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Review Article

Dentistry Section

Revisiting the Delphi Technique in Orthodontics: A Systematic Review

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ABSTRACT

Introduction: The Delphi technique is an iterative, multi-stage process that consists of questioning a panel of experts through a structured group communication process to reach a consensus on specific issues. The study is a systematic review of the available literature in orthodontics which has utilised the Delphi technique to seek consensus on a range of issues.

Aim: To identify and summarise the studies which have utilised the Delphi technique as a method for gathering consensus in the speciality field of orthodontics. The study evaluated the various characteristics of the Delphi technique.

Materials and Methods: This systematic review followed the methodology of a preset article inclusion and exclusion criteria using an electronic database search using the keywords consensus, Delphi, Delphi technique, Delphi studies, expert opinion was conducted in March 2021. A range of electronic databases comprising PubMed, Excerpta Medica database (EMBASE), Google Scholar, Web of Science and Scopus were searched dated from (January 1990 to March 2021) to identify the studies which involved the use of Delphi in orthodontics. Following this, two authors reviewed and scored each of the studies before finalising a list of five studies to be included in this review.

Results: The searches revealed a total of 187 studies out of which only five studies met the inclusion criteria and were included in this study. Each of the five studies was assessed by two independent assessors. The five studies involved an expert panel from multiple health professionals involving orthodontic specialists, maxillofacial surgeons, nurses, speech therapists, and nutritionists. Five domains (theme, panel constitution, panel size, number of iterations and the level at which consensus reached) were identified and assessed in each of the five studies.

Conclusion: The study has identified and reviewed the Delphi technique and its usage in orthodontics but has also provided a sound description and elaboration of the various components and characteristics of the Delphi technique in addition to providing some correlations between expert panel size and the number of iterations.

Keywords: Delphi studies, Expert opinions, Electronic database, Iterations

INTRODUCTION

Delphi technique vaguely referred to as a panel of wise persons is a structured process that uses a series of questionnaires or rounds or iterations to elicit specific information from an expert panel [1,2]. The Delphi technique is a widely accepted method for obtaining group consensus in different areas of educational research [3], healthcare [4], and the social sciences [5]. Limited evidence-based literature in health professionals' education leads to uncertainty in understanding important areas of curricular needs. Consequently, consensus methods like Delphi Technique become overly significant and relevant to educators in the health professionals' stream. The ability to collect and collate relevant knowledge from academicians provides a channel for educators to voice their otherwise tacit ideas and concerns [6]. The technique which emerged in the 1950s was created by the researchers at the Rand (Research and Development) Corporation [7]. The technique was based on the assumption that "two heads are better than one" and worked on the premise that having more than one opinion about a subject would lead to better decision making [8]. The technique allows a series of rounds to be held until a group consensus is reached [9]. The method employs experts in a specific field to gather useful information to solve an issue in any context. The expert opinion supports collaborative knowledge sharing which enhances the problem-solving capabilities of individuals as part of a larger group [10].

Delphi technique enjoys wide popularity in its use in a variety of research questions across diverse health professionals' education [11]. This trend is seen in different faculties of health professionals' education such as dental education [12-15] medical education [6], pharmacy education [16], veterinary pharmacy education [17] and nursing education [18]. The experts can remain anonymous preventing domination of the consensus by a few experts [1]. The literature reveals that the Delphi technique and its utilisation in the field of orthodontics is an area with very little understanding. This trend is visible in the limited number of studies that have utilised this technique [19-23]. Therefore, the objective is to address this lack of knowledge by reviewing the literature and providing a comprehensive understanding of this technique so that other researchers may utilise the technique and seek answers to complex questions in a simple yet effective manner.

