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The Influence of Dissonance Induction and Assessment Reactivity in Improving Adherence to COVID-19 Precautionary Measures: A Cluster Randomised Controlled Trial

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ABSTRACT

Background: During the coronavirus disease 2019 (COVID-19) pandemic, adherence to suggested precautionary measures has been emphasized as important in preventing and curtailing its spread. However, strict adherence to precautionary measures can be demanding.
Methods: This cluster randomised controlled trial done among 1517 undergraduate dental students tested the effectiveness of 'dissonance induction' (DI) and 'assessment reactivity' (AR) in improving adherence to World Health Organization (WHO) measures as compared to a control group. At baseline, participants in the DI group were tested for their knowledge of precautionary measures, immediately followed by assessment of their adherence to them. This methodology was adapted to systematically reveal the poor adherence of the participants in their self-held cognitions, should there be any. The magnitude of dissonance was measured as the proportion of such dissonant cognitions held by an individual. In the AR group, at baseline, participants were asked about their attitudes alone toward measures. The control group was neither assessed for knowledge and adherence nor for attitudes toward the measures at baseline. Two weeks after the administration of these interventions in the DI and AR groups, the 3 study groups were assessed for adherence.
Results: The follow-up adherence scores in the DI group were found to be significantly higher (15.11 ± 4.1) compared to the AR (13.13 ± 2.01) and control (12.87 ± 2.97) groups as analysed by Kruskal-Wallis analysis of variance ($H = 243.5$; $P < .001$). Wilcoxon signed-rank test showed that the adherence scores significantly improved in the DI group from baseline to follow-up ($z = -8.84$; $P < .001$). Magnitude of dissonance at baseline was found to be a significant predictor of follow-up adherence scores ($R^2 = 0.255$).
Conclusion: This study found that DI is an easy intervention to bring an immediate and significant change in adherence to precautionary measures.

Introduction

The fact that coronavirus disease 2019 (COVID-19) was declared a public health emergency of international concern reflects the magnitude of the global crisis caused by this viral pandemic.[1] Since severe acute respiratory syndrome-coronavirus 2 (SARS-CoV-2), the virus that causes COVID-19, is a

