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Original article

Awareness Dental Specialists about Different Treatment Modalities to Replace Congenitally Missing Lateral Incisors

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ABSTRACT

Aims. *The purpose of this study is to ascertain the dentists' and dental experts' knowledge of orthodontic closure vs. replacement as treatment options for congenitally missing lateral incisors.* ***Methods****. A cross-sectional study involving 185 dentists from several areas was carried out between September and October of 2023. A set of twenty-four multiple-choice questions was developed. Microsoft Excel 2010 was used for data collection, while SPSS version 26 was used for analysis utilising descriptive statistics and Chi-square tests.* ***Results.*** *A study of 185 questionnaires found that the majority of participants were general practitioners, with 56.6% working in private and government-funded clinics. Most participants exhibited an elevated incidence of lateral incisor tooth absence, a trend frequently identified through routine diagnostic procedures. A dentist with over ten years of experience identified a growing occurrence of lateral incisor tooth absence, calling for a specialised treatment approach. Participants generally preferred dental implants over orthodontics, fixed prostheses, and removable prostheses. Most general practitioners, oral surgeons, prosthodontists, and orthodontists preferred implant replacement for long-term aesthetic and functional results. The study found significantly those general practitioners and oral surgeons mostly stay updated on missing lateral incisor treatment through continuing education courses, while orthodontists and prosthodontists prefer reading professional journals.* ***Conclusion.*** *It is evident that the prevalence of tooth agenesis has increased, leading to a heightened demand for specialised dental treatment. Management of this anomaly requires comprehensive planning, considering self-consciousness, aesthetics, and malocclusion. The study emphasises the need for a multidisciplinary approach in the treatment of missing lateral incisors to ensure optimal outcomes.*

Keywords: Missing Lateral Incisors, Orthodontic Closure, Replacement, Dental Specialists.

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الأهداف. الغرض من هذه الدراسة هو التأكد من معرفة أطباء الأسنان وخبراء طب الأسنان بإغلاق تقويم الأسنان مقابل الاستبدال كخيارات علاجية للقواطع الجانبية المفقودة خلقيًا. **الطُرق**. تم إجراء دراسة مقطعية شملت 185 طبيب أسنان من عدة مناطق في الفترة ما بين سبتمبر وأكتوبر من عام 2023. وتم تطوير مجموعة من أربعة وعشرين سؤالاً متعدد الاختيارات. تم استخدام برنامج Microsoft Excel 2010 لجمع البيانات، بينما تم استخدام برنامج SPSS الإصدار 26 للتحليل باستخدام الإحصائيات الوصفية واختبارات Chi-square. **النتائج**. وجدت دراسة أجريت على 185 استبيانًا أن غالبية المشاركين كانوا من الممارسين العامين، حيث يعمل 56.6% منهم في عيادات خاصة وممولة من الحكومة. أظهر معظم المشاركين ارتفاعًا في معدل غياب الأسنان القاطعة الجانبية، وهو اتجاه يتم تحديده بشكل متكرر من خلال إجراءات التشخيص الروتينية. حدد طبيب أسنان يتمتع بخبرة تزيد عن عشر سنوات حدوثًا متزايدًا لغياب الأسنان القاطعة الجانبية، مما يدعو إلى اتباع نهج علاجي متخصص. يفضل المشاركون بشكل عام زراعة الأسنان على تقويم الأسنان والأطراف الصناعية الثابتة والأطراف الصناعية القابلة للإزالة. يفضل معظم الممارسين العامين وجراحي الفم وأخصائي التعويضات السنية وتقويم الأسنان استبدال الغرسات للحصول على نتائج جمالية ووظيفية طويلة المدى. وجدت الدراسة بشكل ملحوظ أن الممارسين العامين وجراحي الفم يظلون في الغالب مطلعين على علاج القواطع الجانبية المفقودة من خلال دورات التعليم المستمر، في حين يفضل أطباء تقويم الأسنان وأخصائيو التعويضات السنية قراءة المجلات المهنية. **الخاتمة**. ومن الواضح أن انتشار خلل تكوّن الأسنان قد زاد، مما أدى إلى زيادة الطلب على علاج الأسنان المتخصص. تتطلب إدارة هذا الشذوذ تخطيطًا شاملاً، مع الأخذ في الاعتبار الوعي الذاتي والجماليات وسوء الإطباق. تؤكد الدراسة على الحاجة إلى اتباع نهج متعدد التخصصات في علاج القواطع الجانبية المفقودة لضمان النتائج المثلى.

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INTRODUCTION

The absence of the upper incisors is a significant condition that needs complicated care. There are various alternatives, such as auto-transplantation of developing premolars, osseointegrated implants, resin-bonded bridgework, removable partial dentures, and space closure with orthodontics [1-7]. However, clinicians generally prefer implant placement, restorative treatment, and space closure.

There has been an increase in tooth agenesis over the past ten years [8], leading to an increase in demand for orthodontic and prosthodontic treatment. These results from increased attention to aesthetics and a higher perception rate of malocclusions. One of the frequently treated conditions is agenesis of the maxillary lateral incisors [9], which causes both functional and aesthetic problems. Different clinicians have different approaches to treating missing maxillary lateral incisors. Some choose canine substitution, in which the canine is repositioned to fill the space and then reshaped to mimic a lateral incisor. Others choose dental implants or restorations supported by adjacent teeth [10-12]. To replace lost teeth and provide an acceptable dental appearance, treatment planning for patients with missing lateral incisors must consider various factors, including general and clinical concerns [13].

