

# Relationship Between Patient-reported Orofacial-dental Pain Severity and Tele-triage Decisions During COVID-19 Pandemic - Does the Severity of Pain Drive Tele-triage Decisions?

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## Research Article

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# Abstract

**BACKGROUND:** Globally, with COVID-19 pandemic, elective dental services were stopped, and only urgent/emergency conditions were managed face-to-face after tele-triage (TT). However, no previous research explored whether the severity of orofacial/ dental pain (OFDP) drives the TT decisions. The current report undertook this task.

**METHODS:** This retrospective cross-sectional report analyzed the pain severity (PS) reported by hotline callers during the first COVID-19 lockdown and its association with patient's age, sex, history of chronic illness, and dental discipline required. PS was also compared across triage categories, associated dental history and tentative tele-diagnosis. PS was measured using self-reported numerical rating scale (NRS-11). Binomial logistic regression assessed the association between the PS (exposure) and likelihood of being referred for face to face management, controlling for age, sex, history of chronic illness, and dental discipline needed. ANOVA compared pain severity (PS) across dental history and tentative diagnosis.

**RESULTS:** PS was significantly associated with TT decisions ( $p < 0.05$ ). An increase in pain score by 1 unit was associated with 1.4 times increased odds of face-face referral. Pediatric/ adolescent patients (9-18 years) were 2.1 times more likely, and those with chronic illness were 2.12 times more likely to be referred for face-to-face management. Among the dental specialties, surgical and orthodontic specialties were each associated with increased odds of referral (1.9 and 7.016 respectively) compared to restorative specialties.

The highest PS was highest for the emergency triage category ( $8.00 \pm 2.83$ ,  $P < 0.0001$ ), adults ( $6.29 \pm 2.18$ ,  $P < 0.0001$ ), and the tentative tele-diagnosis of cellulitis ( $7.75 \pm 2.87$ ,  $P < 0.0001$ ).

**CONCLUSIONS:** TT decisions were significantly influenced by severity of patient-reported OFDP, adjusting for a range of variables. However, acute dental conditions were not referred when they were judged to be manageable remotely; and conversely, less acute dental conditions were given the attention they required and referred when they had potential life threatening or quality of life implications. Considering such tele-approach after the pandemic has subsided might be safe and useful in a range of scenarios and healthcare facilities.

## Background

As COVID-19 affected the world, it was soon categorized as a pandemic by the World Health Organization [1], and nationwide complete lockdown became the sole option [2]. This affected all aspects of health care including oral health. A complete move from the traditional care became critical, and virtual health technologies came to the forefront out of necessity to continue patient care and reduce risk of transmission [3]. In line with recommendations of the World Health Organization [4], Hamad Dental Center (HDC), the sole public tertiary dental services provider in Qatar, initiated changes related to all aspects of dental services. These included patient triage for COVID-19 symptoms, operatory preparation, infection control, and selection of low-risk interventions. HDC also initiated a dedicated teledentistry (TD) hotline to ensure the continuity of care to patients including triage, consultation, identifying oral diseases, and treating and/or rereferring according to the urgency of oral/dental condition [5]. TD applies to the remote provision of dental care without physical contact using broad variety of technologies [6], while tele-triage (TT) applies to using TD to interview callers, assess urgency and sort patients by priority and level of care required [7, 8]. The aim was to maintain the continuity of services and avoid missing serious or emergency dental conditions.

As part of the COVID-19 measures, the American Dental Association (ADA) published a guidance with definitions for different categories of dental conditions [6]. Dental pain was a fundamental component in these definitions as it is a highly prevalent and a significant health problem that reduces quality of life and well-being [9 – 12].