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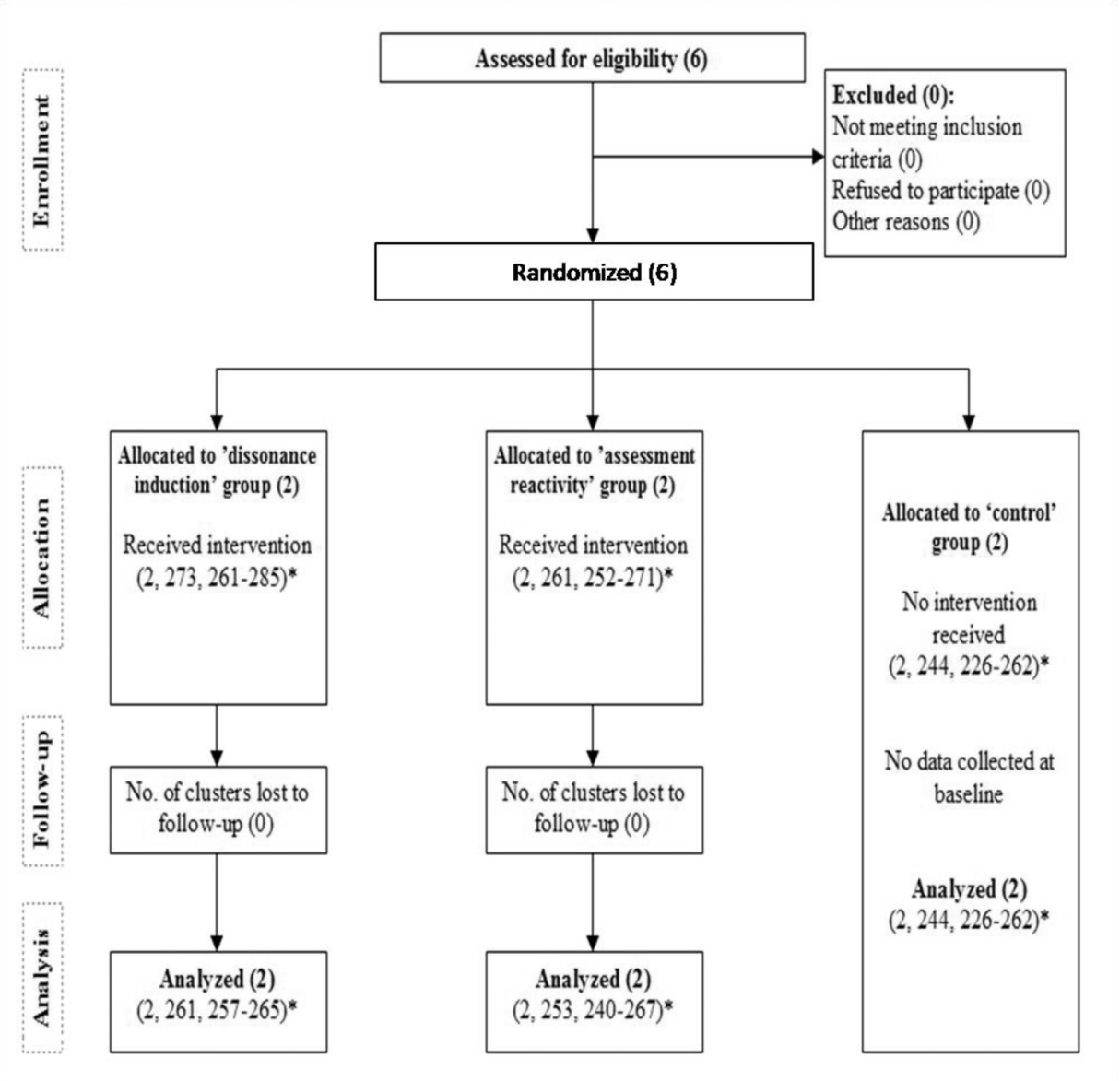
novel virus with recent emergence among humans, humans are completely immune-naÿve and consequently vulnerable to infection.[2] International experiences suggest that the transmission of the disease can be rapid in rather short periods of time.[3,4] Though COVID-19 is associated with mortality, the case fatality rate was reported to be lesser for COVID-19 (2%) compared with severe acute respiratory syndrome (SARS) (10%) and Middle East Respiratory Syndrome (MERS; 34%). However, it was reported that COVID-19 has been responsible for more deaths than SARS and MERS combined. These findings reflect the more contagious, though less severe, nature of COVID-19 compared with SARS and MERS.[5] It is for this reason that the greatest challenge ahead for health care systems is to curtail the rapidity and magnitude of transmission. As on 24 December 2020, official reports from the Ministry of Health and Family Welfare, Government of India suggest that 10.1 million individuals have been confirmed positive among suspected cases and contacts of known cases.[6] These numbers illustrate the nature of transmission of the disease. Responsibility has been placed on the citizens of the nation to prevent themselves from getting affected. The World Health Organization (WHO) suggested precautionary measures of frequent hand washing, social distancing, avoiding touching face, nose, or mouth, practising respiratory hygiene, maintaining 1-meter distance from those coughing and sneezing, and refraining from smoking and activities that weaken the lungs. These measures have been widely circulated in various media platforms for people to assimilate and adopt.[7] However, literature suggests that though persuasive health messages are often successful in bringing attitudinal changes among people, these changes are short-lived. More importantly, it has been strongly established by social psychologists that positive attitudes do not necessarily translate to positive behaviours. Therefore, more thorough and scientifically informed behavioural interventions are warranted to improve adherence to precautionary measures and combat the outbreak of this and other infectious diseases.

