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10.4103/jos.jos_14_24

Perspectives on managing patients with Down's syndrome among orthodontists in Saudi Arabia: A vignette and a COM-B analysis study

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Abstract

OBJECTIVE: This study aims to explore perspectives on managing patients with Down's syndrome among orthodontists in Saudi Arabia using a vignette study and COM-B model.

METHODS: This was a cross-sectional study for orthodontists working in Saudi Arabia. Participants were asked about their demographic data. Vignette (clinical scenarios) and COM-B model (C: capability, O: opportunity, M: motivation, and B: behavior) were used to assess orthodontists' perspectives regarding the management of patients with Down's syndrome. A model of Alpha (Cronbach) was used to study the properties of measurement scales. A Pearson's correlation coefficient was used to correlate variables represented by means. An independent *t*-test and one-way ANOVA, with least significant difference (LSD) as a *post hoc* test, were used to compare two group means and more than two groups, respectively.

RESULTS: Most participants ($n = 70$, 85.4%) reported that they had no training/exposure to dealing with Down's syndrome patients during their orthodontic clinical training. Participants reported an average of 3.82 (SD = 1.1) when treating moderate Down's syndrome and 2.48 (SD = 1.4) when treating severe Down's syndrome with mild occlusion discrepancies. Participants also showed that their behavior and attitude are significantly related to their capability, opportunity, and motivation regarding the management of patients with Down's syndrome. The average reported agreement ranges from 2.46 (SD = 1) for the hypoplasia of the mandible to 4.38 (SD = 0.8) for the congenitally missing teeth.

CONCLUSION: This study found that orthodontists in Saudi Arabia showed low confidence levels to manage Down's syndrome patients with moderate and severe challenging behavior. Despite this, the likelihood of increasing their confidence levels and attitude regarding the management of patients with Down's syndrome increased by increasing their capability, opportunity, motivation, and knowledge in this field.

Keywords:

Attitude, behavior, confidence level, Down's syndrome, perspectives, psychometric analyses

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Submitted: 01-Feb-2024

Revised: 11-May-2024

Accepted: 15-Jun-2024

Published: 17-Sep-2024

Introduction

First described as a disease entity by J Langdon Down, Down's syndrome is a well-recognized genetic condition with specific clinical characteristics comprising a set of distinctive physical defects and mental

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disabilities.^[1] The etiology of the condition has been attributed by many investigators to the presence of an extra copy of chromosome 21.^[2] The classical clinical presentation of Down's syndrome includes varying degrees of mental disability accompanied by a set of physical traits including physical disability (short stature), oblique eye fissures, epicanthic folds, protruding tongue, and flat nasal bridge.^[2]

How to cite this article: Abed H, Taju W. Perspectives on managing patients with Down's syndrome among orthodontists in Saudi Arabia: A vignette and a COM-B analysis study. *J Orthodont Sci* 2024;13:33.

In Saudi Arabia, a nationwide 2-year epidemiological survey of several congenital anomalies (2004 and 2005) reported that the prevalence of Down's syndrome was 6.6 per 10,000 children.^[3] The survival rate of individuals with Down's syndrome has been on the rise. For example, it was estimated that 57% of people with Down's syndrome were in their third decade and 28% were in their fifth decade as of 2010, compared to only 27% in the third decade and only 4% in the fifth decade in 1950.^[4] This marked increase in the survival rates of individuals affected with Down's syndrome has made it a necessity to include them in society, allow them to be able to function as normally as possible, and provide them with the required medical care, including dental care, that improves their overall quality of life.

Individuals with Down's syndrome appear to have certain craniofacial and occlusal traits that have been frequently reported in the literature.^[5] They are affected by the generalized underdevelopment of craniofacial structures, with a marked flatness of the midface and a reduction of both linear and angular measurement fields.^[6] This pattern of hypoplasia which more often affects the midfacial region leads to a Class III malocclusion, anterior open bite, posterior crossbite, delayed eruption, failure of eruption, and missing and deformed teeth.^[6] Since treating malocclusion can improve the function and health of the dentition, as well as the facial aesthetics, individuals with Down's syndrome should have access to orthodontic care, as it will have a considerable positive impact on their quality of life.^[7,8] To our knowledge, no survey-based study has been done to assess the ability, knowledge and level of confidence of orthodontists to properly manage Down's syndrome patients in an orthodontic clinic. Accordingly, this study aims to explore perspectives on managing patients with Down's syndrome among orthodontists in Saudi Arabia using a vignette study and COM-B model.