Pre-pandemic literature suggested that there is an elevated demand of emergency appointments in dental practices and in a certain proportion of general medical practices and emergency departments due to high level and frequency of orofacial/ dental pain (OFDP) [13]. Correspondingly, the pandemic literature suggests that the COVID-19 pandemic influenced the utilization of emergency dental services [14], and its impact on patterns of dental emergencies was shown in the high prevalence of dental pain compared to other oral health related problems during the pandemic [15 – 20]. It has also been suggested that during the pandemic, only patients with acute pain remained constant [21], while the less acute but nevertheless existing dental problems were neglected [22]. Such actions might have led to the worsening of overall health, triggering infections with local and systemic complications, compromising general health, and forcing at risk patients to visit hospitals emergency rooms [15, 23]. These complications were attributed to the use of the recommended advice, analgesics and antibiotics (AAA) strategy in dental pain management which has significant limitations with severe pain-related conditions where face-to-face dental procedures are necessary to achieve symptomatic relief [24].

While TD offers acceptable reliability for the tentative diagnosis [25], the literature on TT during the pandemic reveals knowledge gaps [15, 16, 20, 21, 26]. No previous research objectively reported whether TT decisions were driven by severity of pain. Likewise, according to our knowledge, no studies compared the pain severity (PS) across its associated symptoms, and tentative tele-diagnosis. Studies examined selective conditions e.g., dental-facial trauma [27], or pain, swelling and trauma [15], with less attention to other conditions associated with OFDP e.g., loose/broken dental restorations, orthodontic appliances, oral ulcers, or bleeding. In addition, many reports focused on paediatric populations [27, 28] where PS cannot be objectively determined remotely.

Therefore, the aim of the current report is to assess whether tele-triage decisions were driven by severity of pain. PS was appraised across its associated dental history, and tentative tele-diagnosis to analyse their influence on tele-triage decisions. The emerging findings provide important information to a non-existent evidence base on the management of OFDP during pandemics. Findings will provide practitioners and policy makers with information necessary to better manage OFDP related emergencies during situations like those experienced during COVID-19 pandemic, or where resources are significantly limited for managing such emergencies.

## Methods

### Ethics, Design and Participants

The institutional research board (IRB) at Hamad Medical Corporation (HMC) granted permission for this service evaluation project to proceed. This is a retrospective analysis of information routinely collected for clinical audit and service evaluation. We analyzed patient, and triage data of all hotline calls during the first wave of Covid-19 lockdown (N= 1239 for 5 months, 23 March – 31 August 2020). We excluded callers with incomplete records where outcomes were not reported (n= 389), and children  $\leq$  8 years old (n= 125) as the numeric pain scale is not applicable to patients at this age [29, 30]. We excluded patients who were not exposed to pain (0 pain score) (n= 193). The inclusion of those with no pain could bias the results, as patients who did not report pain would be referred for face-to-face management for a reason other than the pain itself.

After exclusions, the sample comprised 532 callers who reported various extents of pain. We analyzed pain severity (PS) reported by callers and its association with patient's age, sex, history of chronic illness, and dental discipline required. We also assessed the association between the PS and likelihood of the TT decision of being referred for face to face management, controlling for the same variables. Data were extracted from the electronic health records and the TD data collection forms. The forms were completed by each tele-dentist for every caller, as part of an ongoing service audit.

## Setting and Procedures

HDC set up a dental emergency services hotline managed by a team of qualified dentists to remotely consult, diagnose oral/ dental diseases, and undertake urgent TT decisions. TD policy and guidelines were formulated to guide the categorization of triage levels (emergency, urgent or non-urgent) and assist the team in the management of self-reported pain, swelling, bleeding, trauma, and oral-mucosal ulceration (Fig. 1). These guidelines were not binding but indicative, leaving some freedom of interpretation to the tele-dentists, who had been trained to ensure consistency of the service in arriving at triage and management decisions while observing caller privacy.

The recommended policy and guidelines, based on American and British recommendations [6, 31, 32], helped to triage the call, arrive at a tentative diagnosis, and accordingly offer appropriate care and/or referral. The guideline document was available to each practitioner and posted near the telephone set. In addition, as part of the service, dentists administered a TD data collection form (Fig. S1) for each call. The form collected information on: 1) call (frequency, time, duration); 2) patient (demographics, medical/ allergy history, relationship of caller to patient, chief complaint, severity of pain on scale from 0-10); and 3) triage (specialty required, management, referral to emergency/ dental facility undertaken, medications prescribed, procedure performed at point of referral). The focus of the current report is on the pain.