The benefits of answering questions, termed as 'question benefit effect' (QBE), about a behaviour in producing positive changes, though minor in magnitude, in that behaviour have been previously studied.[8] Various theories have been proposed to explain the behaviour change following responding to questions on that behaviour. Sherman[9] postulated that mental stimulation takes place while responding to questions about a behaviour that results in formation of cognitive representations or behavioural scripts. These cognitive representations get reactivated while the subject performs that behaviour and assists a positive behavioural change. Another explanation is the theory of attitude accessibility that proposes that the questions about behavioural intentions of individuals activate the attitudes intrinsic for that behaviour, making them more accessible in memory.[10] This theory was tested with regard to healthy eating behaviours.[11] Cognitive dissonance is another explanation for QBE, which attempts to attribute the benefit to the cognitive conflict felt by reporting behaviours inconsistent with their beliefs. Cognitive dissonance, as proposed by Leon Festinger,[12] is an unpleasant drive state similar to hunger or thirst experienced when 2 psychologically inconsistent cognitions are simultaneously held by a person that is against the inner drive to maintain harmony between one's attitudes/beliefs and behaviour. Aronson[13] proposed that dissonance theory makes its clearest predictions when the people's self-concepts are violated by their own actions. Aronson also argued that passing on information to individuals in a persuasive manner would only result in attitudinal changes that are temporary. Dissonance-induced persuasion is more effective in bringing a behavioural change because individuals' inconsistent behaviour with their own self-concept creates a necessity to attain consistency between their self-concepts and behaviour. Assessment reactivity, on the other hand, is the influence of behavioural assessment at the present time on later behaviour. It was proposed that mere questioning about a behaviour influences an individual to change the behaviour in question.[14] In the present study, the group where inconsistency of the subjects' behaviour with their own concepts is explicitly made evident to them by testing their knowledge and behaviour at baseline is identified henceforth as the 'Dissonance Induction' (DI) group. The group where mere questioning of attitudes was done at baseline is identified as the 'Assessment Reactivity' (AR) group. There is a control group which was neither tested for knowledge, behaviour nor for the attitudes at baseline. Our hypothesis (H1) was inducing dissonance among subjects by systematically making evident to them the poor adherence to their own cognitions results in better follow-up adherence to the precautionary measures. If the null hypothesis (H0) were to be true, there would be no difference in the follow-up adherence scores between the 3 study groups.

Methods

This cluster randomised controlled trial was conducted during the months of February and March 2020 following ethical approval from the Institutional Ethical Committee of SIBAR Institute of Dental Sciences (Pr.69/IEC/SIBAR/2020). The allocation ratio was 1:1:1 in the DI, AR, and control groups. Six teaching dental institutions (clusters) of the 16 functioning dental institutions in the southern Indian state of Andhra Pradesh were selected and 2 each were allocated to DI, AR, and the control groups after randomisation. The study details are depicted in Figure 1. All the study participants were provided with the necessary information on the purpose and process of the study without revealing the specific focus and objectives of the study. Consent was obtained prior to the subjects' participation in the study, and participation in the study was voluntary. Care was taken to ensure anonymity in the questionnaire, leaving no place for coercion. Since all the participants within a cluster received either the same intervention or no intervention, contamination between the study groups was not possible. Furthermore, study participants from each individual dental institution were neither aware of the alternative interventions tested in the study nor did they know about the parallel conduct of the study among students from other dental institutions.

DI at baseline: In the DI group, dissonance was induced at baseline by administering a self-administered, structured questionnaire that revealed the existing cognitive conflict, should there be any. This questionnaire consisted of 2



*(number of clusters, average cluster size, range of cluster size)

Fig. 1 – CONSORT flow diagram of the cluster randomized trial.
CONSORT = Consolidated Standard of Reporting Trials.
***Number of clusters, average cluster size, and range of cluster size.**

sections: knowledge about COVID-19 precautionary measures and adherence to precautionary measures. To assess knowledge on COVID-19 precautionary measures, a combination of 6 WHO suggested precautionary measures and 6 distractor options was given for the participants to choose from. The adherence was assessed immediately after the participants had responded to the knowledge questions. This questionnaire served 2 purposes: making the subjects explicitly mention their self-concepts in the 'knowledge' section and making it evident for the subjects how consistent/inconsistent their actions were with their own cognition in the 'adherence section'. Dissonance was considered to be induced if a subject chose a WHO suggested precautionary measure in the knowledge section and reported his or her current adherence to that precautionary measure to be 'occasional' or 'never' as the poor adherence of the subjects with their self-held cognitions was systematically revealed to them. On the other hand, consonant cognitions refer to WHO suggested precautionary measures chosen by the subjects in the knowledge section for which they report their adherence to be 'often' or 'almost always'. The knowledge score (ks) of a subject 'i' was calculated using the formula ks(i) = N -Z, as

suggested by Kurz, where N is the number of correct responses chosen by that subject and Z refers to the number of incorrect responses.[15] This ensures that a subject who chooses all the responses randomly will get a 'zero' knowledge score. The baseline adherence to WHO suggested COVID-19 precautionary measures was assessed on a 4-point Likert scale (0-3) with higher score indicative of better adherence. The magnitude of dissonance (M_D) was calculated as the number of dissonant cognitions divided by the sum of number of consonant and dissonant cognitions ($M_D = N_{dc}/N_{cc} + N_{dc}$; where N_{cc} refers to number of consonant cognitions and N_{dc} refers to number of dissonant cognitions).