These therapy choices are not suitable for every patient; therefore, each situation requires an individualised treatment approach. Before initiating treatment, dentists should consider the patient's expectations, malocclusion, individual tooth characteristics, and facial features [14]. Dentists ought to discuss the advantages and disadvantages of each therapy with patients and their parents prior to starting the procedure. Clinicians need to employ a multidisciplinary strategy to integrate and coordinate a comprehensive treatment plan [15,16].

Patients born without maxillary lateral incisors express concern about the treatment process and seek satisfaction with the results, as these teeth are integral to the aesthetic zone. Therefore, dentists must be well-informed about various treatment choices and enable patients to make decisions considering the advantages, disadvantages, indications, and contraindications of each procedure. The management of congenitally missing maxillary lateral incisors is primarily reliant on dentists' personal experiences and is rarely covered in textbooks.

The purpose of this study is to determine dental specialists' and dentists' understanding of orthodontic closure vs. replacement as treatment options for congenitally missing laterals.

METHODS

The study was a cross-sectional study conducted from September 2023 to October 2023. It included specialists in prosthodontics (i.e., fixed and removable prosthodontics), orthodontics, oral surgeons, and general dental practitioners from various areas.

Twenty-four multiple-choice items were included in the questionnaire that the authors created. It was sent to 185 dentists in total. All the questions were created with the study's objectives in mind. The questionnaire was created with the purpose of identifying the questions that are relevant. Following that, they were presented to five experts for evaluation to determine the content's validity. A small panel of three other experts reviewed them for validity (i.e., face validity) To ensure these questions were relevant and clear, a copy of the completed version was sent to the intended target audience.

A Microsoft form was used to produce the questionnaire. The participants were selected randomly by sending questionnaires through emails and posts to groups on social media. A spreadsheet in Microsoft Excel 2010 was used to collect data, with participant names not included in the questionnaire to maintain anonymity. Statistical analysis was performed using descriptive statistics and Chi-square tests using SPSS version 26.

RESULTS

A study with 185 questionnaires showed that 100% of the questionnaires were returned. Men comprised

61.6% of the study's participants (Table 1). Among the respondents, 56.6% were general practitioners, 17.8% were orthodontists, 14.1% were fixed and removable prosthodontists, and 13.5% were oral surgeons, making general practitioners the largest group (Table 2). Over half of the participants had over ten years of experience in the field (Table 3). The majority of participants worked at both private and government-funded clinics (Table 4).

Table 1: Distribution of dentists according to gender

Gender	Frequency	Percent
Male	114	61.6%
Female	71	38.4%
Total	185	100%

Table 2: Distribution of dentists according to speciality

Qualification	Frequency	Percent
General dentist	101	54.6%
Orthodontist	33	17.8%
Prosthodontist (fixed and/or removable)	26	14.1
Oral surgeon	25	13.5%
Total	185	100%

Table 3: Distribution of dentists according to clinical experience

Years of clinical experience	Frequency	Percent
< 5 years	61	33%
5 – 10 years	29	15.7%
> 10 years	95	51.4%
Total	185	100%

Table 4: Distribution of dentists according to their work place

Work place	Frequency	Percent
Government-funded and private clinic	60	32.4%
Private clinic	57	30.8%
Government-funded	33	17.8%
Dental institution	21	11.4%
Private clinic and dental institution	9	4.9%
Government-funded, private clinic, and dental institution	3	1.6%
Government-funded and dental institution	2	1.1%

According to dentist experience (table 5), there was no significant difference between all groups. The majority of participants showed an increase in the absence of lateral incisor teeth congenitally (45.9%); they are also often discovered during routine diagnosis (58.9%). Over ten years of dentist experience indicate a rise in lateral incisor tooth absence (44.2%), often discovered during routine diagnosis (55.8%). According to dentists who have more than ten years of experience, this defect necessitates a special treatment approach different from that of less experienced dentists. The absence of lateral incisors can cause issues with dental function and aesthetics, necessitating special attention, as strongly agreed upon by the majority of participants (56.2%). Furthermore, treatment techniques vary depending on the patient's condition, compatibility, appearance, and expectations.

As seen in Table 5, participants in this sample generally prefer dental implants (67.0%) over orthodontics (25.4%), fixed prostheses (5.4%), and removable prostheses (2.2%). They also preferred that the treatment be based on evidence (52.4%). In addition, they believed that the primary reason for treating the absence of lateral incisor teeth was aesthetic and functional (70.8%). Orthodontic treatment, which is the second option, is preferred because it offers advantages like preserving natural teeth, improving conformity, and being a permanent treatment (56.8%). Additionally, fixed prosthodontic treatments are selected because of their immediate, faster, aesthetic benefits and their ability to address gaps in lateral incisors, with a wide range of treatment options available (44.9%).