Material and Methods

Study setting and eligibility criteria

This was a cross-sectional survey of orthodontists practicing in Saudi Arabia. An online survey using Microsoft Forms (Microsoft Office 365 version 4.0.3; 2022) was used to develop the survey. The survey was made available online to collect responses during the period from May 2023 to August 2023. All responses were anonymous. Full ethical approval was granted from the Biomedical Research Ethics Committee at Umm Al-Qura University (reference number: HAPO-02-K-012-2022-09-1208). Informed consent was obtained from each participant. This study included four sections as follows:

Section 1: Demographic details

Each participant was asked about their age, gender, years of experience, postgraduate study country, type of highest degree, region of work, place of work, and type of dental setting.

Section 2: Four scenarios for Down's syndrome patients requiring orthodontic care

Participants were asked about their confidence (i.e., assessed via a scale from 1 – not confident at all, to 5 – very confident) in treating patients with Down's syndrome in four different behaviors (i.e., scenario 1: fit and well patients with mild occlusion discrepancies, scenario 2: mild Down's with mild occlusion discriminates, scenario 3: moderate Down's with mild occlusion discriminates, and scenario 4: severe Down's with mild occlusion discrepancies).

Section 3: Attitude of orthodontists toward management of Down's syndrome

This section will be based on the COM-B model (a total of 12 questions and each question is assessed via a scale from 1 (very important) to 5 (very unimportant)). The minimum score was 12, and the maximum score was 60.

- **Capability**
 - How confident are you in your ability to perform orthodontic treatment for individuals with Down's syndrome?
 - How confident are you in your ability to use dental radiographs to add information to the overall detection and assessment of orthodontic treatment needs and treatment planning specifically for individuals with Down's syndrome?
 - How confident are you in the ability (of you and your team) to tailor your management of Down's syndrome individuals with different challenging behavior levels (i.e. mild, moderate, or severe)?
- **Opportunity**
 - How important do you think it is that you have the experience to manage individuals with Down's syndrome in your orthodontic practice?
 - How important do you think it is that you are familiar with different oral/dental traits that are commonly found in individuals with Down's syndrome?
 - Do you have available to you the resources you need (time, equipment, materials, etc.) to manage an individual with Down's syndrome in an orthodontic practice?
 - How important do you think it is for you and your team to be able to manage Down's syndrome individuals with different challenging behavior levels (i.e. mild, moderate, or severe)?
- **Motivation**
 - How satisfied are you in your ability to perform orthodontic treatment for an individual patient with Down's syndrome?

- How satisfied are you with the outcomes that you receive for tailoring your orthodontic management of Down's syndrome individuals with different challenging behavior levels (i.e., mild, moderate, or severe)?
- **Behavior**
 - How often do you perform an orthodontic treatment for an individual with Down's syndrome?
 - How often are you able to identify different oral/dental traits that are commonly found in an individual with Down's syndrome?
 - How often are you able to assess an individual with Down's syndrome for an orthodontic treatment?

Section 4: Orthodontists' knowledge regarding the oral manifestation of Down's syndrome

Participants were asked about their knowledge of the oral manifestation of Down's syndrome. Each question was assessed using a five-point scale (1: not agree at all to 5: very agree). The minimum score was 8, and the maximum score was 40.

Statistical analyses

This study was analyzed using IBM SPSS version 27 (IBM Corp., Armonk, N.Y., USA) and visually presented by using GraphPad Prism version 8 (GraphPad Software, Inc., San Diego, CA, USA). A simple descriptive statistics was used to define the characteristics of the study variables through a form of counts and percentages for the categorical and nominal variables, while continuous variables are presented by mean and standard deviations.

To calculate the total score of each domain and subdomains, a simple additive method was used. A reliability analysis was used with a model of Alpha (Cronbach) to study the properties of measurement scales and the items that compose the scales and the average inter-item correlation. To correlate variables which were both represented by means, a Pearson's correlation coefficient was used. While comparing two group means and more than two groups, an independent *t*-test and one-way ANOVA, with least significant difference (LSD) as a *post hoc* test, respectively, were used. These tests were done with the assumption of normal distribution. Otherwise, Welch's *t*-test for two group means and Games-Howell for multiple groups were used as an alternative for the LSD test. Lastly, a conventional *P* value <0.05 was the criteria to reject the null hypothesis.