Baseline attitudinal measurement in the AR group: In the AR group, a self-administered questionnaire inquiring the attitudes of the subjects toward WHO suggested COVID-19 precautionary measures was administered. In contrast with the DI group, these participants were neither assessed on their knowledge of the precautionary measures nor were they asked about their adherence to precautionary measures at baseline. The attitudes were documented on a 4-point Likert scale (0-3) with higher scores indicative of more positive attitudes.

The control group was not assessed for either the knowledge and practice or the attitudes toward precautionary measures at baseline.

Assessment of adherence in the study groups at follow-up: During the follow-up, 2 weeks after the administration of corresponding questionnaires in the DI and AR groups, self-reported adherence to the WHO suggested COVID-19 precautionary measures was documented in all the 3 study groups on a 4-point Likert scale (0-3) with '0' indicating nonadherence and '3' indicating perfect adherence. Adherence score of a subject at the follow-up was calculated as the sum of scores obtained for the responses to the 6 precautions of interest. Therefore, the follow-up adherence scores range from 0 to 18, with '0' indicating nonadherence to all the 6 precautionary measures and '18' indicating perfect adherence to all the precautionary measures. A total of 60 students were lost to follow-up across both the intervention groups and were excluded from the analysis. The final sample included 1517 subjects with 522 in the DI group, 507 in the AR group, and 488 in the control group.

Statistical Analysis: SPSS version 2.0 software was used for descriptive statistics and data analyisi. The Wilcoxon signed rank test identified the change in adherence scores from baseline to follow-up in the DI group, Spearman's correlation test evaluated the correlation between attitudinal scores at baseline and follow-up adherence scores in the AR group, Kruskal-Wallis analysis of variance tested the differences in follow-up adherence scores between the study groups, and simple linear regression analysis was used for the DI group with follow-up adherence score as the dependent variable and magnitude of dissonance as the explanatory variable.

Results

The response rate was 68.4% in the DI group, 66% in the AR group, and 63.2% in the control group. There was no significant difference in the gender distribution between the study groups with female students representing 80.07% (418) of the DI group, 77.51% (393) of the AR group, and 78.07% (381) of the control group.

Table 1 – Distribution of responses to the knowledge test on COVID-19 precautionary measures in the Dissonance Induction group at baseline (*n* = 522).

Precautionary measure	Response	*n* (%)
Use prophylactic antibiotics	Yes	47 (9)
	No	475 (91)
Eat plenty of garlic	Yes	112 (21.45)
	No	410 (78.55)
Avoid touching your face	Yes	425 (81.41
	No	97 (18.59)
Refrain from smoking and other activities that weaken the lungs	Yes	259 (49.61)
	No	263 (50.39)
Use hand dryers after washing your hands	Yes	97 (18.58)
	No	425 (81.42)
Cover your mouth and nose when coughing or sneezing	Yes	499 (95.6)
	No	23 (4.4)
Maintain at least 1 meter distance between you and people sneezing or coughing	Yes	495 (94.82)
	No	27 (5.18)
Take regular hot water baths	Yes	73 (13.98)
	No	449 (86.02)
Practice social distancing and avoid unnecessary travel	Yes	485 (92.91)
	No	37 (7.09)
Stay in hot and humid climates	Yes	51 (9.77)
	No	471 (90.23)
Stay away from mosquitoes as they can transmit SARS-CoV-2	Yes	45 (8.62)
	No	477 (91.38)
Wash your hands frequently with alcohol-based hand rub	Yes	510 (97.7)
	No	12 (2.3)

COVID-19 = coronavirus disease 2019; SARS-COV-2 = severe acute respiratory syndrome-coronavirus 2.