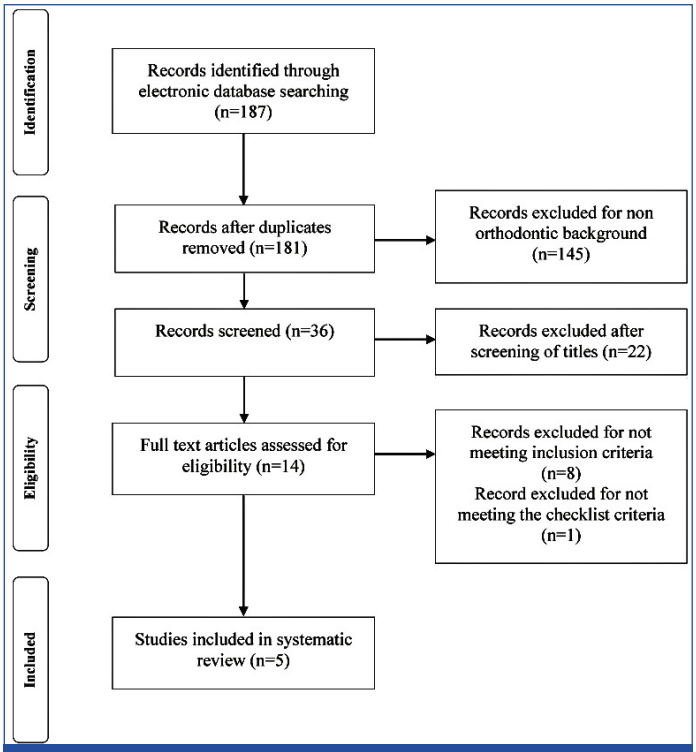
MATERIALS AND METHODS

This study follows the dynamics of a systematic review conducted in March 2021 at Advanced Medical and Dental Institute, Universiti Sains Malaysia. The use of non restrictive search criteria helped in having a broader search result as described in [Table/Fig-1]. A range of electronic databases comprising Pubmed, EMBASE, Google Scholar, Web of Science and Scopus over a period from January 1990-March 2021 were searched.

Sorting Review Articles

All articles that used the Delphi technique as the method employed for acquiring expert opinions in orthodontics were identified. The articles retrieved by these searches were initially analysed by the first author for suitability of inclusion into the study. Following this, each study was reviewed further to understand the Delphi characteristics employed by them. The authors established an article inclusion list based on the Delphi Technique characteristics.

Two authors [1,2] marked each of the five studies under five domain criteria of theme, panel constitution, panel size, number of iterations and the level at which consensus was reached.



[Table/Fig-1]: PRISMA flow diagram.
PRISMA: Preferred reporting Items for systematic reviews and meta-analyses

The articles were only included if all the characteristics were fulfilled. The studies revealing information on all five domains were finally selected for inclusion in the study [Table/Fig-2]. The data resulting from these five domains from five studies were then extracted, compiled, and presented in a summary table for better clarity [Table/Fig-3].

After selection, these five studies were subjected to a checklist [24,25] to determine the methodological quality which was reviewed and assessed by two independent assessors. The checklist consisted of nine criteria that measured the intervention strength [Table/Fig-3]. Each included study was reviewed independently by them. Each included study was scored twice using the checklist. Each study was scored against the nine criteria. The study 1 [19] received a score of 7/9, study 2 [20] received 6/9, study 3 [21] received 6/9, study 4 received 7/9 [22] and study 5 [23] received 6/9. The sixth study [26] which was scored but not included for the study received a score of 5/9. This study received the same score by both assessors and as the information available was limited the, study failed to make the final list of five studies for inclusion in this review. The analysed studies had to meet a minimum of six out of nine criteria for inclusion as recommended by earlier studies [24,25]. Once the scoring was completed, the scores from both authors were compiled. Any disagreement was overcome through mutual discussion on the merits of the study. Following this exercise, one article was excluded and the final list of five studies was included for this review.

RESULTS

Following Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [26], various article selection stages were performed before a final list of five articles were included for analysis [Table/Fig-1].

The articles were evaluated on the five domains of theme, panel constitution, panel size, number of iterations and the level at which consensus reached. The themes on which the expert opinion was sought represented validation of clinical diagnostic test [19], content creation and validation of a patient education booklet for patients undergoing orthognathic surgeries [20], development of an orthodontic curriculum for undergraduate students [21], for identifying challenges of undergraduate orthodontic education [22] and produce a recommendation on the risks to be discussed with patients as part of consent for orthodontic treatment [23]. The Delphi technique served as a validation tool for all five articles [19-23] [Table/Fig-2].