Table 5: Dentists' responses based on their clinical expertise

Question	Selected response	< 5 years of clinical experience	5 - 10 years of clinical experience	> 10 years of clinical experience	Total	P
		N (%)	N (%)	N (%)	N (%)	
Q5. The prevalence of lateral incisors agenesis has increased over the last decade.	Strongly agree	8 (13.1)	1 (3.4)	8 (8.4)	17 (9.2)	0.627
	Agree	30 (49.2)	13 (44.8)	42 (44.2)	85 (45.9)	
	Neutral	19 (31.1)	13 (44.8)	39 (41.1)	71 (38.4)	
	Disagree	4 (6.6)	1 (3.4)	5 (5.3)	10 (5.4)	
	Strongly disagree	0 (0)	1 (3.4)	1 (1.1)	2 (1.1)	
Q6. A tooth agenesis resulting in the need for multidisciplinary treatment.	Strongly agree	14 (23)	7 (24.1)	31 (32.6)	52 (28.1)	0.288
	Agree	34 (55.7)	20 (69.0)	55 (57.9)	109 (58.9)	
	Neutral	11 (18.0)	2 (6.9)	8 (8.4)	21 (11.4)	
	Disagree	2 (3.3)	0 (0)	1 (1.1)	3 (1.6)	
	Strongly disagree	0 (0)	0 (0)	0 (0)	0 (0)	
Q7. Agenesis of the maxillary lateral incisors creates aesthetic and functional problems.	Strongly agree	33 (54.1)	16 (55.2)	55 (57.9)	104 (56.2)	0.345
	Agree	22 (36.1)	9 (31.0)	36 (37.9)	67 (36.2)	
	Neutral	2 (3.3)	3 (10.3)	3 (3.2)	8 (4.3)	
	Disagree	4 (6.6)	1 (3.4)	1 (1.1)	6 (3.2)	
	Strongly disagree	0 (0)	0 (0)	0 (0)	0 (0)	
Q8. Congenitally missing maxillary lateral incisors are seldom mentioned or investigated in routine practice and are mostly managed based on clinician's experiences.	Strongly agree	15 (24.6)	3 (10.3)	17 (17.9)	35 (18.9)	0.714
	Agree	31 (50.8)	17 (58.6)	53 (55.8)	101 (54.6)	
	Neutral	6 (9.8)	5 (17.2)	8 (8.4)	19 (10.3)	
	Disagree	8 (13.1)	4 (13.8)	14 (14.7)	26 (14.1)	
	Strongly disagree	1 (1.6)	0 (0)	3 (3.2)	4 (2.2)	
Q9. Missing maxillary lateral incisors create chanllenges may be due to a higher perception rate of malocclusions, as well as a greater attention to aesthetics.	Strongly agree	26 (42.6)	9 (31.0)	36 (37.9)	71 (38.4)	0.488
	Agree	26 (42.6)	15 (51.7)	52 (54.7)	93 (50.3)	
	Neutral	6 (10.3)	3 (10.3)	5 (5.3)	14 (7.6)	
	Disagree	3 (4.9)	3 (10.3)	5 (5.3)	14 (7.6)	
	Strongly disagree	0 (0.0)	1 (3.4)	1 (1.1)	2 (1.1)	
Q10. Management of missing maxillary lateral incisor is a key tooth of the anterior aesthetic zone needs specialist attention.	Strongly agree	25 (41.0)	13 (44.8)	50 (52.6)	88 (47.6)	0.174
	Agree	22 (36.1)	11 (37.9)	37 (38.9)	70 (37.8)	
	Neutral	10 (16.4)	3 (10.3)	3 (3.2)	16 (8.6)	
	Disagree	4 (6.6)	2 (6.9)	5 (5.3)	11 (5.9)	
	Strongly disagree	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Q11. Dentist and dental specialities differ in their treatment of missing maxillary lateral inciors based on outcome of the selected options.	Strongly agree	15 (24.6)	9 (31.0)	25 (26.3)	49 (26.5)	0.540
	Agree	32 (52.5)	16 (55.2)	59 (62.1)	107 (57.8)	
	Neutral	8 (13.1)	2 (6.9)	9 (9.5)	19 (10.3)	
	Disagree	5 (8.2)	2 (6.9)	2 (2.1)	9 (4.9)	
	Strongly disagree	1 (1.6)	0 (0.0)	0 (0.0)	1 (0.5)	
Q12. To coordinate a comprehensive treatment plan and not limit treatment to an isolated decision or speciality, clinicians must multidisciplinary approach.	Strongly agree	14 (23.0)	12 (41.4)	32 (33.7)	58 (31.4)	0.006
	Agree	28 (45.9)	16 (55.2)	54 (56.8)	98 (53.0)	
	Neutral	16 (26.2)	1 (3.4)	8 (8.4)	25 (13.5)	
	Disagree	3 (4.9)	0 (0.0)	1 (1.1)	4 (2.2)	
	Strongly disagree	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Q13. Treatment options are not suitable for all patients, and an appropriate treatment plan must be formulated in each case.	Strongly agree	35 (57.4)	20 (69.0)	52 (54.7)	107 (57.8)	0.323
	Agree	20 (32.8)	7 (24.1)	40 (42.1)	67 (36.2)	
	Neutral	4 (6.6)	2 (6.9)	2 (2.1)	8 (4.3)	
	Disagree	2 (3.3)	0 (0.0)	1 (1.1)	3 (1.6)	
	Strongly disagree	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Q14. The individual plan formulated according to the characteristics of the present teeth, malocclusion, facial features, and the patient's expectations.	Strongly agree	30 (49.2)	19 (65.5)	50 (52.6)	99 (53.5)	0.786
	Agree	27 (44.3)	9 (31.0)	38 (40.0)	74 (40.0)	
	Neutral	4 (6.6)	1 (3.4)	6 (6.3)	11 (5.9)	
	Disagree	0 (0.0)	0 (0.0)	1 (1.1)	1 (0.5)	
	Strongly disagree	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	