Sample size calculation

To estimate how many orthodontists should be included in this study to understand their attitudes, knowledge, and behavior toward managing patients with Down

syndrome, from a pool of 5000 orthodontists with 95% CI, approximately 46 orthodontists were required. Indeed, this sample size allowed us to be reasonably certain that the attitudes, knowledge, and behavior observed in this study sample reflected those of the larger group of orthodontists, with only a small likelihood of significant deviation.

Results

Demographic characteristics

Table 1 shows participants' demographic characteristics (N = 82). Most of participants were male (n = 53, 64.6%) with an average of 9 years of experience in orthodontics (SD = 5.5). Most of the participants obtained their postgraduate studies abroad (n = 50, 61%) compared to 32 participants (39%) who had a local program of orthodontics in Saudi Arabia. Forty-two participants (51.2%) obtained a clinical diploma compared to the clinical certificate, Master of Science, and Doctor of Philosophy degrees (n = 40, 48.8%). Additionally, most participants practiced orthodontics in Makkah (n = 30, 36.6%) and Riyadh region (n = 28, 34.1%). Current places for most orthodontists are governmental (n = 25, 30.5%), private (n = 23, 28%), university (n = 9, 11%), and both governmental and private settings (n = 25, 30.5%). Surprisingly, most participants (n = 70, 85.4%) reported that they had no training/exposure to dealing with Down's syndrome patients during their orthodontic clinical training.

Orthodontists' confidence level in treating patients with Down's syndrome

Table 2 presents orthodontists' confidence level in treating patients with Down's syndrome. When participating orthodontists were asked about their confidence level in treating patients with Down's Syndrome, they reported different levels of confidence. For example, participants reported an average of 4.98 (SD = 0.2) when treating fit and well patients with mild occlusion discrepancies, 4.76 (SD = 0.6) when treating mild Down's syndrome with mild occlusion discriminates, 3.82 (SD = 1.1) when treating moderate Down's syndrome with mild occlusion discriminates, and lastly 2.48 (SD = 1.4) when treating severe Down's syndrome with mild occlusion discrepancies. Figure 1 presents orthodontists' confidence level in treating patients with Down's syndrome who have different levels of behavioral complexity.

The attitude of orthodontists toward management of patients with Down's syndrome using COM-B model

Table 3 presents the attitude of orthodontists toward the management of Down's syndrome using the COM-B

Table 1: Participants' demographic characteristics (n=82)

Demographics		n	Min	Max	Mean	SD
Age		82	26	55	39.24	6.5
Years of experience in orthodontics		82	2	28	9.00	5.5
				Count	%	
Total				82	100.0	
Gender	Male			53	64.6	
	Female			29	35.4	
Country of postgraduate study	Local program (in Saudi Arabia)			32	39.0	
	International program (outside Saudi Arabia)			50	61.0	
Highest degree in orthodontics	Clinical certificate			20	24.4	
	Master of Science			15	18.3	
	Doctor of Philosophy			5	6.1	
	Clinical Diploma (Board certified/Membership)			42	51.2	
Years practicing orthodontics	0–5 years			26	31.7	
	6–10 years			28	34.1	
	More than 10 years			28	34.1	
Primary region of practice in Saudi Arabia	Al-Baha			2	2.4	
	Al-Madinah			5	6.1	
	Al-Qaseem			3	3.7	
	Al-Riyadh			28	34.1	
	Aseer			1	1.2	
	Eastern Region			10	12.2	
	Jazan			3	3.7	
	Makkah			30	36.6	
	Governmental			25	30.5	
Current place of work	University			9	11.0	
	Private			23	28.0	
	More than one setting			25	30.5	
	Governmental			25	30.5	
Have you had any training/exposure to dealing with Down syndrome patients during your orthodontic clinical training?	Yes			12	14.6	
	No			70	85.4	