Authors and Year	Theme	Panel constitution	Panel size	Number of iterations	Level at which consensus reached
Yezioro Rubinsky S and Eslava-Schmalbach J., 2007 [19]	To validate experts' clinical diagnosis test (ECDT) as gold standard for severe vertical facial excess (VFE)	Orthodontists, Maxillofacial Surgeons with more than 10 years of clinical experience and an academic bond to a recognised postgraduate program	12	2	2nd round
Sousa CS and Turrini RN, 2012 [20]	To create and validate educational material for patients undergoing orthognathic surgery	Oral and maxillofacial surgeons, nurses, speech therapists and nutritionists	10	3	3rd round
Bashir U et al., 2017 [21]	To develop faculty consensus of orthodontic learning outcomes associated with knowledge and skills of "Treatment" required for undergraduate students.	Orthodontic faculty members with a minimum of three years of teaching experience along with holders of fellowship from Royal College of Surgeons England (RCSE), Royal College of Physician and Surgeon (RCPS) Edinburgh, Royal College of Surgeon, Glasgow and Royal College of Surgeon Ireland	42	2	2nd round
Kaggal Lakshmana Rao G et al., 2020 [22]	To develop consensus in identifying challenges of undergraduate orthodontic education in Malaysian public universities	Orthodontists with a minimum of two years of teaching experience	10	3	3rd round
Perry J et al., 2021 [23]	produce a recommendation on the risks to be discussed with patients as part of consent for orthodontic treatment	Orthodontists with an e-mail address registered on the British Orthodontic Society (BOS) membership database	237	2	2nd round

[Table/Fig-2]: Description of articles included for the review [19-23].

Checklist to assess strength of educational intervention
Was a strong design used to assess efficacy?
Were outcomes validly and reliably measured?
Were interventions validly and reliably measured?
Was the assignment of subjects randomised?
Were both pre-test and post-test values documented?
If finding were of no difference was the power of the study >80%?
Was loss of follow-up less than 20% and balanced between test and controls?
Were the groups similar at the start of the trial?
Aside from the experimental intervention, were the groups treated equally?

[Table/Fig-3]: Checklist used to assess the strength of educational intervention studies [24,25].
Checklist adapted from other studies [24,25]

The expert panel constitution comprised of various professionals from the faculties of orthodontics, maxillofacial surgery [19,21-23], nursing, speech therapy and nutrition [20]. The expert panel selection involved different numbers of health professionals. One group of orthodontists were involved in three studies [21-23] two groups of orthodontists and maxillofacial surgeons were involved in the third study [19] and four groups of oral and maxillofacial

surgeons, nurses, speech therapists and nutritionists were involved in the fifth study [20].

The expert panel sizes included were 12 [19], 10 [20,22], 42 [21] and 237 [23]. Only three studies [21-23] revealed that all participating experts were orthodontists. However, no information could be extracted from the other two studies [19,20] on the number of participating experts available from each of the professions. The number of Delphi rounds was recorded in each of the five studies. Three studies [19,21,23] had two rounds each while the other two studies [20,22] had three rounds each. The level at which consensus was reached was recorded in all five studies. Three studies [19,21,23] reached consensus after the second iteration while the other two studies reached consensus after the third iteration [20,22]. Of the five studies, only two studies [22,23] used the e-Delphi technique while the rest of the studies used conventional Delphi.

Risk of bias: None of the five studies reported any risk of bias as the Delphi technique utilises an anonymous approach free of any confounding factors such as researcher influence and freedom of expression preventing any dominating effect of certain panel participants as in other survey methods [22].

DISCUSSION

The Delphi technique has been very popular in gaining expert opinions in a multitude of research areas [3,12,27-29]. The ideology of two heads is better than one that has found credibility in the Delphi technique. Delphi technique has been suggested as the methodology whenever a process involves any informed judgment or decision-making [30]. The technique follows the rule of rounds or iterations which are repeated until a consensus on each of the questions is reached by the group. The suitability of the Delphi technique as a method of gathering expert opinion can be applied to studies exhibiting one or more of the following properties such as when subjective expertise and judgmental input is required on any topic or theme of interest. The approach can be easily applied to complex, large and multidisciplinary problems with considerable uncertainties. The technique also provides a method of validation when causal models cannot be built or validated in addition to providing opinions from a large group, where anonymity is deemed beneficial [31]. The Delphi technique allows a group of experts selected by the researchers to be queried on future events via a sequential questionnaire. The technique incorporates the researcher coming up with a question that requires an opinion from competent experts [7].