Q15. Before initiating treatment, clinicians should know the outcome and explain the different treatment options to the patient, with the advantages and disadvantages of each, so that an informed decision can be made.	Strongly agree	37 (60.7)	25 (86.2)	73 (76.8)	135 (73.0)	0.006
	Agree	19 (31.1)	2 (6.9)	22 (23.2)	43 (23.2)	
	Neutral	5 (8.2)	2 (6.9)	0 (0.0)	7 (3.8)	
	Disagree	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
	Strongly disagree	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Q16. Consideration of treatment alternatives according to patients' expectations can lead to a successful outcome and patient satisfaction.	Strongly agree	18 (29.2)	17 (58.6)	35 (36.8)	70 (37.8)	0.152
	Agree	30 (49.2)	8 (27.6)	46 (48.4)	84 (45.4)	
	Neutral	7 (11.5)	1 (3.4)	10 (10.5)	18 (9.7)	
	Disagree	1 (6.6)	2 (6.9)	4 (4.2)	10 (5.4)	
	Strongly disagree	2 (3.3)	1 (3.4)	0 (0.0)	3 (1.6)	
Q17. What is treatment option considered as the most preference to yourself?	Dental implant	41 (67.2)	19 (65.5)	64 (67.4)	124 (67.0)	0.964
	Fixed partial denture (e.g., bridges)	3 (4.9)	2 (6.9)	5 (5.3)	10 (5.4)	
	Orthodontic space closure	16 (26.2)	8 (27.6)	23 (24.2)	47 (25.4)	
	Removable partial denture	1 (1.6)	0 (0.0)	3 (3.2)	4 (2.2)	
Q18. What is/are reasons made you choose the above treatment option (Q17)?	Age of patient	9 (14.8)	4 (13.8)	9 (9.5)	22 (11.9)	0.067
	Conservation of tooth	24 (39.3)	13 (44.8)	25 (26.3)	62 (33.5)	
	Ease of treatment	3 (4.9)	0 (0.0)	1 (1.1)	4 (2.2)	
	Evidence-based treatment	25 (41.0)	12 (41.4)	60 (63.2)	97 (52.4)	
Q19. Which treatment options according to your knowledge and expertise gives the best long-term aesthetic and functional results?	Fixed partial denture (e.g., resin-bonded bridgework/bridges)	3 (4.9)	1 (3.4)	2 (2.1)	6 (3.2)	0.742
	Removable partial denture	0 (0.0)	1 (3.4)	4 (4.2)	5 (2.7)	
	Implant-retained crown	41 (67.2)	19 (65.5)	61 (64.2)	121 (65.4)	
	Orthodontic space closure	17 (27.9)	8 (27.6)	28 (29.5)	53 (28.6)	
Q20. What is the main reason of treatment selection for replacing maxillary lateral incisors?	Aesthetic and/or function	43 (70.5)	15 (51.7)	73 (76.8)	131 (70.8)	0.038
	Clinician experience	3 (4.9)	5 (17.2)	6 (6.3)	14 (7.6)	
	Cost	1 (1.6)	1 (3.4)	7 (7.4)	9 (4.9)	
	Patient age	5 (8.2)	2 (6.9)	0 (0.0)	7 (3.8)	
	Patient compliance/preference	8 (13.1)	5 (17.2)	7 (7.4)	20 (10.8)	
	Patient's oral hygiene	1 (1.6)	1 (3.4)	2 (2.1)	4 (2.2)	
Q21. Interdental space and arch width measurements are routinely considered in selecting and communicating treatment options to patient.	Strongly agree	23 (37.7)	10 (34.5)	28 (29.5)	61 (33.0)	0.867
	Agree	29 (47.5)	16 (55.2)	57 (60.0)	102 (55.1)	
	Neutral	7 (11.5)	2 (6.9)	7 (7.4)	16 (8.6)	
	Disagree	2 (3.3)	1 (3.4)	2 (2.1)	5 (2.7)	
	Strongly disagree	0 (0.0)	0 (0.0)	1 (1.1)	1 (0.5)	
Q22. In your opinion, what is/are the advantage(s) of orthodontic closure of missing lateral incisors space?	Conservative approach	10 (16.4)	7 (24.1)	17 (17.9)	34 (18.4)	0.229
	Improve occlusion	4 (6.6)	0 (0.0)	3 (3.2)	7 (3.8)	
	Maintain natural dentition	5 (8.2)	3 (10.3)	21 (22.1)	29 (15.7)	
	Permanent solution	5 (8.2)	2 (6.9)	3 (3.2)	10 (5.4)	
	All of the above	37 (60.7)	17 (58.6)	51 (53.7)	105 (56.8)	
Q23. In your opinion, what are the advantages of replacing missing lateral incisors with prosthetic appliances?	Can correct occlusion in some cases	6 (9.8)	1 (3.4)	4 (4.2)	11 (5.9)	0.157
	Customizable for aesthetic concerns	7 (11.5)	2 (6.9)	12 (12.6)	21 (11.4)	
	Immediate solution	20 (32.8)	8 (27.6)	28 (29.5)	56 (30.3)	
	Wide range of options available	0 (0.0)	5 (17.2)	9 (9.5)	14 (7.6)	
	All of the above	28 (45.9)	13 (44.8)	42 (44.2)	83 (44.9)	
Q24. How do you stay up-to-date on the latest treatment modalities and techniques for replacing missing lateral incisors?	Attend continuing education courses	21 (34.4)	7 (24.1)	26 (27.4)	54 (29.2)	0.446
	Network with colleagues	13 (21.3)	9 (31.0)	26 (27.4)	48 (25.9)	
	Read professional journals	11 (18.0)	7 (24.1)	28 (29.5)	46 (24.9)	
	Other	16 (26.2)	6 (20.7)	15 (15.8)	37 (20.0)	

There was no statistically significant difference (P > 0.05) between the groups, but the majority of general practitioners (70%), oral surgeons (80%), prosthodontists (61.5%), and orthodontists (51.5%) preferred implant replacement of missing maxillary lateral incisors (Table 6). They also preferred it because it gives the best long-term aesthetic and functional results (65.4%), according to their knowledge and experiences. Most general practitioners (68.3%) and prosthodontists (61.5%) chose implant-retained crowns over orthodontic space closure (18.8% and 30.8%, respectively). The participants in this study who preferred dental implants were selected according to evidence-based treatment as their primary reason (52.4%). Additionally, the implant-retained crown was chosen for long-term aesthetic and/or functional results (65.4%) based on participants' knowledge and experiences. Most prosthodontists (61.5%) said that they preferred crowns retained in implants over fixed or removable prostheses, with 3.8% of respondents agreeing. Only 8.9% of general practitioners preferred bridges, compared to 3.8% of prosthodontists. Most general practitioners (49.5%) believe that missing lateral incisors should be investigated in routine dental practice, while only 4% disagree.