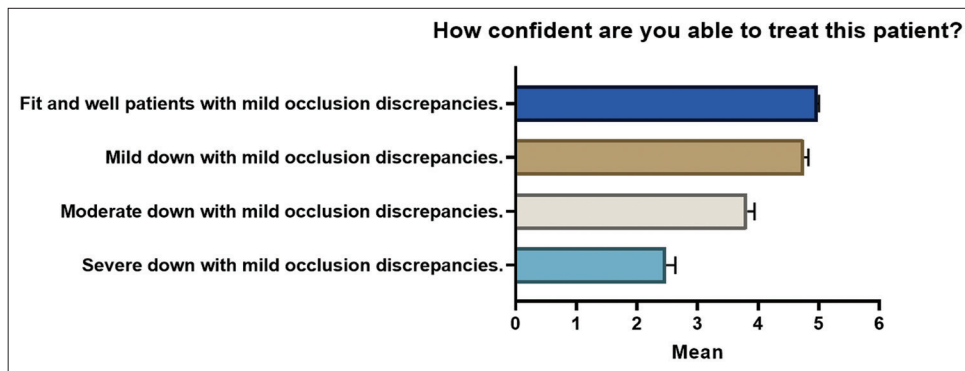


Figure 1: Orthodontists' confidence level in treating patients with Down syndrome who have different levels of behavioral complexity

model. When asked about their capability toward management of patients with Down's syndrome, participants reported an average of 4.55 (SD = 0.8) using dental radiograph, 3.90 (SD = 0.9) to perform orthodontic treatment, and 3.66 (SD = 1.1) tailoring their management of individuals with Down's syndrome with different challenging behavioral levels (i.e. mild, moderate, or severe).

When asked about their opportunity toward management of patients with Down's syndrome, participants reported

averages of 4.50 (SD = 0.7) on their familiarity with different oral/dental traits that are commonly found in individuals with Down's syndrome, 4.11 (SD = 0.9) on their experience in managing individuals with Down's syndrome at their orthodontic practice, 3.98 (SD = 1.0) on their ability to manage Down's syndrome individuals with different challenging behavior levels (i.e. mild, moderate, or severe), and 2.94 (SD = 1.1) on availability of the resources (time, equipment, and materials) to manage an individual with Down's syndrome in an orthodontic practice.

Table 2: Orthodontists' confident level on treating patients with Down syndrome

Patient's behavioral level	Min	Max	Mean	S.E.	SD
Fit and well patients with mild occlusion discrepancies	3	5	4.98	0.024	0.2
Mild Down syndrome with mild occlusion discriminates	2	5	4.76	0.068	0.6
Moderate Down syndrome with mild occlusion discriminates	1	5	3.82	0.122	1.1
Severe Down syndrome with mild occlusion discrepancies	1	5	2.48	0.155	1.4

Table 3: Attitude of orthodontists toward management of patients with Down syndrome using COM-B model

COM-B model questions	Min	Max	Mean	S.E.	SD
C1: How confident are you in your ability to perform orthodontic treatment for individuals with Down syndrome?	2	5	3.90	0.099	0.9
C2: How confident are you in your ability to use dental radiographs to add information to the overall detection and assessment of orthodontic treatment needs and treatment planning specifically for individuals with down syndrome?	2	5	4.55	0.083	0.8
C3: How confident are you in the ability (of you and your team) to tailor your management of Down syndrome individuals with different challenging behavior levels (i.e., mild, moderate, or severe)?	1	5	3.66	0.118	1.1
O1: How important do you think it is that you have the experience to manage individuals with Down syndrome in your orthodontic practice?	2	5	4.11	0.104	0.9
O2: How important do you think it is that you are familiar with different oral/dental traits that are commonly found in individuals with down syndrome?	3	5	4.50	0.080	0.7
O3: Do you have available to you the resources you need (time, equipment, and materials) to manage an individual with Down syndrome in an orthodontic practice?	1	5	2.94	0.119	1.1
O4: How important do you think it is for you and your team to be able to manage Down syndrome individuals with different challenging behavior levels (i.e, mild, moderate, or severe)?	1	5	3.98	0.110	1.0
M1: How satisfied are you in your ability to perform orthodontic treatment for an individual patient with Down syndrome?	1	5	3.70	0.108	1.0
M2: How satisfied are you with the outcomes that you receive for tailoring your orthodontic management of Down syndrome individuals with different challenging behavior levels (i.e, mild, moderate, or severe)?	1	5	3.72	0.114	1.0
B1: How often do you perform an orthodontic treatment for an individual with Down syndrome?	1	4	2.12	0.097	0.9
B2: How often are you able to identify different oral/dental traits that are commonly found in an individual with down syndrome?	1	5	3.30	0.133	1.2
B3: How often are you able to assess an individual with Down syndrome for an orthodontic treatment?	1	5	2.49	0.103	0.9

When asked about their motivation toward the management of patients with Down's syndrome, participants reported averages of 3.72 (SD = 1) on their satisfaction with the orthodontic management of Down's syndrome individuals and 3.70 (SD = 1) on their ability to perform orthodontic treatment for an individual patient with Down's syndrome.