Baseline observations in the DI group: Table 1 shows the participants' responses to knowledge questions in the DI group at baseline. The mean knowledge score of COVID-19 precautionary measures among the participants from the DI group was 3.23 ± 2.15 (95% CI 3.04-3.41), after adjusting for the incorrect responses. The mean score for magnitude of dissonance was observed to be 0.26 ± 0.18, which suggests that the proportion of dissonant cognitions on an average was slightly more than 25%. The mean adherence to precautionary measures score in the DI group at baseline was 13.02 ± 3.74 (95% CI 12.69-13.34).

Baseline observations in the AR group: The mean attitudinal score toward COVID-19 precautionary measures in the AR group at baseline was 14.02 ±3.6, where a score of 18 was indicative that the subject is most likely to practice all 6 precautionary measures suggested.

Follow-up observations in the study groups: An apparent difference was noted among the 3 study groups with regard to their mean follow-up adherence scores in practicing the COVID-19 precautionary measures, with the DI group demonstrating higher scores compared to AR and control groups (Figure 2). Significantly higher adherence scores in DI group were suggestive of the more thorough adherence to precautionary measures in the DI group compared to AR and control groups at follow-up. No significant differences were noted between the AR and control groups in post hoc tests for

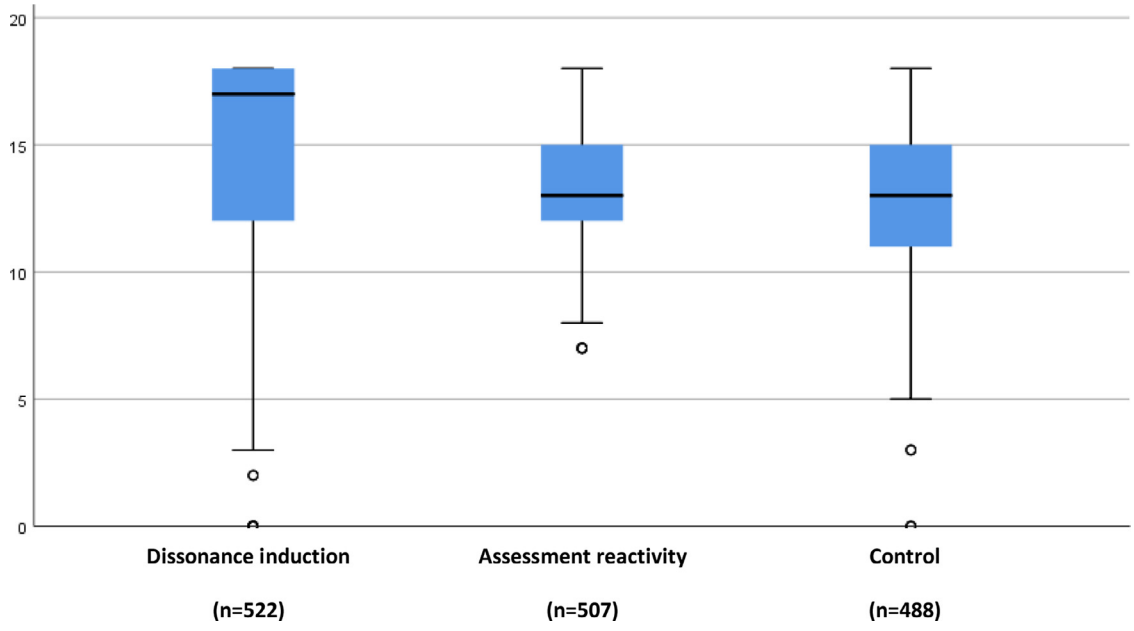


Fig. 2 – Box plot showing differences in the follow-up adherence scores between the study groups.

Table 2 – Differences in follow-up adherence scores to COVID-19 precautionary measures between the study groups.

Group	N	mean ± SD	95% CI	Mean rank	H (df, N)	P value	P value (post hoc tests)		
							DI - AR	DI - C	AR - C
DI	522	15.11 ± 4.1	14.75-15.47	999.4	243.5 (2, 1517)	.001*	.001*	.001*	.27
AR	507	13.13 ± 2.01	12.96-13.31	639.97					
C	488	12.87 ± 2.97	12.6-13.14	625.51					

AR = assessment reactivity; C= control; CI = confidence interval; COVID-19 = coronavirus disease 2019; df = degrees of freedom; DI = dissonance induction; SD = standard deviation.
Kruskal-Wallis ANOVA; P ≤ 005 considered statistically significant.

