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Research Article

Ethical Calculus for the Provision of Dental Care during and after the COVID-19 Pandemic of 2020

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ABSTRACT

Background: Due to its high rate of spread and unpredictable course, the COVID-19 virus has limited dentistry to providing only urgent treatment through the pandemic of 2020. With time, the burden of untreated dental disease will slowly rise, but too early a return to elective treatment will contribute to the spread of coronavirus and under-utilize much needed PPE, causing undue morbidity and mortality.

Methods: A theoretical framework is proposed for calculating a safe return to work for dental providers in the United States after the COVID-19 pandemic. Clinical, ethical, economic, and mathematical principles are utilized.

Results: A model is offered using the concept of QALYs and DALYs to calculate benefits and risks of dental care. The model includes a 13-variable formula that takes into account the prevalence and impact of dental disease and the novel coronavirus.

Practical Implications: Organized dentistry groups are encouraged to couple clinicians and policymakers to calculate the optimal timing for a measured return to work. Specifically, a safe return will balance PPE supply and efficacy with hospital capacity to find an optimal prevalence of COVID-19 and dental disease where it would be most responsible for dentists to return to providing elective care. Lastly, a call is made to lobby for government support for dentists, as dental care is a vital service to the public provided almost entirely by a private sector workforce in the United States.

Background

The novel coronavirus of 2019-2020 has an unpredictable effect on those infected, ranging from no symptoms at all to severe acute respiratory syndrome and death. This combined with its high rate of spread has limited dentists to providing only urgent treatment during the pandemic of 2020. Commonly stated reasons for this are conservation of personal protective equipment (PPE) and reduction of non-essential visits which would contribute to the spread of COVID-19 [1]. The decision to pause non-urgent dental care is undoubtedly the correct one. As the COVID-19 crisis peaks and eventually tapers, we will face the question of when the appropriate time is to re-open for business as usual.

At the time of writing this paper (April 13, 2020), many states' directives do not have an end date for their current recommendation to postpone all non-urgent needs [2]. While the vast majority of what we do in dentistry is elective, some proportion of untreated dental disease goes on to cause acute infections, and the proximity to the airway can lead to significant morbidity and even some mortality. Additionally, quality of life can be significantly affected by the pain and dysfunction of untreated disease. This paper is meant to act as a guide for what types of calculations we must do as an organized group of professionals to help our workforce return to work safely when the time is right.

Methods

A theoretical framework is proposed for calculating a safe return to work for dental providers in the United States after the COVID-19 pandemic.

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Principles from clinical, ethical, economic, and mathematical backgrounds are utilized. No empirical studies were performed.

Results

The simplest version of the calculus we must do is to find when the net benefit of dental care is greater than its risks. This can be denoted as follows: Net Benefit of Dental Care > Net Risk of Dental Care. This can be abbreviated as formula (1):

B > R

We may then break down each major category into its specific parts (Table 1).

Table 1

Benefits of Dental Care	Abbr	Risks of Dental Care	Abbr
Treatment of pain	P	Spread of COVID-19 to patients (and associated morbidity/mortality)	CVP
Prevention of infection	I	Spread of COVID-19 to dental providers (morbidity, mortality, and effect on provision of dental care)	CVD
Prevention of tooth/bone loss	TBL	Utilization of PPE for something other than direct COVID-19 treatment (increasing morbidity/ mortality of COVID-19)	PPE
Prevention of emergency department visits (higher cost and exposure to COVID-19)	EDV		
Esthetics/Social improvement	ES		
Economic benefit to patients (increased productivity)	EB		
Economic benefit to dental providers (wages)	W		

Abbr: Abbreviation.

The benefits of dental care are a function of the variables on the left, while the risks are a function of the variables on the right. By modifying formula (1), we arrive at formula (2):

(1) B > R

(2) B (P, I, TBL, EDV, ES, EB, W) > R (CVP, CVD, PPE)

In this model, I have chosen to include the "Risks of not providing dental care" in "Benefits of Dental Care."

This begs the question; how do we quantify the value of each of these factors? While these would be highly variable for individuals, we can consider using the concept of DALYs and QALYs to help us on a population level.

What are DALYs (Disability-Adjusted Life Years) and QALYs (Quality-Adjusted Life Years)?

DALYs and QALYs are composite measures of impact of diseases and/or treatments on both quantity and quality of life. They are calculated using coefficients for a given state of health or disease multiplied by time spent in that state. DALYs are typically used as indicators of disease burden, i.e. time spent living with a disability and time lost due to premature mortality [3]. QALYs are used to measure the benefits of an intervention, i.e. time spent multiplied by a coefficient representing the health-related quality of life (HRQoL) experienced during that time [4]. The coefficients for HRQoL can be calculated in a number of ways outlined by Whitehead and Ali [5]. The EQ-5D questionnaire is the most commonly used, which asks cognitively simple questions about mobility, self-care, usual activities, pain/discomfort, and anxiety/depression using a 3-point scale for each.