Lastly, when asked about their behavior toward the management of patients with Down's syndrome, participants reported averages of 3.30 (SD = 1.2) on the frequency of the orthodontic treatment for an individual with Down's syndrome, 2.49 (SD = 0.9) on the ability to assess an individual with Down's syndrome for orthodontic treatment, and 2.12 (SD = 0.9) on the frequency of orthodontic treatment for an individual with Down's syndrome.

Orthodontists' knowledge regarding the oral manifestation of Down's syndrome

Table 4 shows orthodontists' knowledge regarding the oral manifestation of Down's syndrome. Participants showed different levels of knowledge regarding oral manifestations of Down's syndrome. The average reported agreement ranges from 2.46 (SD = 1) for the hypoplasia of the mandible to 4.38 (SD = 0.8) for the

congenitally missing teeth. Figure 2 presents participants' knowledge regarding the oral manifestations of Down's syndrome.

Association of demographic variables and orthodontists' prospective outcomes

Table 5 presents the association of demographic variables and orthodontists' prospective outcomes. Male orthodontists showed higher motivation levels toward managing patients with Down's syndrome ($P = 0.016$). Orthodontists with more experience who obtained postgraduate studies internationally were shown to have higher confidence, attitude, capability, motivation, and behavior toward management of patients with Down's syndrome ($P < 0.001$). Also, orthodontists who have higher degrees than clinical certificates and Master of Science degrees were shown to have higher levels of opportunity and behavior toward the management of patients with Down's syndrome ($P < 0.001$). Regarding the place of work, orthodontists who work in more than one setting were shown to have higher confidence, attitude, capability, motivation, behavior, and knowledge toward managing patients with Down's syndrome ($P < 0.001$). Lastly, orthodontists who had experience/exposure to dealing with Down's syndrome patients showed higher

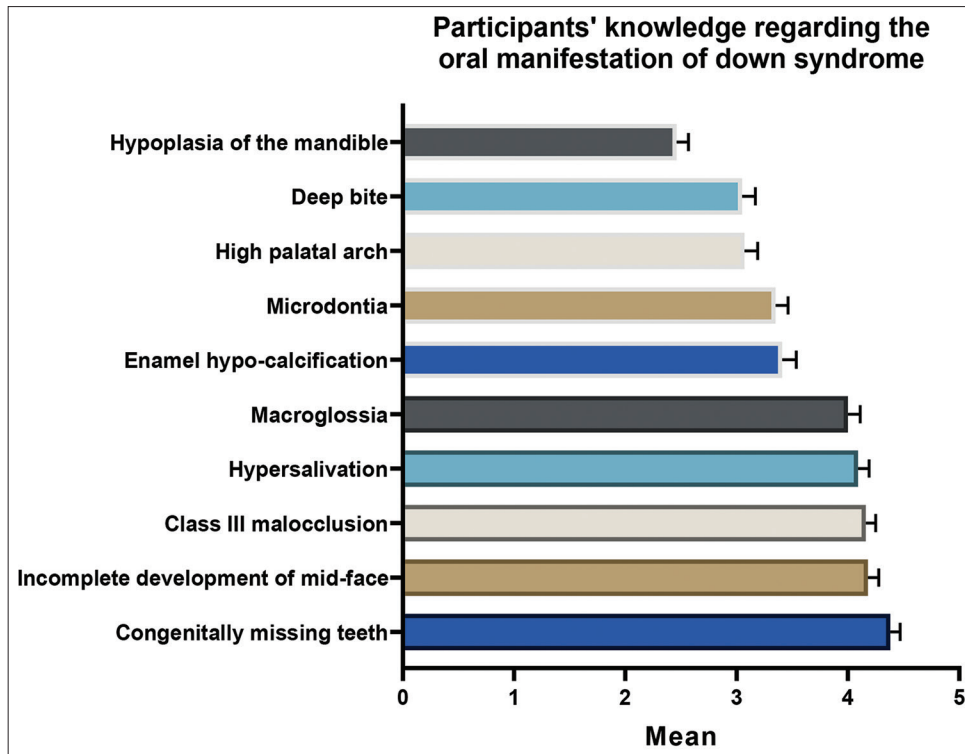


Figure 2: Participants' knowledge regarding the oral manifestations of Down syndrome