According to Table 6, the only significant difference (P = 0.003) between the groups appeared when the answers to Table 6's questions were categorised based on the dentists' specialties: "How do you stay up-to-date on the latest treatment modalities and techniques for replacing missing lateral incisors?". Most general practitioners (34.7%) and oral surgeons (32%) acquired new information about missing lateral incisor treatment through continuing education courses, while few orthodontists and prosthodontists preferred this method (18.2% and 19.2%, respectively). Orthodontists (51.5%) and prosthodontists (34.6%) preferred reading professional journals, while oral surgeons (32%) preferred networking with colleagues.

Table 6: Dentists' responses based on their qualifications

Question	Selected response	General dentist	Oral surgeon	Orthodontist	Prosthodontist (fixed and/or removable)	Total	P
		N (%)	N (%)	N (%)	N (%)	N (%)	
Q5. The prevalence of lateral incisors agenesis has increased over the last decade.	Strongly agree	9 (8.9)	4 (16.0)	2 (6.1)	2 (7.7)	17 (9.2)	0.711
	Agree	47 (46.5)	9 (36.0)	18 (54.5)	11 (42.3)	85 (45.9)	
	Neutral	35 (34.7)	12 (48.0)	12 (36.4)	12 (46.2)	71 (38.4)	
	Disagree	8 (7.9)	0 (0.0)	1 (3.0)	1 (3.8)	10 (5.4)	
	Strongly disagree	2 (2.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (1.1)	
Q6. A tooth agenesis resulting in the need for multidisciplinary treatment.	Strongly agree	24 (23)	7 (28.0)	15 (45.5)	6 (23.1)	52 (28.1)	0.066
	Agree	57 (56.4)	16 (64.0)	18 (54.5)	18 (69.2)	109 (58.9)	
	Neutral	18 (2.0)	2 (8.0)	0 (0.0)	1 (3.8)	21 (3.8)	
	Disagree	2 ((2.0)	0 (0.0)	0 (0.0)	1 (3.8)	3 (1.6)	
	Strongly disagree	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Q7. Agenesis of the maxillary lateral incisors creates aesthetic and functional problems.	Strongly agree	54 (53.5)	15 (60.0)	20 (60.6)	15 (57.7)	104 (56.2)	0.927
	Agree	38 (37.6)	8 (32.0)	11 (33.3)	10 (38.2)	67 (67.0)	
	Neutral	4 (4.0)	1 (4.0)	2 (6.1)	1 (3.8)	8 (4.3)	
	Disagree	5 (5.0)	1 (4.0)	0 (0.0)	0 (0.0)	6 (3.2)	
	Strongly disagree	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Q8. Congenitally missing maxillary lateral incisors are seldom mentioned or investigated in routine practice and are mostly	Strongly agree	22 (21.8)	6 (24.0)	3 (9.1)	4 (15.4)	35 (18.9)	0.474
	Agree	50 (49.5)	11 (44.0)	22 (66.7)	18 (69.7)	101 (54.6)	
	Neutral	11 (10.9)	4 (16.0)	2 (6.1)	2 (6.1)	19 (10.3)	
	Disagree	14 (13.9)	4 (16.0)	6 (18.2)	2 (7.7)	26 (14.1)	

