARE TEST					
	Value		df		P
X^2	25.19		2		3.39e - 6
N	70				

DISCUSSION

Our association and experiences with covid 19 for the past 2 and half years, made us thoroughly learn about the virus and its mutations and their varied clinical presentations that kept modifying depending on the host, environment, comorbidities and many other factors. Vaccination against SARS CoV-2, has brought down the incidence of newer cases and also the severity of the disease, in cases of new and re-infections. SARS CoV-2 has kept us all in a messed-up state, with its weird post covid manifestations in the affected individuals, which made the term 'Long covid syndrome' come into existence. Transmission of SARS CoV-2 is facilitated by ACE receptors which is also found in oral epithelial cells [13]. The binding of ACE 2 & SARS CoV-2 increases the oxidative stress and endothelial damage. Tissue oxygenation is found to be limited in Covid-19 and reduced oxygenation in turn induce Hypoxia inducible factor and the genes that favor the tissue to adapt the prevailing hypoxia. Optimum Oxygenation promotes wound healing, which is found to be altered in Covid-19 [14]. There is accumulated evidence that covid 19 infected patients, carry at least one symptom for weeks or even months after the acute phase events. Out of 47,910 covid positive patients, 50% reported to have sustained symptoms like fatigue, cognitive dysfunction, shortness of breath. Out of 250000 covid survivors, more than 50% of them had symptoms that was persistent for more than six months [15]. It is utmost important for a clinician to understand these symptoms and also separate these Post covid presentations from the presentations occurring due to other reasons for a better treatment planning and beneficial outcome for the patients. It was observed that 6 in 10 patients with history of covid and hospitalization had post or Long covid syndrome. The reported symptoms were persistent from weeks to more than six months. The common reported symptoms were extreme fatigue, intolerance to walk and any physical activity, loss of stamina, shortness of breath, palpitations, problems in the gastrointestinal tract and modulating weight. Females were presenting more of this long covid syndrome than males [16]. With the evidences of, possibilities of post covid alterations in multiple organs, we decided to study the status of wound healing in dental extraction sockets of patients recovering from covid 19. The duration of the symptoms of covid 19 infections after acute phase is documented to last over 12 months from the time of initial infections. our study included patients recovering from covid, with longest duration one year. all the participants gave history of covid vaccination with 2 doses after the infection. The extraction wounds were observed from day 1 to day 7, the healing index of Landry et al was used to score the healing status. The noncovid control patients gave scores from good to excellent as per the criteria. Granulation tissue was observed on day 3 and no bleeding on palpation was observed, whereas, the group with covid history scored poor and good on day 3, bleeding on palpation was observed on day 3 in participants with covid history. On day 7 the healing was found to improve quiet well in both the groups and scored good, very good and excellent. The bleeding in the extraction sites, observed on day 3 in the group with covid history could be due to the elevated levels of early tissue hypoxia due to the history of covid infection. The improvement in scoring on day 7 in covid positive patients comparing to the day 7 of the covid negative control group could be due to the altered process of wound healing which takes place in an organized fashion. The altered process of wound healing will further delay the wound healing and hence the difference in the two groups. In the current study we hypothesize there could be a possibility of prolonged early phase of wound healing. The study group, presented with symptoms like fever, myalgia, loss of taste, loss of smell, headaches, shortness of breath. Both the groups scored from 1 to 2 in VAS scale and was not a significant finding. However, little significance we observed in our study, results attained from the clinical scoring needs to be confirmed with the levels of hypoxia inducible factor (HIF). Wound healing should be assessed in covid infected individuals with short recovery to remove the confounders. Another major limitation of our study, would be the possibility of the control group to have been infected with covid. Based on the patient's history and records of their tests (PCR, rapid antigen) we selected the patients as covid positive and negative. During the third wave, covid presented with milder flu-like symptoms, which

brought down the need of testing and hospitalization. In addition to this, both the groups were vaccinated and the effect of vaccination on wound healing should be studied. Sample size can be increased to bring down the limitations.

CONCLUSION

It was intended to study the Influence of SARS CoV-2 on the Stepwise Physiological process of Wound Healing after Dental Extraction in individuals recovering from covid and healthy individuals without history of covid. It was observed in the study group that there was bleeding upon palpation in the extraction sites, which could be due the altered early hypoxia which could alter the tissue homeostasis thereby prolonging the early phase of wound healing. The minor differences in scoring on day 7 between the groups could be due to the altered process of wound healing which takes place in an organized fashion. In the current study we hypothesize there could be a prolonged early phase of wound healing in the dental extraction wounds in patients with history of covid, which could be yet another feature of long covid syndrome in the oral cavity. During our study period, we observed few areas where further studies need to be done. The wound healing should be compared with the levels of hypoxia inducible factor (HIF) for its definite causal association. Wound healing should be assessed in covid infected individuals with short recovery to remove the confounders. Another major limitation of our study, would be the possibility of the control group to have been infected with covid. Based on the patient's history and records of their tests (PCR, rapid antigen) we selected the patients as covid positive and negative. During the third wave, covid presented with milder flu like symptoms, which brought down the need of testing and hospitalization. In addition to this, both the groups were vaccinated and the effect of vaccination on wound healing should be studied. The effect of long covid syndrome in oral cavity and its associated structures should be studied for any long-term changes at cellular and tissue level.