Delphi technique has been divided into three different types namely, conventional, real-time and policy [32]. In the conventional type, the researcher or a team design the questionnaire which is circulated amongst the experts. This is followed by the summarising of the feedback by the researcher or the moderator to generate another questionnaire which is again sent out to receive the next set of feedback from the group. In this type, the respondents usually get one opportunity to re-evaluate their original answers based on the group's response. The real-time Delphi differs from the conventional one in terms of the time and number of iterations. The real-time Delphi takes place during a meeting or a conference. The third type, Policy Delphi, bases its principle of generating all the options and supporting evidence from an informed group to achieve consideration from the decision-makers. The policy Delphi does not have a prime objective of reaching consensus as seen in the other two types. The stepwise outline of a typical conventional Delphi process has been established by previous researchers [32] and the process has been described in [Table/Fig-1].

The steps involved in the Delphi technique are simple and follow a logical sequence that is easy to replicate. The process involves the development of the initial Delphi probe or question, selection of the expert panel, distribution of the first-round questionnaire, collection and analysis of round 1 responses, providing feedback from round 1 responses, formulation of the second round questionnaire based on round 1 responses and re-distribution and then a repetition of all the above steps culminating in round 3 followed by an analysis of the final results and distribution results to panellists. The straightforward methodology allows for easier employability of this technique in any domain of research [33].

The study evaluated each of the five studies under five domains as mentioned earlier. We established and defined the Delphi technique as any type of self-administered questionnaire with no face-to-face meetings [34]. The Delphi technique employed by the five studies has revealed a certain interesting perspective from the evaluation of five domains. Three studies [19-21] had used a conventional Delphi while the other two studies [22,23] used e-Delphi. It is interesting to note that the Delphi technique was used for different scenarios of a clinical test, patient education, developing orthodontic curriculum, identifying challenges of undergraduate orthodontic education and producing a set of risks to be discussed with patients as part of consent for orthodontic treatment. The validation of a clinical diagnostic test bears a similar structure to a study conducted by other faculties of healthcare [35]. The Delphi study conducted for gathering consensus on patient education booklet is following similar scenarios followed by other studies in the faculties of medicine [36]. The literature is in favour of using the Delphi technique as a means of developing learning outcomes as can be seen in similarly designed studies [37]. These thematic variations highlight the applicability of this technique in any scenario across a variety of faculties.

The domain of the expert panel constituted of health professionals in all five studies. The number of fields from which professionals were chosen ranged from one to four. However, only four of the studies [19,21] have provided information on the eligibility of the chosen expert panel and who they deemed could participate as experts. None of the studies provides any inclusion or exclusion criteria for expert selection. No other pre-requisites have been mentioned for expert panel selection. In addition to this, three studies [19-21] fail to mention the exact number of different health professionals chosen and the reason for such a selection. The studies mentioned only the panel size and not the specific number of experts from different backgrounds. This is particularly relevant as the selection of expert panels depends on the theme or topic in question. Involving several groups of professionals will create a longer time in reaching consensus and also increase the number of iterations as can be seen in this study [20]. The expert panel size is another area that was evaluated in all five studies. The expert panel sizes employed in all the five studies were found to be a desirable number as suggested by other authors [38]. It can be observed that the expert panel sizes showed some correlations with the number of iterations.

The two studies [20,22] with ten experts had three iterations as compared to studies [19,21,23] who had only two iterations. The literature, however, is in agreement with the typical number of iterations limited to three [3]. The smaller panel size of ten although at first might seem to correlate with more iterations on closer examination, reveals that the study involved a greater number of professionals from different backgrounds. This factor might be one of the reasons for the delay in reaching consensus as the topic under consideration might pose different levels of comprehension for the expert panel. To further emphasise this relationship, the other two studies can be assessed from the same perspective. The study had used 12 experts from two professional backgrounds and reached a consensus after the second iteration as the professionals are from different but related backgrounds with common knowledge on the topic in question [19]. The study [21,23] which had 42 and 237 experts from one professional background, had fewer iterations due to the similarity in the profession, which might have played a role in reducing the number of iterations.

Therefore, the panel sizes based on the above observation seems to not influence the number of iterations whereas, the educational

background of the expert panel members may influence and hasten the consensus reaching abilities of that group.