managed based on clinician's experiences.	Strongly disagree	4 (4.0)	0 (0.0)	0 (0.0)	0 (0.0)	4 (2.2)	
Q9. Missing maxillary lateral incisors create chanllenges may be due to a higher perception rate of malocclusions, as well as a greater attention to aesthetics.	Strongly agree	42 (41.6)	7 (28.0)	13 (39.4)	9 (34.6)	71 (38.4)	0.675
	Agree	45 (44.6)	15 (60.0)	18 (54.5)	15 (57.7)	93 (50.3)	
	Neutral	9 (8.9)	3 (12.0)	1 (3.0)	1 (3.8)	14 (7.6)	
	Disagree	4 (4.0)	0 (0.0)	1 (3.0)	0(0.0)	5 (2.7)	
	Strongly disagree	1 (1.0)	0 (0.0)	0 (0.0)	1 (3.8)	2 (1.1)	
Q10. Management of missing maxillary lateral incisor is a key tooth of the anterior aesthetic zone needs specialist attention.	Strongly agree	41 (40.6)	13 (52.0)	21 (63.6)	13 (50.0)	88 (47.6)	0.079
	Agree	37 (36.6)	11 (44.0)	11 (33.3)	11 (42.3)	70 (37.8)	
	Neutral	14 (13.9)	0 (0.0)	0 (0.0)	2 (7.7)	16 (8.6)	
	Disagree	9 (8.9)	1 (4.0)	1 (3.0)	0 (0.0)	11 (5.9)	
	Strongly disagree	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Q11. Dentist and dental specialities differ in their treatment of missing maxillary lateral inciors based on outcome of the selected options.	Strongly agree	21 (20.8)	11 (6.6)	9 (27.3)	8 (6.9)	49 (26.5)	0.104
	Agree	55 (54.5)	12 (48.0)	23 (69.7)	17 (65.4)	107 (57.8)	
	Neutral	16 (15.8)	1 (4.0)	1 (3.0)	1 (3.8)	19 (10.3)	
	Disagree	8 (7.9)	1 (4.0)	0 (0.0)	0 (0.0)	9 (4.9)	
	Strongly disagree	1 (1.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.5)	
Q12. To coordinate a comprehensive treatment plan and not limit treatment to an isolated decision or speciality, clinicians must multidisciplinary approach.	Strongly agree	27 (26.7)	8 (32.0)	14 (42.4)	9 (34.6)	58 (31.4)	0.074
	Agree	50 (49.5)	13 (52.0)	18 (54.5)	17 (65.4)	98 (53.0)	
	Neutral	20 (19.8)	4 (16.0)	1 (3.0)	0 (0.0)	25 (13.5)	
	Disagree	4 (4.0)	0 (0.0)	0 (0.0)	0 (0.0)	4 (2.2)	
	Strongly disagree	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Q13. Treatment options are not suitable for all patients, and an appropriate treatment plan must be formulated in each case.	Strongly agree	53 (52.5)	14 (56.0)	24 (72.7)	16 (61.5)	107 (57.8)	0.372
	Agree	39 (38.6)	11 (44.0)	7 (21.2)	10 (38.5)	67 (36.2)	
	Neutral	7 (6.9)	0 (0.0)	1 (3.0)	0 (0.0)	8 (4.3)	
	Disagree	2 (2.0)	0 (0.0)	1 (3.0)	0 (0.0)	3 (1.6)	
	Strongly disagree	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Q14. The individual plan formulated according to the characteristics of the present teeth, malocclusion, facial features, and the patient's expectations.	Strongly agree	49 (48.5)	14 (56.0)	21 (63.6)	15 (57.7)	99 (53.5)	0.724
	Agree	44 (43.6)	10 (40.0)	9 (27.3)	11 (42.3)	74 (40.0)	
	Neutral	7 (6.9)	1 (4.0)	3 (9.1)	0 (0.0)	11 (5.9)	
	Disagree	1 (1.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.5)	
	Strongly disagree	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Q15. Before initiating treatment, clinicians should know the outcome and explain the different treatment options to the patient, with the advantages and disadvantages of each, so that an informed decision can be made.	Strongly agree	64 (63.4)	22 (88.0)	27 (81.8)	22 (84.6)	135 (73.0)	0.044
	Agree	30 (29.7)	3 (12.0)	6 (18.2)	4 (15.4)	43 (23.2)	
	Neutral	7 (6.9)	0 (0.0)	0 (0.0)	0 (0.0)	7 (3.8)	
	Disagree	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
	Strongly disagree	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Q16. Consideration of treatment alternatives according to patients' expectations can lead to a successful outcome and patient satisfaction.	Strongly agree	36 (35.6)	8 (32.0)	14 (42.4)	12 (46.2)	70 (37.8)	0.876
	Agree	46 (45.5)	11 (44.0)	17 (51.5)	10 (38.5)	84 (45.4)	
	Neutral	11 (10.9)	3 (12.0)	2 (6.1)	2 (7.7)	18 (9.7)	
	Disagree	6 (5.9)	2 (8.0)	0 (0.0)	2 (7.7)	10 (5.4)	
	Strongly disagree	2 (2.0)	1 (4.0)	0 (0.0)	0 (0.0)	3 (1.6)	
Q17. What is treatment option considered as the most preference to yourself?	Dental implant	71 (70.3)	20 (80.0)	17 (51.5)	16 (61.5)	124 (67.0)	0.063
	Orthodontic space closure	19 (18.8)	5 (20.0)	15 (45.5)	8 (30.8)	47 (25.4)	
	Fixed partial denture (e.g., bridges)	9 (8.9)	0 (0.0)	0 (0.0)	1 (3.8)	10 (5.4)	
	Removable partial denture	2 (2.0)	0 (0.0)	1 (3.0)	1 (3.8)	4 (2.2)	
Q18. What is/are reasons made you choose the above treatment option (Q17)?	Age of patient	15 (14.9)	2 (8.0)	2 (6.1)	3 (11.5)	22 (11.9)	0.768
	Conservation of tooth	35 (34.7)	8 (32.0)	9 (27.3)	10 (38.5)	62 (33.5)	
	Ease of treatment	3 (3.0)	0 (0.0)	1 (3.0)	0 (0.0)	4 (2.2)	