## Pain

The numerical rating scale (NRS-11) is a simple and easy to score pain assessment tool [30] that consists of a total of 11 numbers, ranging from 0 to 10, representing no pain to the worst possible pain, respectively [33]. NRS-11 is reliable and valid as a self-report scale of pain intensity in many populations including children and adolescents as young as 8 years old, however it is not suitable for very young children as certain cognitive skills are required for children to understand the meaning of the numbers of the NRS-11 and provide accurate ratings of PS [34]. Hence, callers  $\leq 8$  years old were excluded.

Tele-dentists categorized the condition into emergency, urgent or non-urgent and managed the condition accordingly. AAA strategy was utilized as appropriate, and medications were home delivered to patients using courier service. Callers who were referred to hospital emergency or dental facility to receive face-to-face interventions were tele-triaged for COVID-19 symptoms and directed accordingly to either HDC or COVID-19 dedicated facilities.

## Statistical Analysis

Descriptive and inferential statistics characterized the sample. Categorical variables are reported as frequencies and percentages and differences TT decisions compared using Fisher's Exact test (Monte Carlo test with 99% CI) due to relatively small sample size. Continuous variables are reported as mean  $\pm$  standard deviation and PS compared using t test if comparisons were between two groups or Analysis of variance (ANOVA) if  $> 2$  groups. Binomial logistic regression assessed the association between the PS (exposure) and likelihood of being referred

for face to face management, adjusted for age, sex, history of chronic illness, and dental discipline needed. Adjusted odds ratios are reported. Statistical analysis was performed using IBM SPSS Statistics for Windows, version 25 (IBM Corp., USA).  $P < 0.05$  (two-tailed) was considered statistically significant.

## Results

### PS across selected sample characteristics

Table 1 illustrates that majority of callers were adults (68.61%), while there was almost equal proportions of males and females. About three quarters of the sample had no history of chronic illness. More than half of the callers needed restorative specialties that operate mainly aerosol generating procedures. The mean PS for the whole sample was moderate/ high ( $6.05 \pm 2.284$ ), with adults reporting significantly more severe pain than other age groups ( $p < 0.0001$ ). Likewise, callers who needed restorative and surgical specialties reported moderate/ high PS, while those who needed orthodontic procedures demonstrated significantly less PS. PS did not differ by caller sex or history of chronic illness.

Table 1  
Pain severity across selected characteristics of the sample

Characteristic	N (%)	Pain Severity <sup>a</sup>	P-value <sup>b</sup>
Whole sample	532 (100)	6.05 ± 2.284	
Age group			< 0.0001
Child/ Adolescent 9-18 Y	69 (12.97)	4.91 ± 2.247	
Adult 19-44	365 (68.61)	6.29 ± 2.181	
Middle Aged 45-64	60 (11.28)	5.93 ± 2.350	
Aged 65+	38 (7.14)	5.89 ± 2.638	
Gender			0.330
Male	252 (47.4)	6.15 ± 2.193	
Female	280 (52.6)	5.95 ± 2.363	
History of chronic illness			0.109
No	396 (74.44)	5.95 ± 2.288	
Yes	136 (25.56)	6.32 ± 2.260	
Dental discipline required			< 0.0001
Restorative Specialties	312 (58.65)	6.24 ± 2.239	
Surgical Specialities	150 (28.2)	6.23 ± 2.190	
Orthodontics	70 (13.16)	4.79 ± 2.315	

Pain severity (PS) represented as mean ± standard deviation; restorative specialties = restorative dentistry, endodontics & prosthodontics; surgical specialities = oral surgery & periodontics; <sup>a</sup> higher scores indicate higher

severity of pain; <sup>b</sup> P-value based on ANOVA test for comparison of means.

## Association between pain severity and tele-triage decisions

The logistic regression analysis showed that an increase of 1 unit in pain score was significantly associated with 1.4 times increased odds of referral for face-to-face management. Three out of the remaining four variables included in the logistic regression were also significantly associated with tele-triage decision of referral for face-to-face management (Table 2). The odds of face-to-face referral increased 2.1 times for patients of pediatric or adolescent age groups (9-18 years). Likewise, those with presence of chronic illness were 2.12 times more likely than those with no illness to be referred for face-to-face management. Among the dental specialties, surgical and orthodontic specialties were each associated with increased odds of referral of the patient for face-to-face management (1.9 and 7.016 respectively) compared to restorative specialties. Sex was not significantly associated with referral for face-to-face management.