Our formula can now be modified:

(1) B > R

(2) B (P, I, TBL, EDV, ES, EB, W) > R (CVP, CVD, PPE)

- QALYs gained from dental care: These are a function of the HRQoL gained from esthetic/social improvement, increase in productivity in society, and wages of dental providers.
- DALYs avoided by dental care: These are a function of the prevalence of dental disease and its subsequent impact on quality of life due to pain, infections (morbidity and mortality), decrease in chewing/smiling capacity from tooth/bone loss, and Emergency Department visits avoided.
- DALYs of providing dental care: These are a function of the spread of COVID-19. The variables that influence this are COVID-19 prevalence (therein limited by our inadequate access to imperfect testing), hospital capacity, efficacy of preventive measures taken in offices, and supply of PPE (both for dental providers and hospitals). This yields formula (3):

(3) [QALYs gained from ES, EB, W] + [DALYs avoided by P, I, TBL, EDV] > [DALYs of CVP, CVD, PPE]

In our calculation, the QALYs gained and DALYs avoided by provision of dental care are directly dependent on the prevalence of dental disease (Pr DD), while the DALYs of providing dental care are dependent on the prevalence of COVID-19 (Pr COVID-19) and the effectiveness of disease-spread-reducing measures in offices (EDSRM). This yields our final formula (4):

(4) Pr DD ([QALYs gained from ES, EB, W] + [DALYs avoided by P, I, TBL, EDV]) >

Pr COVID-19 x EDSRM [DALYs of CVP, CVD, PPE]

Discussion

Untreated dental disease remains among the most prevalent conditions worldwide, affecting an estimated 2.4 billion people as of 2010 [6]. We

are now appreciating the acute toll of the novel coronavirus, and we are yet to find out what the long-lasting sequelae may be. Preventing spread of this disease is the most important thing in the world today. Unfortunately, this narrow focus has negative consequences, and the longer it takes us to get the coronavirus under control, the more of these unintended consequences we will feel on a daily basis.

Cessation of elective dental care is a part of the physical distancing measures necessary to control spread of COVID-19. As this continues, the morbidity and mortality of dental disease will increase, as will the economic strain on dental practices. The fact that we do not have a reliable way of predicting which patients with chronic dental disease will go on to have acute problems highlights a deficient area of our understanding of dental disease, and pain from untreated disease will contribute to the ongoing struggle we have as a society with opioids. These pressures will push individual dentists to want to return to practice.

In the calculations outlined in this paper, the current author has presented the view that at the very *least*, the benefits of performing dental treatment should be greater than its risks before we return to work in full force, but it is not clear that this threshold is high enough. In the United States where dental care is provided almost entirely in the private sector, the direct financial incentive dentists have for providing treatment can lead to public concern about our professional integrity and motivations [7]. The prevalence of COVID-19 may never again be zero, and we may never be able to assure that no one contracts COVID-19 in a dental office. Organized dentistry groups at both the national and state levels have been providing excellent, frequently updated guidelines for dentists on their websites specifically dedicated to COVID-19. This includes guidance on how to minimize risk of transmission, legal statements, ethical support, and flow charts for screening and treatment of dental disease [8, 9].

The American Dental Association is naturally positioned to take the lead in devising a measured, systematic, and transparent way to calculate an optimally timed return to elective care, and state run groups should provide their region-specific considerations based on the best evidence available on the prevalence and impact of both COVID-19 and dental disease. Used globally for decades in multiple economic and public health evaluations, DALYs and QALYs provide quantitative measures of disease burden and impact of interventions, respectively. The current author proposes these calculations be used by professional organizations to advise dentists on a safe return to work.

This should involve a collaboration of dentists with public health experts, policymakers, and economists to lay out a step-wise plan that gives formal consideration to the risks and benefits of treating specific diseases/diagnoses, the amount of aerosolization from the type of treatment, hospital capacity, and the ever-changing supply of PPE.

Lastly, as of 2009, 91.7% of the 186,084 professionally active dentists in the United States were engaged in the private practice of dentistry as a primary or secondary occupation [7]. These small businesses will be pushed by market forces to re-open too early, thus risking a second wave of COVID-19 and contributing to public distrust of dentistry [10]. As an organized group of professionals, we must lobby for government support for dental practices, as their service is vital to the public yet provided almost entirely by a private sector workforce in the United States. The theoretical framework laid out in this paper is meant to assist organized dentistry leaders in policy discussions to be held over the coming months.

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