	Evidence-based treatment	48 (47.5)	15 (60.0)	21 (63.6)	13 (50.0)	97 (52.4)	
Q19. Which treatment options according to your knowledge and expertise gives the best long-term aesthetic and functional results?	Implant-retained crown	69 (68.3)	19 (76.0)	17 (51.5)	16 (61.5)	121 (65.4)	0.345
	Orthodontic space closure	25 (24.8)	6 (24.0)	15 (45.5)	7 (26.9)	53 (28.6)	
	Fixed partial denture (e.g., resin-bonded bridgework/bridges)	4 (4.0)	0 (0.0)	0 (0.0.)	2 (7.7)	6 (3.2)	
	Removable partial denture	3 (3.0)	0 (0.0)	1 (3.0)	1 (3.8)	5 (2.7)	
Q20. What is the main reason of treatment selection for replacing maxillary lateral incisors?	Aesthetic and/or function	71 (70.3)	20 (80.0)	21 (63.6)	19 (73.1)	131 (70.8)	0.221
	Clinician experience	8 (7.9)	2 (8.0)	4 (12.1)	0 (0.0)	14 (7.6)	
	Cost	2 (2.0)	1 (4.0)	3 (9.1)	3 (11.5)	9 (4.9)	
	Patient age	7 (6.9)	0 (0.0)	0 (0.0)	0 (0.0)	7 (3.8)	
	Patient compliance/preference	10 (9.9)	1 (4.0)	5 (15.2)	4 (15.4)	20 (10.8)	
	Patient's oral hygiene	3 (3.0)	1 (4.0)	0 (0.0)	0 (0.0)	4 (2.2)	
Q21. Interdental space and arch width measurements are routinely considered in selecting and communicating treatment options to patient.	Strongly agree	35 (34.7)	9 (36.0)	7 (21.2)	10 (38.5)	61 (33.0)	0.480
	Agree	49 (48.5)	13 (52.0)	24 (72.7)	16 (61.5)	102 (55.1)	
	Neutral	12 (11.9)	2 (8.0)	2 (6.1)	0 (0.0)	16 (8.6)	
	Disagree	4 (4.0)	1 (4.0)	0 (0.0)	0 (0.0)	5 (2.7)	
	Strongly disagree	1 (1.0)	0 (0.0)	0 (0.0)	0 (0.0.)	1 (0.5)	
Q22. In your opinion, what is/are the advantage(s) of orthodontic closure of missing lateral incisors space?	Conservative approach	19 (18.8)	4 (16.0)	5 (15.2)	6 (23.1)	34 (18.4)	0.513
	Improve occlusion	7 (6.9)	0 (0.0)	0 (0.0)	0 (0.0)	7 (3.8)	
	Maintain natural dentition	12 (11.9)	7 (28.0)	7 (21.2)	3 (11.5)	29 (15.7)	
	Permanent solution	6 (5.9)	1 (4.0)	2 (6.1)	1 (3.8)	10 (5.4)	
	All of the above	57 (56.4)	13 (52.0)	19 (57.6)	16 (61.5)	105 (56.8)	
Q23. In your opinion, what are the advantages of replacing missing lateral incisors with prosthetic appliances?	Can correct occlusion in some cases	8 (7.9)	0 (0.0)	3 (9.1)	0 (0.0)	11 (5.9)	0.336
	Customizable for aesthetic concerns	10 (9.9)	8 (12.0)	5 (15.2)	3 (11.5)	21 (11.4)	
	Immediate solution	33 (32.7)	8 (32.0)	10 (30.3)	5 (19.2)	56 (30.3)	
	Wide range of options available	5 (5.0)	3 (12.0)	1 (3.0)	5 (19.2)	14 (7.6)	
	All of the above	45 (44.6)	11 (44.0)	14 (42.4)	13 (50.0)	83 (44.9)	
Q24. How do you stay up-to-date on the latest treatment modalities and techniques for replacing missing lateral incisors?	Attend continuing education courses	35 (34.7)	8 (32.0)	6 (18.2)	5 (19.2)	54 (29.2)	0.003
	Network with colleagues	25 (24.8)	8 (32.0)	8 (24.2)	7 (26.9)	48 (25.9)	
	Read professional journals	14 (13.9)	6 (24.0)	17 (51.5)	9 (34.6)	46 (24.9)	
	Other	27 (26.7)	3 (12.0)	2 (6.1)	5 (19.2)	37 (20.0)	

DISSCUSION

Management of missing lateral incisors as dental anomalies is considered more than just a replacement of a tooth. Replacement of these teeth must provide acceptable function and aesthetics [2,8]. Therefore, treatment planning for patients with such dental anomalies needs to take into consideration several factors, including the clinician's skills and experiences.

In the literature, it is evident that any treatment consideration should consider the patient's expectations, the individual tooth features, as well as their facial characteristics [9,11,13]. It is frequently implemented to debate their treatment using a multidisciplinary approach to be able to integrate or coordinate a comprehensive treatment strategy.

This anonymous online question-based survey was conducted to assess dentists' understanding of treatment options for the management of missing lateral incisors, either by closing or opening their corresponding spaces. The questionnaire was developed based on the contemporary challenges and treatment options of missing lateral incisors debated in the literature [2,11,17]. It was further reviewed for validity and clarity of the contents to ensure these questions were relevant, clear, and concise with the study objectives.

A total of 185 questionnaires (100%) were returned as fully completed. Of these, 101 (56.6 %) general dental practitioners, 33 (17.8 %) Orthodontist, 26 (14.1 %) Prosthodontist and 25 (13.5 %) were oral surgeons (table 2). Almost more than half of the participants (51.4%) attained skills with more than 10 years of clinical experience in their dental practice. According to dentist experience, there was no statistically significant difference in the group's awareness in the absence of lateral incisor teeth congenitally [(p = 0.627) table 5], and this in agreement with other researches [17]. But dentists with more than 10 years of experience (54.7%) considered that this dental anomaly necessitates a special treatment approach, which is considered not statistically significant as opposed to that of less experienced dentists (p = 0.488). The absence of lateral incisors can compromise dental function and aesthetics, necessitating special attention, strongly agreed by most participants (56.2%). Furthermore, treatment techniques vary depending on the patient's condition, compatibility, appearance, and expectations.

It is generally agreed that treatment options for replacing missing lateral incisors are not suitable for every patient; thus, each case requires an individual assessment [2-3,11]. Prior to any treatment consideration, the clinician should consider the patient's expectations, individual tooth features, and their facial character. Clinicians ought to discuss their treatment planning using a multidisciplinary strategy to be able to integrate and coordinate a comprehensive treatment plan [2,4,15-16]. According to the results, the majority of participants preferably chose dental implants as their selected option, with a response rate of 67.0%, as opposed to other alternative treatments such as orthodontics (25.4%), fixed prostheses (5.4%), and removable prostheses (2.2%). Their decision was evidence-based. Additionally, their reasons for treating missing lateral incisor teeth were aesthetic and functional considerations [70.8% (p = 0.038)]. Orthodontic treatment as the 2nd preferable treatment option [56.8% (p = 0.229)], it offers the advantages of being a permanent solution, a convenient approach, as well as maintaining natural dentition in its normal physiological and anatomical state. On the other hand, fixed prosthodontics are widely accepted to treat cases with such dental anomalies because of their immediate, faster, and acceptable aesthetic benefits. Many studies suggest that resin-bonded fixed dental prosthesis (RBFDP) is the most popular treatment for replacing missing anterior teeth due to its aesthetic appeal and patient satisfaction [17-19].