* Denotes statistical significance.

multiple pair wise comparisons, while statistically significant differences were noted for DI group compared with both the AR and control groups (Table 2).

Observations in DI group from baseline to follow-up: The adherence scores in the DI group significantly improved from baseline to follow-up (Wilcoxon Z statistic = -8.84; P < .001) (Table 3). It was noted in this group that the follow-up adherence scores exhibited a positive linear relation with the magnitude of dissonance at baseline (Spearman's $\rho = 0.505$; P < .001). Magnitude of dissonance was found to be a significant predictor of the follow-up adherence scores in linear regression analysis (Table 4).

Observations in the AR group from baseline to follow-up: In the AR group, there was no correlation between the adherence scores of the study participants at follow-up and their attitudinal scores at baseline (Spearman's $\rho = -0.006$; P = 0.88).

Table 3 – Differences in adherence scores to COVID-19 precautionary measures in the DI group from baseline to follow-up.

Time	mean ± SD	95% CI	z-statistic	P value
Baseline	13.02 ± 3.74	12.69-13.34	-8.84	.001*
Follow-up	15.11 ± 4.1	14.75-15.47		

CI = confidence interval; COVID-19 = coronavirus disease 2019; DI = dissonance induction; SD = standard deviation.
Wilcoxon signed rank test; P ≤ .05 considered statistically significant.

* Denotes statistical significance.

Table 4 – The relation between magnitude of dissonance and practice precautionary measures during follow-up in the DI group.

Predictor	β - coefficient	95% CI	P value	R^2 value
Constant	11.7	11.1 – 12.3	.001*	0.255
Magnitude of dissonance	11.93	10.1 – 13.6	.001*	

CI = confidence interval; DI = dissonance induction; R^2 = coefficient of determination.
Linear regression.

* Denotes statistical significance.

Discussion

DI was found to be an effective way to bring positive changes in adherence to COVID-19 precautionary measures, demonstrating significant positive differences with the AR and control groups, and consequently, the null hypothesis (H_0) can be rejected in support of H1. This study attempted to make subjects in the DI group experience the cognitive conflict at baseline by testing their knowledge on and immediately inquiring about their practice of COVID-19 precautionary measures. Such inquiry results in induction of dissonance, a state of cognitive conflict, by making the discrepancy between cognition and behaviour explicitly evident to the respondent. This may influence people to adopt behaviours that they believe are health-promoting in nature. Aronson et al[16] referred to this method as creation of dissonance by hypocrisy induction. Aronson et al[16] successfully tested the effectiveness of this method in overcoming denial and improving the intentions to use condoms, where hypocrisy was induced by having the subjects publicly advocate condom use and then systematically making the subjects aware of their own previous failures in condom use. Dickerson et al[17] reported behaviours conducive to water conservation among the hypocrisy-induced group. Aronson argued that the change in people's attitudes through informational campaigns is short-lived because such a change is brought about by an external source. They proposed that little investment of the self in formation of the attitude is the reason behind the impermanent nature of these changes and such attitudes are vulnerable for change if there is a stronger counterargument by a different external source in the future. Aronson et al[18] suggested that dissonance-generated persuasion is effective in resulting a long-term change as there is the opportunity for critical reflection and investment of the self in the process of attitudinal or behavioural change. In the present study, magnitude of dissonance explained more than a quarter of the variance in the follow-up adherence scores in the DI group adding strength to the argument that induction of dissonance is effective in bringing positive health behavioural changes. Wilding et al[19] reported that the dissonance-enhanced QBE condition was more effective in health behavioural modification compared to a standard QBE intervention. Dissonance was also discussed as the most plausible mechanism explaining QBE in the meta-analyses conducted by Wood et al[11] and Spangenberg et al.[20]