Table 2  
Association between reported PS and TT decision

	Refer for face to face management	
Variable	OR (95% CI)	P value
<b>Patient Age groups <sup>a</sup> (Years)</b>		
Ref – adults (19-44)		.061
Child/ adolescent (9-18)	2.07 (1.07- 4.02)	.031
Middle aged (45-64)	1.73 (0.91 - 3.31)	.096
Aged (65+)	0.86 (0.36 - 2.05)	.737
<b>Gender</b>		
Ref – female	1.01 (0.67 - 1.51)	.960
<b>Presence of Chronic illness</b>		
Ref – Absence of illness	2.12 (1.28 -3.51)	.003
<b>Pain Scale (1-10)</b>		
	1.39 (1.26 - 1.54)	.000
<b>Dental Specialty Needed</b>		
Ref – Restorative specialties <sup>b</sup>		.000
Surgical Specialties <sup>c</sup>	1.93 (1.22 - 3.04)	.005
Orthodontics	7.02 (3.54 -13.87)	.000

OR = Adjusted odds ratios obtained for various factors using binomial regression; CI = confidence interval; Ref = reference; <sup>a</sup> age groups categorized as standard age ranges defined by the Medical Subject Headings (MeSH); <sup>b</sup> restorative specialties = restorative, endodontics and prosthodontics; <sup>c</sup> surgical specialties = oral surgery and periodontics.

## Triage categories, TT decisions, and their relation to PS

Table 3 displays that PS differed significantly across different triage categories with emergency category had highest PS ( $P < 0.0001$ ). Likewise, TT decision significantly differed among different triage categories ( $P < 0.0001$ ), were for all calls triaged as emergency, the TT decision was to refer for face-to-face management; 83.4% of calls triaged as urgent were referred; whilst only 2.9% of calls triaged as not urgent were referred. Although management decisions were based on the triage categories, however, when PS was tested against management decisions undertaken, there were also significant differences between them ( $P < 0.0001$ ). Calls that were remotely managed were found to have a significantly lower PS ( $5.69 \pm 2.227$ ) than those where the management decision was to refer ( $6.79 \pm 2.229$ ).

Table 3  
Triage categories, TT decisions, and their relation to pain severity

Triage categories	TT Decision <sup>b</sup>		Total
	Remote management N (%)	Referral N (%)	N (%)
Emergency ( $PS 8.00 \pm 2.83$ ) <sup>a</sup>	0 (0)	4 (100)	4 (100)
Urgent ( $PS 7.13 \pm 2.05$ ) <sup>a</sup>	31 (16.6)	156 (83.4)	187 (100)
Not urgent ( $PS 5.43 \pm 2.17$ ) <sup>a</sup>	331 (97.1)	10 (2.9)	341 (100)
<b>Total</b>	<b>362 (68.07)</b>	<b>170 (31.95)</b>	<b>532 (100)</b>
Pain	5.69 $\pm$ 2.23	6.79 $\pm$ 2.23	

*PS*: pain severity on the numerical rating scale (NRS-11); all percentages represent row percentages; <sup>a</sup> differences in PS across different triage categories and PS (ANOVA),  $P < 0.0001$ ; <sup>b</sup> differences in TT decisions across triage categories (Fischer's exact test),  $P < 0.0001$ ; differences in PS among different TT decisions (ANOVA),  $P < 0.0001$

## PS differences across associated dental history, tentative diagnosis, and TT decisions

In terms of dental history (Table 4), although tooth with cavity or filling were most frequent and most painful, only 21.78% were referred for face-to-face management. Similarly, jaw-related symptoms had the second highest PS, but only 40% of those callers were referred. Conversely, while orthodontic appliance problems had the lowest PS, 60% of these problems were referred for face-to-face clinical interventions.

