Knowledge, Attitude and Practice towards Orthodontic-Endodontic Interdisciplinary Treatment among Dental Postgraduate Students in Southern India

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Abstract

The Ortho-endo interdisciplinary treatment for patients are mainly managed by postgraduate students who majorly provide treatment on out-patient basis in dental colleges in India. There is lack of research in assessing the knowledge and practice related skills of treating such interdisciplinary cases among post graduates of these respective departments. The objective of this survey was to evaluate the knowledge, attitude and practice of post-graduate students towards endodontic and orthodontic interdisciplinary approach in dental clinics.

An online cross sectional KAP questionnaire survey was conducted among postgraduate students of dental colleges in Southern India which were divided into 2 study groups belonging to Orthodontics, and Conservative dentistry and endodontics departments respectively. A predetermined sample size of 400 participants were divided into 2 groups of 200 from each department. Questionnaire consisted of 15 questions, of which nine were to assess knowledge, three to learn the attitude and three were to understand the practice among postgraduate students. The data collected was analysed using SPSS version 23 on receiving 200 responses in each group.

A total of 400 responses were obtained in a period of 2 months. The results derived were analysed in terms of percentage. More than half of the respondents could answer only 25% of the knowledge-based questions correctly. The responses for attitude-based questions showed more than 90% of the respondents were positively motivated to improve their knowledge and awareness. Less than 50% of respondents could aptly use their knowledge in clinical practice while treating interdisciplinary cases.

Participants displaying limited knowledge about the subject but positive attitude towards it suggests that there is need to enhance awareness by means of continuous dental educational programs for both orthodontics and endodontics post graduate students focusing on ortho-endo interdisciplinary dental treatment needs, which will improve their awareness towards interdisciplinary treatment and its applicability in future practice.

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Introduction

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Soft and hard tissue of the tooth is interrelated several in aspects such as embryological, anatomical, and functional.1 Establishment of healthy relation among all will help to maintain the tooth form and function. When a pulpally involved tooth requires an orthodontic treatment. а balanced interrelationship would be the main objective for an interdisciplinary approach.^{2,3} The orthodontic

 $Volume \cdot 16 \cdot Number \cdot 2 \cdot 2023$

treatment protocols and outcome vary to a certain extent for healthy teeth, traumatized teeth, restored teeth and, immature teeth. Additionally, biological response of the tissue to the applied orthodontic force depends on various biological and mechanical factors. Biological factors include patient's age and gender, tooth form and location, type of trauma and, health status of the pulp. Whereas mechanical factors include type. amount and duration of orthodontic force and: movement.⁴ tooth Appropriate extent of assessment of the above-mentioned parameters determines the outcome and long-term prognosis of such cases.

Orthodontic treatment of pulpally involved tooth includes appropriate treatment planning and careful selection of a period to perform an endodontic treatment. Hence, it is important to know the when the endodontic treatment should be carried out in the tooth undergoing an orthodontic treatment.⁵ Apart from this, it is also important to know the exact conditions for which orthodontic treatment is indicated in a tooth undergoing endodontic treatment.

There are several controversies in the dental community about the interdisciplinary treatment approaches. Although the endodontic and orthodontic fields have shown continuous improvement, the treatment protocols for malocclusion can be completely altered when a patient reports with traumatized or pulpally damaged teeth to an Orthodontic clinic and vice versa.⁶ In order to treat such cases, the basic knowledge regarding the existing state of treatment protocol and understanding of the recent modalities are expected from the postgraduate students for a better ethical practice and patient care. A Comprehensive evaluation of literature using Medline, Pubmed and Scopus databases (from 2000-2021), has disclosed that there are no studies in India that evaluate the knowledge, attitude and practice of post-graduate student towards ortho-endo interdisciplinary treatment approach in dental clinics. Hence, the need of this survey was done to assess the knowledge, attitude and practice regarding the Orthodontic-Endodontic interdisciplinary approach among the Endodontic and Orthodontic Post-graduate students in Southern India.