Besides induction of dissonance, another intervention tested in this study was mere questioning about the attitudes toward COVID-19 precautionary measures at baseline without assessing the knowledge and practice of these measures. The existing evidence regarding whether mere questioning of the attitudes relating to a behaviour may bring a positive behavioural change is equivocal.[14,18,21] In the present study there was no significant difference between the AR and control groups in the follow-up adherence scores. Moreover, the attitudes toward practice of the precautionary measures at baseline in the AR group demonstrated no correlation with the follow-up adherence scores. Spangenberg et al[22] also reported no differences between participants who were asked and not asked to predict their behaviour. These findings, however, were inconsistent with those reported by Wood et al,[11] in which participants who were asked to report their intentions demonstrated more accessible attitudes compared to those who were not. Ayres et al[23] proposed that QBE alone is insufficient in promoting health behaviours; a combination of motivation and QBE was reported to be effective in significantly increasing behaviour in a randomised controlled trial. Thus, the present study adds strength to the existing QBE research and postulates DI, over mere questioning about attitudes, as an efficient intervention to promote healthy behaviours with regard to COVID-19 precautionary measures.

Possessing concrete insight into positive health behaviours does not mean practice of these behaviours.[24] Also, it was reported in the literature that people believe their behaviour to be better than their actual behaviour.[25] Therefore, one of the fundamental goals of health behavioural research is to close the gap between knowledge and behaviours. As a cost-effective alternative to close this gap, QBE was previously tested in different domains of health care such as health screening,[26] health check-ups,[27] vaccination,[28] adoption of health-promoting behaviours, and reduction of risk behaviours.[19] However, this is the first time, to our knowledge, that QBE has been tested for behavioural change with respect to limiting the spread of an infectious disease where strict adherence to suggested precautionary measures is regarded as the best way to combat the spread. It is evident from this study that though the study population possesses good knowledge of the COVID-19 precautionary measures to be followed; they also held some misconceptions among which eating plenty of garlic was the most common. Other common misconceptions identified were the need to take regular hot water baths; the need to use hand dryers after hand wash; and the need to stay in hot and humid climates. Refraining from smoking was identified by only less than half of the participants in the intervention group as a precautionary measure. The problem with holding erroneous beliefs is that the unwarranted practice of these beliefs may act as a compensatory mechanism for people to ignore the actual precautionary measures to be followed. For instance, a person from India who holds a notion that staying in hot and humid climates is protective against severe acute respiratory syndrome-coronavirus 2 may not feel the necessity to practice social distancing. This study highlights some of the erroneous notions held by the dental students and provides an indication of the necessity to more effectively communicate the precautionary measures to reduce the transmission of COVID-19.

The limitations of this study are randomisation at the level of the dental institution; short follow-up time; increased accessibility to information related to COVID-19 through the study period. Randomisation was not done at the participant level to prevent contamination bias.[29] Students from the same institution randomised to any of the 3 study groups may share their experiences with colleagues in a different study group than theirs; this is the reason why cluster randomisation was preferred. However, cluster randomisation carries the risk of reduced statistical power. A follow-up time of only 2 weeks was considered in the present study. It was reported in the literature that QBE decays with time. However, in the context of epidemics, even short-term changes in behaviours toward the positive are of tremendous importance. In the literature, follow-up times after administering

the questionnaire varied over a wide range in the previous QBE research with Van Kerckhove et al[30] measuring the dependent variable immediately after questioning and Murray et al[31] reported a time interval of 5 years between administration of questionnaire and measurement of the outcomes. It is important to point here that all study participants, regardless of the study groups, had increased accessibility to COVID-19 information through the study period, which may have an influence on their adherence to the precautionary measures. Nevertheless, access to information is common for participants in all study groups and any possible influence could have affected the follow-up adherence scores in all groups. Another limitation in this study is the gender imbalance with 78.5% of the study participants being females. However, this imbalance is consistent with the existing gender-based imbalance in enrolment into dentistry in India.[32] DI was found to be a low-cost, rapid, and effective intervention in this study to improve adherence to COVID-19 precautionary measures. We propose that a more definitive argument in favour of making use of DI as a cost-effective method can be made by comparing the adherence levels to healthy behaviours between DI and strict auditing. Such establishment of DI as a cost-effective alternative goes a long way in the determination of the choice of interventions for behaviour change and not just with regard to COVID-19 but also in the broader context of various health behaviours. Future research on QBE in health behavioural research must also attempt randomisation at an individual level and optimum follow-up times.

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Conflict of interest

None disclosed.

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