Each of the five studies reported differently as can be observed here. The first study [19] concluded their results only after the group was interviewed again independently and each of the participants made aware of the consensus and was given another chance to change their previous concept, however, all the participants confirmed their initial opinion. This deviation from the conventional Delphi analysis was not seen in the rest of the studies. The second study reported a satisfactory outcome of fulfilling the objectives of their study [20]. The third study reported the inability of the survey to be completed due to time constraints and limited the responses to the 2nd iteration [21]. The fourth study reported the e-Delphi was an effective methodology for achieving the objective of their study [22]. The fifth study reported that the e-Delphi technique was able to capture the views of many participants and further provided greater participant anonymity [23]. Although two studies utilised open-ended questions but only one study was able to complete all the iterations [21,23]. This highlights the need to have competent and active expert participation along with provisions for proper time allotment.

These factors highlight the importance of panel selection criteria as the selection is based wholly on the opinions being sought. However, the above correlations are hard to generalise as the studies in question are limited to only five. Considering the above information and correlations, a summary of what constitutes the advantages and disadvantages of using the Delphi technique will further strengthen the overall understanding and implementation which is described below.

Advantages and Disadvantages of using the Delphi Technique

The Delphi technique has shown that it is a valid research tool for gathering expert opinions from different backgrounds and different levels of experience in the faculty of orthodontics [19- 23]. The characteristics of Delphi permit the survey to be conducted through electronic means without the barriers of geographical limitations [22,39]. The technique further opens a cost-effective approach as there are no resources involved in travel, meeting arrangements and face to face interactions [39,40]. This will be extremely beneficial for researchers intending to collect opinions from different geographical locations for wider comparison and establishing correlations. This, in the situation of a pandemic further expands the scope of the technique which otherwise would be greatly restricted because of the travel and social distancing norms. The e-Delphi, therefore, becomes an extremely relevant tool in the current global scenario [22].

Another important characteristic of the Delphi technique is the provision of experts to stay anonymous [30]. The anonymity of experts provides the freedom of expression [37] along with membership variations [25,41,42]. The experts, when are not face-to-face, have a fairer chance of providing an unbiased and undominated opinion on an issue [43]. Further advantages of an anonymous interaction are that it removes the effects of status, personalities, and group pressures [44]. The change of membership or membership variations i.e., the members do not have to remain the same number throughout the process [23,41]. The participants can drop out of a round and re-enter for another round as far as the number across the groups remains balanced throughout with the expert selection criteria being maintained [42]. This is helpful when the researchers have involved panel experts from different geographical locations who might be difficult to reach out to in case of dropout. The ability to engage experts at different stages provides some amount of flexibility in data collection.

The disadvantages of the Delphi technique have been summarised as having an absence of social-emotional support making the process too mechanical and non motivating [45] researcher bias [30] researcher shortcomings such as poor summarising of panel contributions or incomplete presentation of the group responses for the next round [11]. The time consumed in the iterations is another area that has received judgment [21]. The experts or participants might lose interest in the issue or questions and might provide answers solely from the standpoint of completing the survey whereby the participants might falsely agree on an issue to reach consensus [46]. However, these disadvantages can be easily overcome by establishing appropriate inclusion criteria for expert selection and selecting the experts from backgrounds similar to the theme of the study.

Limitation(s)

The review of the limited literature available in orthodontics which has utilised the Delphi technique as a tool. Not all the five studies provided data on the precise number of experts who participated in the respective studies making the results less significant and preventing generalisation of the conclusions.

CONCLUSION(S)

Although the review found insufficient literature, the study was able to find valuable information with dependable conclusions being drawn from the five included studies. The study has thus provided a much-needed elaboration on the various components and characteristics of the Delphi technique. Despite being an effective and straightforward technique, Delphi has been very poorly utilised in orthodontics. Another highlight of this review is the correlation brought forward by the expert panel constitution and the number of iterations. This correlation needs to be explored further by incorporating more studies and research methodologies with the Delphi technique using varying expert panel sizes. Furthermore, the e-Delphi expands the scope of the technique which otherwise would be greatly restricted because of the travel and social distancing norms which have become extremely relevant in the current global scenario.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Mar 30, 2021
- Manual Googling: Jul 31, 2021
- iThenticate Software: Aug 19, 2021 (16%)

ETYMOLOGY: Author Origin

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