As for tentative tele-diagnoses (Table 4), cellulitis was associated with the highest pain, and all cases were referred to a hospital emergency facility. Temporomandibular dysfunction (TMD) was also associated with high pain levels and 50% were referred for clinical management. Pulpitis was the most common tele-diagnosis (31.77%) and was significantly associated with high PS, however, 76.33% were managed remotely. While orthodontic problems were associated with lowest pain levels, more than half of the callers could not be managed remotely and were referred for chairside interventions.

Table 4

Pain severity differences across diverse dental histories, tentative diagnosis, and teletriage decisions.

Characteristic	N (%)	Pain Severity <sup>a</sup>	P-value*	Decision		P-value**
				Remote Management <sup>b</sup>	Referral	
Dental history			< 0.0001			< 0.0001
Tooth with cavity or filling	202 (37.97)	6.65 ± 2.024		158 (78.22)	44 (21.78)	
Jaw symptoms	10 (1.88)	6.60 ± 2.547		6 (60.0)	4 (40.0)	
Wisdom tooth	43 (8.08)	6.35 ± 2.203		33 (76.74)	10 (23.26)	
Swelling	86 (16.17)	6.17 ± 2.181		54 (62.79)	32 (37.21)	
Recent tooth extraction	4 (0.75)	5.75 ± 3.403		3 (75.0)	1 (25.0)	
Dental restoration/prosthesis	39 (7.33)	5.74 ± 2.673		24 (61.54)	15 (38.46)	
Dental trauma or tooth fracture	40 (7.52)	5.70 ± 2.115		25 (62.5)	16 (37.5)	
Bleeding	13 (2.44)	5.23 ± 2.315		12 (92.31)	1 (7.69)	
Ulcer	13 (2.44)	5.23 ± 2.455		8 (61.54)	5 (38.46)	
Inflamed gums	14 (2.63)	5.07 ± 1.940		13 (92.86)	1 (7.14)	
Orthodontic appliance	68 (12.78)	4.71 ± 2.350		27 (39.71)	41 (60.29)	
Tentative diagnosis			< 0.0001			< 0.0001
Cellulitis	4 (0.75)	7.75 ± 2.872		0 (0.0)	4 (100)	
TMD	8 (1.50)	6.75 ± 2.375		4 (50.0)	4 (50.0)	
Pulpitis	169 (31.77)	6.74 ± 2.077		129 (76.33)	40 (23.67)	
Dental caries	52 (9.77)	6.63 ± 1.783		40 (76.92)	12 (23.08)	

<sup>a</sup> M±SD, higher scores (1-10) indicate higher severity of pain, <sup>b</sup> comprising AAA: advise, analgesics antibiotics; \* P value based on ANOVA test for comparison of means; \*\* P value based on Fisher's Exact (Monte Carlo test with 99% CI), TMD = temporomandibular dysfunction.

Characteristic	N (%)	Pain Severity <sup>a</sup>	P-value*	Decision		P-value**
				Remote Management <sup>b</sup>	Referral	
Pericoronitis	57 (10.71)	6.25 ± 2.214		44 (77.19)	13 (22.81)	
Dry socket	5 (0.94)	6.20 ± 3.114		3 (60.0)	2 (40.0)	
Dental abscess	46 (8.65)	6.11 ± 2.046		31 (67.39)	15 (32.61)	
Dental fracture	39 (7.33)	5.77 ± 2.241		23 (58.97)	16 (41.03)	
Saladenitis	2 (0.38)	5.50 ± 2.121		0 (0.0)	2 (100)	
Broken dental filling/prosthesis	32 (6.02)	5.38 ± 2.697		19 (59.38)	13 (40.62)	
Ulcer	13 (2.44)	5.23 ± 2.455		8 (61.54)	5 (38.46)	
Periodontitis	35 (6.58)	4.97 ± 2.051		32 (91.42)	3 (8.58)	
Broken orthodontic appliance	70 (13.16)	4.70 ± 2.318		29 (41.43)	41 (58.57)	

<sup>a</sup> M±SD, higher scores (1-10) indicate higher severity of pain, <sup>b</sup> comprising AAA: advise, analgesics antibiotics; \* P value based on ANOVA test for comparison of means; \*\* P value based on Fisher's Exact (Monte Carlo test with 99% CI), TMD = temporomandibular dysfunction.