DECLARATIONS

Acknowledgments

This study was done as ICMR – STS project in 2023 and was approved by ICMR and was satisfactory.

Funding

As it was an ICMR – STS project, the funds were provided by ICMR.

Ethical Approval

This study was designed and presented in the institutional review board and institutional ethical committee and the study was approved (IEC no: IGIDSIEC2022NRP47UGRKOPM).

Informed Consent

Informed Consent was obtained from all the patients who were willing to participate in the study, and were explained about the procedure.

REFERENCES

1. Guo SA, DiPietro LA. Factors affecting wound healing. Journal of dental research. 2010 Mar;89(3):219-29.
2. Karsan N, Zuker RM. Viral infections and wounds. Canadian Journal of Plastic Surgery. 1998 Sep;6(3):159-61.
3. Østergaard L. SARS CoV-2 related microvascular damage and symptoms during and after COVID-19: Consequences of capillary transit-time changes, tissue hypoxia and inflammation. Physiological reports. 2021 Feb;9(3):e14726.
4. De Ryck T, Vanlancker E, Grootaert C, Roman BI, De Coen LM, Vandenberghe I, Stevens CV, Bracke M, Van de Wiele T, Vanhoecke B. Microbial inhibition of oral epithelial wound recovery: potential role for quorum sensing molecules?. Amb Express. 2015 Dec;5:1-2.
5. Politis C, Schoenaers J, Jacobs R, Agbaje JO. Wound healing problems in the mouth. Frontiers in physiology. 2016 Nov 2;7:507.
6. Dziedzic A, Wojtyczka R. The impact of coronavirus infectious disease 19 (COVID-19)

on oral health. Oral diseases. 2021 Apr;27:703-6.
7. Shetty L, Nahar S, Domah T, Raj AT. COVID-19 patients could be at high risk for dry socket. Medical Hypotheses. 2020 Dec 15;146:110462.
8. Inouye D, Zhou S, Clark B, Swanson M, Chambers T, Chambers TN. Two cases of impaired wound healing among patients with major head and neck free-flap reconstruction in the setting of COVID-19 infection. Cureus. 2021 Dec 1;13(12).
9. Aljanabi KS, Almaqbali T, Alkilidar AA. A COVID-19 patient with cavernous sinus thrombosis post dental extraction a diagnostic dilemma. Indian Journal of Otolaryngology and Head & Neck Surgery. 2022 Oct;74(Suppl 2):2887-90.
10. Pippi R. Post-surgical clinical monitoring of soft tissue wound healing in periodontal and implant surgery. International journal of medical sciences. 2017 Jul 18;14(8):721.
11. Marini L, Rojas MA, Sahrmann P, Aghazada R, Pilloni A. Early Wound Healing Score: a system to evaluate the early healing of periodontal soft tissue wounds. Journal of periodontal & implant science. 2018 Oct 24;48(5):274.
12. Nimma VL, Talla HV, Bairi JK, Gopaldas M, Bathula H, Vangdoth S. Holistic healing through herbs: Effectiveness of Aloe vera on post extraction socket healing. Journal of clinical and diagnostic research: JCDR. 2017 Mar 1;11(3):ZC83.
13. Okui T, Matsuda Y, Karino M, Hideshima K, Kanno T. Oral mucosa could be an infectious target of SARS-CoV-2. InHealthcare 2021 Aug 19 (Vol. 9, No. 8, p. 1068). MDPI.
14. Hong WX, Hu MS, Esquivel M, Liang GY, Rennert RC, McArdle A, Paik KJ, Duscher D, Gurtner GC, Lorenz HP, Longaker MT. The role of hypoxia-inducible factor in wound healing. Advances in wound care. 2014 May 1;3(5):390-9.'
15. Maglietta G, Diodati F, Puntoni M, Lazzarelli S, Marcomini B, Patrizi L, Caminiti C. Prognostic factors for post-COVID-19 syndrome: a systematic review and meta-analysis. Journal of clinical medicine. 2022 Mar 11;11(6):1541.
16. Asadi-Pooya AA, Akbari A, Emami A, Lotfi M, Rostamihosseinkhani M, Nemati H, Barzegar Z, Kabiri M, Zeraatpisheh Z, Farjoud-Kouhanjani M, Jafari A. Risk factors associated with long COVID syndrome: a retrospective study. Iranian journal of medical sciences. 2021 Nov;46(6):428.