Study Sample

This cross-sectional questionnaire survey was conducted across randomly chosen dental colleges in Southern India. Two study groups were formed with each containing post graduate students belonging to Department of Conservative Dentistry and Endodontics and Department of Orthodontics and Dentofacial respectively. Further, the target population was invited to participate in this online questionnaire survey using google forms format. A statistically calculated sample size of 400 responses were to be collected with 200 responses in each study group.

Validation of Survey

The questionnaire was subjected to face and content validation by 2 dental faculties from each department and each question was rated using a 5 point Likert scale to test content validity with range from very important to not important. Questionnaire was tested by 40 randomly selected postgraduate students of both the specialities for the validity of the survey. Ethical clearance for this study was obtained from Institutional Review Board.

Questionnaire Content

A consent form with a brief study description and followed by a KAP questionnaire containing 15 multiple choice questions with one correct answer was circulated among the sample group and responses were recorded digitally. The survey form collected basic demographic data such as name, gender, department, year of study of the participants. Nine questions were designed to assess knowledge of the students, three questions to evaluate the attitude towards the topic and three questions were to understand the practice based on applicability of the knowledge on the topic. A sample questionnaire is given below.

Statistical Analysis

The data was entered in Microsoft excel and analyzed using SPSS version 23 for descriptive and inferential statistics. Descriptive statistics were expressed in terms of number and percentage. The inferential statistics were analyzed using ANOVA test.

Materials and methods

Questionnaire Demographic Details: Name (Optional):

Department: Endodontics/ Orthodontics Years of Study: 1st year/2nd year/3rd year Gender: M/F E-mail:

Questions:

Knowledge Based:

- 1. Are males and females equally susceptible to Orthodontically induced External apical root resorption (EARR)?
 - a. Yes
 - b. Females are more susceptible
 - c. Males are more susceptible
 - d. Not sure
- 2. Irreversible pulpal changes resulting from Orthodontic force is more likely seen in?
 - a. Closed apices in aged patients
 - b. Open apices in younger patients
 - c. Both are equally susceptible
- 3. Which phase shows the highest accuracy for the pulp sensibility test during an orthodontic treatment?
 - a. Active treatment phase
 - b. Resting phase
 - c. Retention phase
 - d. Don't know
- 4. Which portion of the pulp is most affected by the Orthodontic forces?
 - a. Coronal portion
 - b. Middle portion
 - c. Apical portion
 - d. Doesn't relate to the location
- 5. Replacement resorption or ankyloses is seen, when heavy and continuous orthodontic forces applied to?
 - a. Tooth with the history of trauma
 - b. Tooth with Dental caries
 - c. Both the above
 - d. None of the above
- 6. Is there any difference in resultant orthodontic movement of vital tooth and endodontically treated tooth?
 - a. Vital tooth moves at a faster rate
 - b. Non-vital tooth moves at a faster rate
 - c. Tooth movement not related to vitality
 - d. Not sure
- 7. Do you think normal Orthodontic force can be applied to a tooth following successfully healed periapical surgery?
 - a. Yes
 - b. No
 - c. Don't know
- 8. What is the time interval required for the stability of orthodontic tooth

movements(extrusion, tipping,etc) following which endodontic therapy needs to be carried out ?

- a. 4-8 weeks
- b. 0-4 weeks
- c. 8-12 weeks
- d. 6 months
- 9. Is apical seal disturbed in Root canal treated tooth during orthodontic tooth movement?
 - a. Yes, though it depends on quality of endodontic treatment
 - b. Yes, though it depends on applied orthodontic forces
 - c. No significance difference due to resorption
 - d. Not sure

Attitude and awareness Based:

- 1. Do you agree to upgrade/enhance/improve your knowledge on interdisciplinary dental practice through continuing education programs?
 - a. Strongly Agree
 - b. Agree
 - c. Unsure
 - d. Disagree
 - e. Strongly disagree
- 2. Do you agree to strictly follow guidelines while treating a case which requires an interdisciplinary approach of endodonticorthodontic treatment?
 - a. Strongly Agree
 - b. Agree
 - c. Unsure
 - d. Disagree
 - e. Strongly disagree
- 3. Do you agree that severe the trauma to the tooth, higher are the chances of root resorption during orthodontic movement, with or without endodontic treatment?
 - a. Strongly Agree
 - b. Agree
 - c. Unsure
 - d. Disagree
 - e. Strongly disagree

Practice based:

- 1. Have you ever treated a case which requires Orthodontic tooth movement to undergo endodontic therapy?
 - a. Yes
 - b. No
- 2. How long do you wait for periapical healing after endodontic therapy to initiate

 $Volume \cdot 16 \cdot Number \cdot 2 \cdot 2023$

Orthodontic force application?

- a. 1 weeks
- b. 3 weeks
- c. 6 weeks
- d. 8 weeks
- 3. Do you inform your patients about risk of root resorption in Interdisciplinary treatment for traumatic tooth injuries?
 - a. Yes
 - b. No

Results

A total of 400 responses (200 in each group) satisfying the inclusion criteria was collected in a period of two months as follows, 127(31.8%) responses from first year postgraduates, 154(38.5%) responses from the second year post graduates, and 119(29.8%) responses from the third year post graduates. Out of the total respondents 133(33.3%) were males and 267(66.8%) were females. (Table 1)

		Frequency	Percent
Department	Cons	200	50.0
Department	Ortho	200	50.0
Year of Study	1 st MDS	127	31.8
	2 nd MDS	154	38.5
	3 rd MDS	119	29.8
	Male	133	33.3
Gender	Female	267	66.8

Table 1. Demographic Characteristics of study participants.

While assessing knowledge, we found 36.3% of respondents were aware that females are more susceptible to higher rate of EARR than seen in males. 44.3% of participants knew that irreversible pulpal changes resulting from orthodontic force are more likely seen in older patients with closed root apices. Only 18.5% respondents knew that retention phase of orthodontic treatment shows maximum accuracy for pulp vitality testing and only 10.8% of participants were aware that coronal portion of the pulp is most susceptible to orthodontic forces. 21% of respondents agreed that replacement resorption was seen in both tooth with history of trauma and tooth with dental caries. 41.5% of participants were very well aware that tooth movement is not dependent on vitality of the

tooth. 74.5% of responded positively when asked if it was fine to apply normal orthodontic force to successfully healed periapical lesion. Only 15.3% of participants knew the time required for stability of orthodontic tooth movement following which endodontic therapy could be carried out. 20.8% were aware that apical seal of previously root canal treated tooth might get disturbed if subject to orthodontic tooth movement, but it's mainly dependent on quality of endodontic therapy. (Table 2)

Frequency Percent Q.No Are males and females equally susceptible to 36.3 1 Orthodontically induced External apical root resorption 145 (EARR)? Irreversible pulpal changes resulting from orthodontic 2 177 44.3 force is seen more likely in Which phase of Orthodontic treatment shows the highest 3 74 18.5 accuracy for the pulp sensibility test? Which portion of the pulp is most affected by the 4 43 10.8 Orthodontic force? Replacement resorption or ankylosis is seen, when heavy 5 84 21.0 and continuous orthodontic forces applied to? Rate of orthodontic movement of vital tooth when 6 166 41.5 compared to endodontically treated tooth is? Do you think optimum orthodontic force can be applied to 7 298 74.5 a tooth following successfully healed periapical surgery? Endodontic therapy can be carried out after orthodontic 8 61 15.3 tooth movements(extrusion, tipping,etc) in ? Is apical seal disturbed in root canal treated tooth during 9 83 20.8 orthodontic tooth movement?

Table 2. Correct responses to the knowledge based questions.