## Discussion

There has been calls to enhance the evidence-base of the management of OFDP [35]. We assessed patient-reported OFDP during the first wave of COVID-19 lockdown in terms of its differences in severity across demographic variables (age and gender), history of chronic illness, dental disciplines needed, dental history and tentative tele-diagnosis. The report's main objective was to explore whether TT decisions (remote management of caller vs referral for face-to-face management) were associated with the PS. To our knowledge, no previous research undertook such tasks. Hence, it was not straightforward to directly compare our findings with previous research.

The main finding was that TT decision to remotely manage or to refer the caller for face-to-face management was significantly associated with OFDP severity. An increase in pain score was associated with increased odds of face-face referral, however, other covariates were also associated with such decisions. Most significant associations were whether the caller had a history of a chronic illness, and whether the discipline needed operates aerosol generating procedures. This indicates that management decisions at HDC were highly individualized, considering the tripartite considerations of the reported pain, clinical judgement, and the high transmission characteristics of COVID-19.

For instance, for callers with high PS, in terms of dental history, callers with problems related to tooth cavity/filling, temporo-mandibular joint, wisdom tooth, and swellings had the highest PS. However, more than two thirds of these patients were managed remotely. In terms of tele-diagnosis, we observed that pulpitis was not only associated with high PS, but it was also the most frequent tele-diagnosis (31.77%), concurring with the range between 22.5% - 46% pulpitis rates reported by others as the origin of OFDP during the pandemic [15, 18, 19]. Despite that endodontic RCT is the gold standard treatment for pulpitis, > 75% of our pulpitis were managed remotely, because RCT generates aerosols. Hence RCT was restricted during the pandemic and reserved for where the tooth was restorable and strategically important, otherwise extraction was favoured. This supports a UK study where 65% of clinical consultations resulted in extractions to avoid aerosol generating procedures [16]. This also explains the increased odds of the patients being seen at the clinic for surgical and orthodontic procedures (1.9 and 7.016 respectively) compared to that of aerosol generating restorative procedures.

High levels of pain severity were observed with conditions that could precede a serious medical emergency or are caused by odontogenic infections. Our management decisions considered the risk of systemic life-threatening complications in tandem with PS, as recommended by the ADA [6]. For instance, we observed that TMD was the second most painful condition. This supports that the pandemic adversely effected peoples' psycho-emotional status and intensified their bruxism and TMD symptoms [36]. However, during tele-triage, patients may provide inaccurate history [37] as TMD is difficult to be described by the patient. In addition, it could be an early symptom of an underlying cardiac problem [38]. Given such uncertainties combined with the fact that our TD was largely limited to telephone consultations during the pandemic's initial stages like other places worldwide [36], half of our TMD cases were referred. Likewise, although we found that cellulitis had the highest PS, pain was not the sole reason for referral. It is recognized that cellulitis of odontogenic infection origins can be life threatening [39]. All cellulitis were categorized by the HDC tele-dentists as emergency and referred to hospital emergency for intravenous antimicrobials and analgesics [39].

For callers with low PS, the individualized approach after careful weighting of reported pain and clinical picture was also evident. For instance, those with history of orthodontic appliance problems experienced least pain, but the majority were referred. The majority of orthodontic patients typically fall in the pediatric or adolescent group (9-18 years), and this could explain the 2.1 times increased odds of face-to-face referral for patients of this age group. Orthodontic appliance related problems may not be life threatening or severely painful; nevertheless, they challenge daily activities (speech, mastication, sleep), quality of life, and could lead to significant consequences if left unattended.