Table 4: Orthodontists' knowledge regarding the oral manifestation of Down syndrome

Oral manifestations	Min	Max	Mean	S.E	SD
Class III malocclusion	2	5	4.16	0.089	0.8
High palatal arch	1	5	3.07	0.120	1.1
Congenitally missing teeth	2	5	4.38	0.090	0.8
Enamel hypocalcification	1	5	3.41	0.126	1.1
Incomplete development of midface	2	5	4.18	0.097	0.9
Deep bite	1	5	3.05	0.118	1.1
Macroglossia	1	5	4.00	0.110	1.0
Hypoplasia of the mandible	1	5	2.46	0.107	1.0
Hypersalivation	1	5	4.09	0.101	0.9
Microdontia	1	5	3.35	0.113	1.0

confidence, attitude, capability, opportunity, motivation, and behavior ($P < 0.001$).

Correlation of orthodontists' confidence level, attitude, behavior, and COM-B model variables

Table 6 presents the correlation of orthodontists' confidence level, attitude, behavior, and COM-B model variables. It found that there were strong and moderate correlations between orthodontists' confidence level and their attitude ($r = 0.770$) and behavior ($r = 0.561$) when managing patients with Down's syndrome ($P < 0.001$), respectively. Similarly, statistical analyses showed a strong correlation between orthodontist's attitudes and behavior regarding the management of patients with Down's syndrome ($r = 0.773$, $P < 0.001$).

It also found that there were moderate correlations between orthodontists' capability and their opportunity ($r = 0.459$) and behavior ($r = 0.504$) but a strong correlation with their motivation ($r = 0.764$) when managing patients with Down's syndrome ($P < 0.001$). Statistical analyses found weak and moderate correlations between orthodontists' opportunity and their behavior ($r = 0.311$) and motivation ($r = 0.461$) and management of patients with Down's syndrome ($P < 0.001$). Lastly, statistical analyses found a strong correlation between orthodontists' motivation and their behavior when managing patients with Down's syndrome ($r = 0.501$, $P < 0.001$).

Discussion

This study aimed to explore perspectives on managing patients with Down's syndrome among orthodontists in Saudi Arabia using a vignette study and COM-B model. Both methods helped to provide a psychometric analysis for a specific behavior.

When presented with specific clinical scenarios, this study found that confidence level of orthodontists in Saudi Arabia was affected by the behavioral complexity level of Down's syndrome patients. For example, participants reported higher levels of confidence when managing Down's syndrome patients with mild behavior challenges, but vice versa with moderate and severe behavior challenges. Additionally, when asked about

Table 5: Association of demographic variables and orthodontists' perspective outcomes