Almost 97.5% of participants responded positively to attitude assessment and agreed to the need of frequent CDE programs to improve knowledge regarding their ortho-endo interdisciplinary treatment approach and need for a strict set of guidelines to deal with such cases, while 89% of responses were in belief that, severe the trauma to the tooth, higher are the chances of root resorption during orthodontic with without movement. or undergoing endodontic treatment. (Table 3)

Q.No		Frequency	Percent
1	Do you agree to enhance/improve your knowledge on interdisciplinary dental practice through continuing education programs?	390	97.5
2	Do you agree that we need a strict set of guidelines while treating Orthodontic-Endodontic interdisciplinary case?	390	97.5
3	Do you agree that severe the trauma to the tooth, higher are the chances of root resorption during orthodontic movement, with or without endodontic treatment?	356	89.0

Table 3. Participants who agree/Strongly agreewith the attitude based questions.

In dental clinics, only 47.8% of participants have treated an ortho-endo interdisciplinary case. Only 42% of respondents rightly waited for 6 weeks post endodontic treatment to start off with orthodontic treatment,

Volume · 16 · Number · 2 · 2023

indicating rest of them either applied early or too delayed orthodontic forces to the endodontically treated tooth. 87% of participants informed their patients regarding risk of root resorption for the tooth that may undergo interdisciplinary treatment following traumatic tooth injuries. (Table 4)

Q.No		Frequency	Percent
1	Have you ever treated a case which requires Orthodontic tooth movement to undergo endodontic therapy?	191	47.8
2	How long do you wait for periapical healing after endodontic therapy to initiate Orthodontic force application?	<mark>1</mark> 68	42.0
3	Do you inform your patients about risk of root resorption in Interdisciplinary treatment for traumatic tooth injuries?	348	87.0

Table 4. Correct responses to the knowledge based questions attitude based questions.

Discussion

The distribution of the questionnaire survey forms were completed through online mode by sharing the link generated from google forms. Study samples included were the postgraduate students of both the departments, Conservative dentistry and Endodontics; and Orthodontics and Dentofacial Orthopedics from various dental colleges across India. The questionnaire was validated by six dentists (three from each department) with a minimum of ten years of clinical experience. Even though online surveys have lower response rate than paper surveys,⁷ they allow for survey form distribution without the need for participants' contact information, which is usually protected. The number of respondents were equally distributed for both the branches.

When a clinical case demands an endoortho multidisciplinary approach, it is essential to understand the consequences and requirements of endodontic and orthodontic treatment. Postgraduate students' desire to expose to various educational program in order to improve and update their knowledge determines their learning attitude. Exposure to such cases during the postgraduate teaching program improves their ability to identify and manage them inadvertently. Thus, this knowledge-attitudepractice based survey was conducted to assess the postgraduate students across India.

Orthodontic treatment of immature teeth requires a careful attention to reduce the postoperative trauma to periapical tissue. Teeth with closed apical foramina are more prone to irreversible pulpal changes or necrosis when being subjected to heavy and continuous orthodontic forces. Whereas healthy teeth with open apices are less susceptible to these changes.⁸ Stage of the root development influences the respiratory rate of the tooth, for instance an immature tooth has a higher respiratory rate than tooth with closed apices. Respiratory rate of the pulp cells also plays a crucial role to maintain dentinogenic activity of the pulp during the lifespan of vital tooth.9 Therefore, immature teeth are more resistant to the biologic effect of the orthodontic forces. However, only 44.3% responders were aware about the correlation between the stage of tooth development and the resultant effect of orthodontic force.