At the height of a rapidly changing pandemic, HDC management decisions provide positive lessons for future 'normal' times after the pandemic. On the one hand, during the pandemic, severe OFDP was the driver of urgent care [21]. On the other hand, pre-pandemic literature suggests that the high OFDP results in an elevated demand of emergency appointments at dental practices, some general medical practices and emergency departments [13]. The present report showed that PS indeed influenced the TT decisions of OFDP (remote management or referral). However, a main observation is that not all our cases with higher severity of pain were referred; and conversely, not all cases with low pain severity were managed remotely. Such discrepancies might seem odd. However, when dental history, tentative tele-diagnosis, discipline required and face-to-face procedure at point of referral were considered, other factors like clinical judgment, risk of disease transmission, potential life-threatening systemic complications, possible diagnostic uncertainty, and probable challenges with daily activities/ deteriorated quality of life if the condition is left unattended contribute to explain such discrepancies. The approach used at HDC

during the pandemic led to the remote management of 31 cases triaged as urgent (5.8% of the total callers) and 331 cases triaged as non-urgent (62.2% of the total callers). During 'normal' (non-pandemic) times, these combined 68% of the patients would have otherwise physically presented themselves at our clinics. Hence, extending the application of teledentistry, tele-triage, tele-consultation, and tele-therapy to after the pandemic is over might offer a promising and useful approach if practiced with the same level of individualization and driven by considerations of both, the reported pain and clinical judgement. This would lead to the freeing of healthcare resources that could be used elsewhere, shortening of long waiting lists, alleviation of over-crowded walk-in clinics, and reserving the chairside appointments to conditions that truly require such management.

The current report has limitations. HDC is a tertiary dental services provider, and the patients in the current report are patients with previous dental experiences or persisting symptoms. Such patients are different than those who present at primary dental care centers experiencing their first dental pain encounter. Hence, generalizability of the findings needs to exercise caution. Despite this, the report has strengths. Previous work on patient-reported OFDP during the pandemic lockdown focused on the association between worsened socioeconomic conditions and pain severity [40], while the current report explored the influence of PS on TT decisions, and appraised PS across triage categories, demographic variables, dental history, discipline required, and tele-diagnosis related factors. These findings provide policy makers with information necessary to better manage OFDP related emergencies and similar epi/pandemics, or where resources are significantly limited in rural areas and underdeveloped regions.

## Conclusion

During this phase of the pandemic, the most frequent symptom with most severe OFDP was decayed or filled tooth, and the most frequent tele-diagnosis was pulpitis. PS was significantly higher for emergency and urgent tele-triage categorization. TT decisions were significantly influenced by severity of patient-reported OFDP, adjusting for a range of variables. However, acute dental conditions were not inevitably referred when they were judged to be manageable remotely; and conversely, less acute dental conditions were given the attention they required and referred when they were judged to have potential life threatening or quality of life implications. Such measured actions could lead to sizeable savings of healthcare resources which could in future be used to reduce pressure on clinics overcrowded with conditions that could be remotely managed. Hence, maintenance of such tele-approach later after the pandemic might be safe and useful for a range of scenarios and healthcare facilities if practiced with similar level of individualization and driven by careful considerations of the combination of reported pain and complaints on the one hand, and meticulous clinical judgement on the other.

## Abbreviations

COVID-19: Coronavirus disease 2019; WHO: World Health Organization; CDC: Centers for Disease Control and Prevention; HDC: Hamad Dental Center, TD: Teledentistry; TT: Teletriage; ADA: American Dental Association; OFDP: Orofacial/ dental pain; PS: Pain Severity; AAA: advise, analgesics and antibiotics; IRB: Institutional research board; NRS-11: Numerical rating Scale; ANOVA: Analysis of variance; RCT: Root Canal Treatment; OR = Adjusted odds ratios obtained for various factors using binomial regression; CI = confidence interval; Ref = reference.

## Declarations

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### **Authors' contributions**

SA: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing original draft, Writing review and editing. WEA: Data curation, Formal analysis, Investigation, Methodology, Writing original draft, Writing review and editing. Both authors read and approved the final manuscript

### **Declarations**

### **Ethics approval and consent to participate**

The institutional research board (IRB) at Hamad Medical Corporation considered this analysis as an audit or service/therapy evaluation project since the data used was routinely collected for clinical audit and as an integral part of service evaluation purposes. The project was granted an exemption from requiring ethics approval.

### **Consent to publish**

Not Applicable

### **Competing interests**

The authors declare that they have no competing interests in relation to the present study.

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### **Availability of data and materials**

The datasets generated and/or analysed during the current study are not publicly available due to the institution regulations, however, they are available from the corresponding author on reasonable request.