Demographics	Total	Confidence Level	Attitude	Capability	Opportunity	Motivation	Behavior	Knowledge
Gender								
Male	53	16.45±2.4	43.94±7.9	12.45±2.2	15.43±3.1	7.79±1.9	8.26±2.3	35.83±4.0
Female	29	15.24±3.2	41.17±6.7	11.48±2.7	15.69±2.3	6.72±1.8	7.28±2.8	36.76±4.2
<i>P</i>		0.054	0.113	0.081	0.697	0.016 ^a	0.085	0.324
How many years have you been practicing orthodontics?								
0–5 years	26	13.85±2.6 ^A	36.50±5.0 ^A	10.08±2.1 ^A	14.54±2.2	5.85±1.6 ^A	6.04±2.4 ^A	36.85±4.8
6–10 years	28	16.18±1.5 ^B	44.07±5.2 ^B	12.54±1.8 ^B	15.93±2.4	7.61±1.5 ^B	8.00±2.1 ^B	35.36±3.7
0 years	28	17.89±2.3 ^C	47.86±7.4 ^C	13.57±1.9 ^C	16.04±3.5	8.68±1.6 ^C	9.57±1.6 ^C	36.32±3.5
<i>P</i>		<0.001 ^{c,e}	<0.001 ^{c,d}	<0.001 ^{c,d}	0.096	<0.001 ^{c,d}	<0.001 ^{c,e}	0.393
From which country did you obtain your postgraduate study in orthodontics?								
Local program (in Saudi Arabia)	32	14.59±2.7	39.81±6.7	10.81±2.5	15.56±2.4	6.34±1.7	7.09±2.7	35.69±4.6
International program (outside Saudi Arabia)	50	16.94±2.3	44.98±7.4	12.94±2.0	15.50±3.1	8.10±1.8	8.44±2.2	36.46±3.6
<i>P</i>		<0.001 ^a	0.002 ^a	<0.001 ^a	0.923	<0.001 ^a	0.016 ^a	0.403
What is your highest degree in orthodontics?								
Clinical certificate	20	15.80±3.7	43.20±7.9	12.10±2.9	15.30±3.1 ^{AB}	7.60±2.2	8.20±2.4 ^{AC}	36.80±3.5
Master of Science	15	15.40±1.5	38.60±5.8	11.60±1.5	13.67±2.3 ^A	6.87±1.5	6.47±2.4 ^B	33.87±3.1
Doctor of Philosophy	5	16.20±3.5	47.20±8.7	12.20±2.8	16.20±3.5 ^{AB}	8.40±1.7	10.40±1.8 ^A	36.20±6.5
Clinical Diploma	42	16.33±2.5	43.90±7.4	12.29±2.4	16.21±2.6 ^B	7.40±2.0	8.00±2.4 ^C	36.67±4.1
<i>P</i>		0.695	0.062	0.829	0.021 ^{c,d}	0.447	0.013 ^{c,d}	0.111
Primary region of your practice								
Al-Baha	2	17.50±2.1	45.50±12.0	12.50±3.5	16.00±1.4	8.00±2.8	9.00±4.2	34.50±6.4
Al-Madinah	5	16.40±1.3	46.80±7.3	13.20±2.2	16.60±2.1	8.00±2.0	9.00±2.0	34.60±3.8
Al-Qaseem	3	17.33±2.5	48.33±4.9	13.67±1.5	17.33±1.5	8.33±1.5	9.00±1.7	37.00±3.5
Al-Riyadh	28	17.00±2.1	43.68±7.2	12.61±2.0	15.29±2.8	7.57±1.6	8.21±2.4	35.79±3.3
Aseer	1	13.00±0.0	34.00±0.0	10.00±0.0	12.00±0.0	7.00±0.0	5.00±0.0	37.00±0.0
Eastern Region	10	15.60±1.6	41.90±6.9	11.70±1.8	14.80±2.9	7.20±1.8	8.20±2.4	34.40±3.7
Jazan	3	14.33±5.5	40.67±9.1	11.00±3.6	15.00±1.7	5.67±2.9	9.00±2.0	34.33±0.6
Makkah	30	15.23±3.3	41.83±8.1	11.60±2.9	15.77±3.1	7.30±2.2	7.17±2.6	37.53±4.8
<i>P</i>		0.180	0.574	0.484	0.704	0.767	0.426	0.391
What is your current place of work?								
Governmental	25	16.08±1.5 ^A	41.88±7.0 ^A	11.88±2.0 ^A	15.24±2.7	6.72±1.4 ^{AB}	8.04±2.5 ^A	33.88±3.3 ^A
University	9	11.67±2.3 ^B	35.22±4.3 ^B	8.67±2.5 ^B	15.67±1.8	5.56±2.0 ^A	5.33±2.6 ^B	40.11±4.0 ^B
Private	23	16.43±2.5 ^A	42.87±7.4 ^A	12.65±1.8 ^{AC}	14.57±3.1	7.70±1.9 ^{BC}	7.96±2.4 ^A	36.26±3.7 ^C
More than one setting	25	17.16±2.6 ^A	46.92±6.9 ^C	13.08±2.2 ^C	16.64±2.7	8.52±1.6 ^C	8.68±2.0 ^A	36.92±3.8 ^C
<i>P</i>		<0.001 ^{c,e}	<0.001 ^{c,d}	<0.001 ^{c,d}	0.074	<0.001 ^{c,d}	0.005 ^{c,d}	<0.001 ^{c,d}
Have you had any training/exposure on dealing with patient's with Down syndrome during your orthodontic clinical training?								
Yes	10	18.10±2.3	50.30±4.9	13.70±2.1	18.30±1.9	8.60±1.7	9.70±1.3	38.00±2.5
No	70	15.79±2.7	42.03±7.4	11.93±2.4	15.17±2.7	7.27±1.9	7.66±2.5	35.71±4.1
<i>P</i>		0.012 ^a	0.001 ^a	0.029 ^a	<0.001 ^a	0.043 ^a	<0.001 ^b	0.088