According to their knowledge and experience, the majority of prosthodontists (61.5%) chose implant-retained crowns as opposed to 3.8% and 7.7% who preferred removable and fixed partial dentures as treatment options, respectively. Prosthodontists (69.7%) and orthodontists (66.7%) generally agreed that missing lateral incisors should be routinely investigated as opposed to other dental professions, but this was not statistically significant (p = 0.474%).

All participants agreed that the prevalence of lateral incisors agenesis has increased over the last decade, resulting aesthetic and functional problems which require multidisciplinary treatment. Congenitally missing maxillary lateral incisors mostly managed

based on dentists' personal experiences could be biased towards treatment plans that are unaware of the multidisciplinary approach that is necessary in such cases. Multidisciplinary treatment of such a congenitally dental anomaly is crucial because missing lateral incisors could adversely affect patient facial appearance and their personal behaviour [2,11]. Clinicians differ in their treatment of missing maxillary lateral incisors; some prefer canine replacement, whereby they close the space by moving and aesthetically reshaping the permanent canine to mimic a lateral incisor. Others, however, prefer to open and restore the space prosthodontically either by tooth-supported restoration or dental implant [20,21]. According to different dental specialties, no statistically significant differences were found regarding which treatment approach they preferred when replacing the missing lateral incisor. Most dentists preferred dental implant replacement of congenitally missing maxillary lateral incisors, while unexpectedly, orthodontists preferred the same strategic therapy as others to substitute the lateral incisor orthodontically using the canine [20,21]. These differences in their responses assume from experience that dental implants will achieve optimum results as opposed to shaping the canine to simulate a lateral incisor.

It is clear that most participant decision-making relies on factors such as knowledge, clinical experience, and individual preferences [2,20-21]. In the present survey, dentists and dental specialists placed more emphasis on aesthetics and function. Conversely, other studies have shown that general dentists and specialists, rather than orthodontists, opted to restore the lateral incisor for aesthetic reasons. Most participants agreed that prosthetic replacements could achieve better aesthetic and functional results, similar to findings in other studies [20,21]. The present survey revealed that most respondents believed that an implant-retained crown was the most preferable treatment option. There were no significant differences among the dental specialties in terms of their preferred prosthetic options, but there were significant differences depending on the respondents' experience. This may indicate that dentists may not necessarily be incorporating the latest treatments into their practice.

In the present study, participants based their decisions about implant treatment options on the following factors: First, the choice of implant was evidence-based therapy, and second, it was based on research, a conservation approach, maintaining natural dentition, ensuring long-term treatment, and maintaining occlusion. It is probable that general dentists and orthodontists were less likely to perform implant therapy than prosthodontic treatment, which requires special training not typically included in their practice.

Most general practitioners (34.7%) and oral surgeons (32%) acquired new knowledge about missing lateral incisor treatment through continuing education, as opposed to orthodontists and prosthodontists (18.2% and 19.2%, respectively) ($p = 0.003$). Orthodontists (51.5%) and prosthodontists (34.6%) preferred reading professional journals, while oral surgeons (32%) preferred networking with colleagues. These findings indicate that continuous education and training would benefit dentists and dental specialists, allowing them to acknowledge more treatment substitution options as opposed to single therapy.

A systematic review found no scientific evidence to support any treatment option for missing lateral incisors due to a lack of sound scientific evidence based on any randomised clinical trials. Though the literature suggests that the best treatment might never be found due to the high complexity of this clinical situation or that randomised clinical trials are not feasible or inappropriate, the clinical decision should be drawn from well-conducted prospective studies that can provide complementary evidence [2,20-21]. However, dentists should not put emphasis on personal opinions when recommending treatment options for replacing missing maxillary lateral incisors because discrepancies exist between the treatment result judged as the most appropriate treatment

option and the one most likely to be recommended. Additionally, aesthetics plays an important role in managing these clinical situations, and in some cases, dentists and dental specialists emphasise its importance more than functional aspects [20, 21].

Within the limitations of this survey, it can be observed that treatment for maxillary lateral incisor agenesis remains a controversial topic due to a lack of consensus in the decision between opening space for prosthetic replacement of the absent teeth or orthodontically closing the spaces, followed by anatomic recontouring of the canines. Therefore, further study is essential to determine, with the evidence available, the best treatment alternative for patients with missing lateral incisors.

CONCLUSION

It is widely acknowledged that the prevalence of tooth agenesis has increased over the last decade, resulting in a significant rise in the demand for specialised dental treatment. Managing this anomaly proves challenging due to self-consciousness as well as a greater attention to aesthetics and malocclusion. However, there is considerable variation in the literature and routine dental practice, with case management predominantly relying on individual dentist experiences.

Furthermore, findings from the present study reveal a consensus among dentists that the treatment of missing lateral incisors necessitates a multidisciplinary approach to ensure optimal results that satisfy both patients and practitioners. Most clinicians expressed a preference for implant-retained crowns when prosthetic replacement of missing lateral incisors was deemed necessary.

In conclusion, the management of this dental anomaly requires comprehensive planning, avoiding limited treatment decisions in isolation or within a specific specialty. Clinicians must adopt a multidisciplinary approach to ensure the best outcomes. While this survey provides valuable insights to guide dentists in formulating treatment options for patients with missing lateral incisors, further research is necessary to explore whether dentists implement their preferred treatments based on evidence-based practices or their clinical experiences.

Conflict of Interest

There are no financial, personal, or professional conflicts of interest to declare.

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