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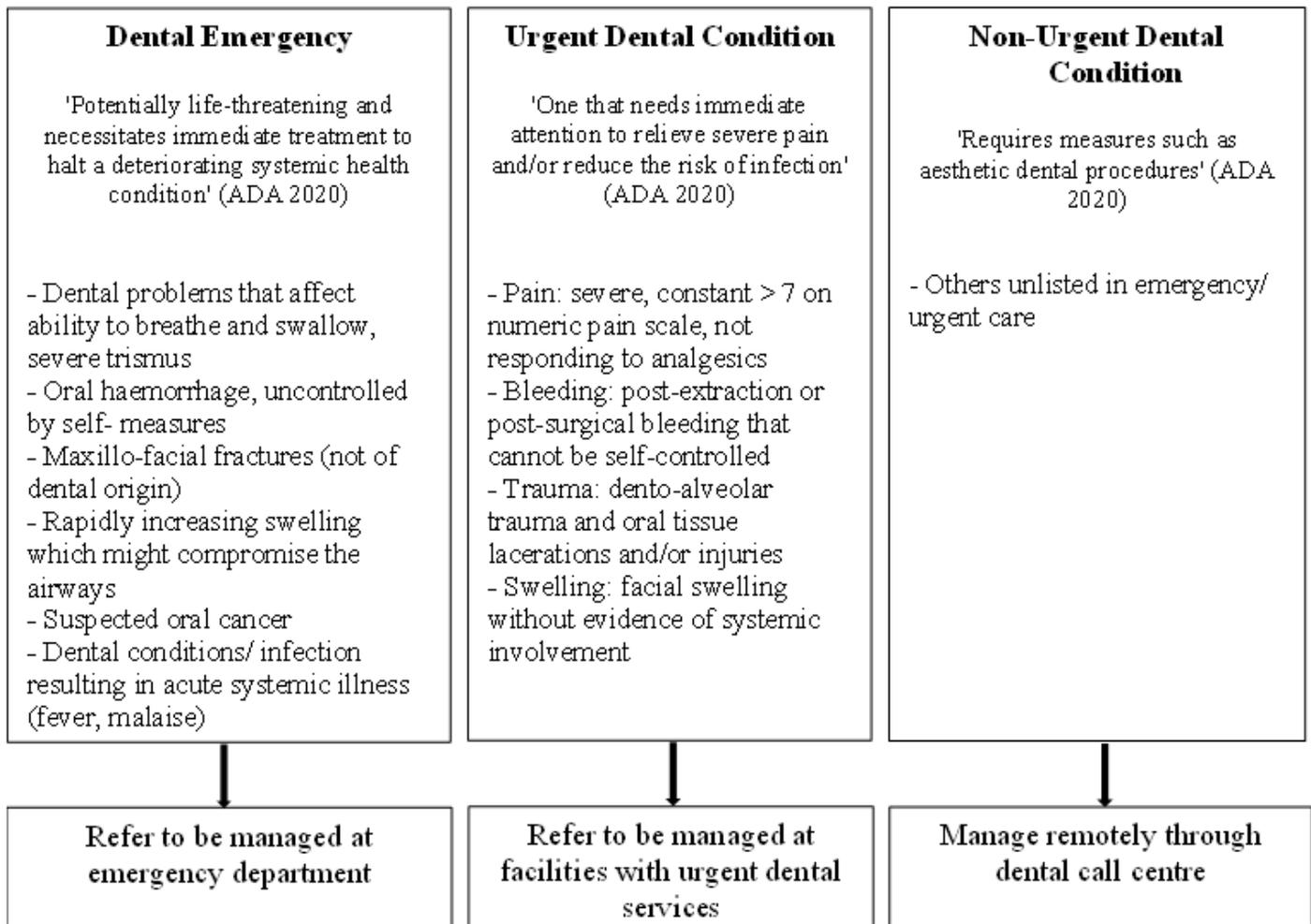
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## Figures



**Figure 1.** Recommend guidelines for self-reported dental emergencies via the hotline

Figure 1

See image above for figure legend.

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