^asignificant using Independent t-test at <0.05 level. ^bSignificant using Welch's t-test at <0.005. ^cSignificant using One-Way ANOVA Test at <0.05 level. ^dPost-Hoc test=LSD. ^ePost-Hoc test=Games-Howell. *CAPITAL letters indicates Post-Hoc multiple pairing summary indicator. Having the same letter means the same measure statistically

their knowledge, a low knowledge level regarding most oral manifestations of patients with Down's Syndrome was noticed among participants. Similarly, previous studies reported that most dentists were able to identify Down's syndrome patients; however, most of them did not have enough knowledge about their oral health criteria and needs and felt unprepared to manage them

properly.^[9,10] These were not surprising findings as most participants reported that they had no training or exposure to dealing with Down's syndrome patients during their orthodontic clinical training. Several other studies found knowledge to influence healthcare professionals' behavior and found it to be the most important factor.^[11-13] Increasing knowledge of a specific

Table 6: Correlation of orthodontists' confident level, attitude, behavior, and COM-B model variables

Correlations	Attitude	Behavior	Knowledge
Confidence Level			
<i>r</i>	0.770**	0.561**	-0.063
<i>P</i>	<0.001	<0.001	0.574
<i>n</i>	82	82	82
Attitude			
<i>r</i>		0.733**	0.082
<i>P</i>		<0.001	0.466
<i>n</i>		82	82
Behavior			
<i>r</i>			-0.048
<i>P</i>			0.670
<i>N</i>			82
Correlations	Opportunity	Motivation	Behavior
Capability			
<i>r</i>	0.459**	0.764**	0.504**
<i>P</i>	<0.001	<0.001	<0.001
<i>n</i>	82	82	82
Opportunity			
<i>r</i>		0.461**	0.311**
<i>P</i>		<0.001	0.004
<i>n</i>		82	82
Motivation			
<i>r</i>			0.501**
<i>P</i>			<0.001
<i>N</i>			82

**Correlation is significant at the 0.01 level (2-tailed)

dental behavior (i.e. management of Down's syndrome) likely contributes to a change in professionals' clinical behavior.^[11-13]

When asked about their attitude using the COM-B model, participants showed that their behavior and attitude are significantly related to their capability, opportunity, and motivation regarding the management of patients with Down's syndrome. Indeed, improving the training of dental professionals in a specific dental procedure has been reported to raise their confidence level, hence increasing their behavior and action toward that procedure.^[14]

Strengths and limitations

This study benefited from using the COM-B model to explore the perspective of orthodontists in Saudi Arabia regarding the management of patients with Down's syndrome. Additionally, a vignette study was used by adding several clinical scenarios to consider given real clinical scenarios and having valuable outcomes. Three scenarios of patients with different behavioral levels were used, but with the same type of occlusion discrepancies. These scenarios indeed explored participants perspective regarding different complexity levels of Down's syndrome and have deep insight regardless to the occlusion discrepancies. On the

other hand, most participants were male and from the Western and Central region of Saudi Arabia. Therefore, findings may not be generalizable to orthodontists working in other regions of Saudi Arabia. Lastly, this was a cross-sectional study design; associations between variables cannot be considered as causative.

Conclusions and Recommendations

This study found that orthodontists in Saudi Arabia showed low confidence levels to manage Down's syndrome patients with moderate and severe challenging behavior. This was supported by low training and exposure during their postgraduate clinical training in orthodontics. Despite this, the likelihood of increasing their confidence levels and attitude regarding the management of patients with Down's syndrome increased by increasing their capability, opportunity, motivation, and knowledge in this field.

Accordingly, orthodontists must have sufficient knowledge and be aware of the proper management of patients with Down's syndrome to be able to manage those patients during dental visits. This is important as orthodontists have a vital role in improving patients with Down's syndrome malocclusion which is shown to improve their quality of life and oral functioning significantly.

Future research is needed to assess the awareness, impact, and exposure of orthodontists to Down's syndrome patients through their involvement in the management of Down's syndrome cases during postgraduate clinical training programs.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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