36.3% responders were able to answer the gender predilection in relation to EARR occurrence. According to Linge and Linge, loss of apical root structure is more evident in females (0.73 mm) compare to males (0.67 mm).¹⁰ Dougherty HL explained this by describing the fact that males are chronologically less mature than females and hence, male teeth are more resistant to the effects of orthodontic forces.¹⁰

Results of pulp sensibility tests during orthodontic treatment is said to be inconsistent even in the teeth which are considered healthy before initiating the orthodontic treatment. Due to direct pressure on apical nerve fibres, response to Electric Pulp Testing (EPT) increases about 3.5 times. An increased response is associated with the period of force application. Response to EPT improves during the resting phase.¹¹ Out of 400, only 70 postgraduates agreed that the tests should be more accurate in retention phase. Among the pulp sensibility tests, thermal tests are considered to be more reliable than EPT.¹²

Only 10.8% of responders had knowledge about the changes seen in the pulp following application of the forces. It is more pronounced in coronal segment and least in apical segment of the pulp.¹³ Whereas, 21% postgraduates were aware of increasing risk of EARR in teeth with previous history. The magnitude, duration and type of orthodontic force and the teeth with previous history of pulpal irritation, for instance trauma, caries, restoration; could cumulatively influence the effects of orthodontic force on pulp tissue which causes increased risk of External apical root resorption (EARR) and Replacement resorption in teeth with previously stimulated vital pulp.¹⁴

A total of 15.3% responders were able to recommendation identifv correct for the stabilization period. Prior to initiation of an endodontic treatment, 8-12 weeks of stabilization period is required for an orthodontically moved tooth. The prime concern about the orthodontic treatment of vital tooth and endodontically treated tooth is the difference in the resultant movement of the both entities. 41.5% postgraduates agreed to the different studies conducted by Remington et al. in 1989, and Mah et al. in 1996. Studies concluded that the vital tooth moves at the same rate and for the same distance as the non-vital tooth.15,16,17

Removal of granulation tissue during endodontic surgical procedures, amount of bone resorption due to inflammatory process, soft tissue healing following endodontic surgical procedure, the quality of the nonsurgical root canal obturation and exposure of infected dentinal tubule at the level of exposure might affect the outcome of surgical endodontic treatment which ultimately affect the retention of the tooth following orthodontic treatment.^{17,18} Hence, a tooth can undergo normal orthodontic movement following successful periapical surgery.

If a root canal is thoroughly cleaned, shaped, and 3-dimensional seal is obtained, that apical seal would be maintained even after extensive tooth loss in External apical Root resorption (EARR). Despite advances in root treatment, due to certain inherent canal limitations; like apical delta, deeper area of dentinal tubules and ramifications may remain uncleaned after endodontic treatment.^{18,19} These become the source of reinfection when it gets exposed to external environment after EARR. Hence, quality of endodontic treatment determines the exposure to the bacterial contamination after application of the orthodontic forces.

The need of a strict set of guidelines for endodontic-orthodontic interdisciplinary treatment plan is demanded by 97.5% of the participants. Moreover, continuing education programs might also give opportunity to the postgraduates to enhance their clinical knowledge. During the postgraduate training, students should be exposed to variety of cases, including those that require an interdisciplinary perspective. However, less than 50% postgraduates (47.8%) have

treated the cases that needed integrated endodontic-orthodontic approach.

It is essential for students to acquire knowledge about the different integrated approaches during their postgraduate training. There are exceptional resources which summarize the general effects of orthodontic pulp.²⁰⁻²⁵ treatment on health of dental Furthermore, Hamilton RS et al; 1999, and Consolaro A et al; 2013 discuss the evidence regarding endodontic-orthodontic interrelationship.^{6,8} However, there are currently no guidelines for endodontists and orthodontists for the management of teeth requiring an integrated endodontic-orthodontic approach.

Conclusions

Participants displaying limited knowledge about the subject but positive attitude towards it suggests that there is need to enhance awareness by means of continuous dental educational programs for both orthodontics and endodontics post graduate students focusing on ortho-endo interdisciplinary dental treatment needs, which will improve their awareness towards interdisciplinary treatment and its applicability in future practice.

Declaration of Interest

The authors report no conflict of interest.

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Volume · 16 · Number · 2 · 2023

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