



جامعة محمد بن راشد
للطب و العلوم الصحية

MOHAMMED BIN RASHID UNIVERSITY
OF MEDICINE AND HEALTH SCIENCES

**A SURVEY OF THE APPLICATION OF THE
SHORTENED DENTAL ARCH BY DENTISTS IN THE
UAE**

Haleimah Saeed Ali AlHmoudi
DDS, Ajman University, 2008

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ABSTRACT

A Survey of the Application of the Shortened Dental Arch by Dentists in the UAE

Haleimah Saeed Ali AlHmoudi

Primary Supervisor: Dr. Fatemeh Amir Rad

Co-supervisor: Dr. Haitham Elbishari

Background: The Shortened Dental Arch (SDA) is a dentition of no more than twenty teeth with an intact anterior region but a reduced number of occluding pairs of posterior teeth. The SDA concept is a valid treatment option in cases in which anteriors and premolars can provide adequate aesthetics, function, and occlusal stability. It focuses on providing the partially dentate patient with the advantages of oral functionality, improved oral hygiene, comfort, while avoiding overtreatment and its unnecessary cost.

Aim: To evaluate the general attitude of dentists in the UAE towards the SDA concept and its application in their practice.

Materials and Methods: This is a cross-sectional study utilizing an online voluntary and anonymous questionnaire. The questionnaire was sent to all dentists registered with Emirates Medical Association (EMA). The questionnaire consists of 17 questions which comprise demographics, awareness, application in dental practice, preferred treatment modality, and risks and benefits associated with SDA. This survey was carried out during the period ranging from June till October 2020. The data was analyzed using SPSS Statistics.

Results: The response rate reported was 40.3%. There is a general awareness of the SDA concept among UAE dentists (n=237, 65.8%); however, it is not usually applied in clinical practice (n=196, 54.7%). Specialists were more aware about the concept and applied it more frequently in their clinical practice than the General Dental Practitioners (GDPs) (P-value = 0.000, 0.041 respectively). Female dentists (n=71, 60.7%) preferred to provide molar support

to their SDA patients more frequently than male dentists (n=109, 45.8%) (P-value 0.006). Respondents agreed that SDA was associated with the risks of teeth migration (n=211, 59.9%), tooth wear (n=196, 55.8%), and/or Temporomandibular Disorder (TMD) (n=163, 45.3%). Implant was found to be the treatment of choice for many of the participants (n=169, 46.6%) to replace missing molars followed by acrylic Removal Partial Denture (RPD) (n=129, 35.5%).

Conclusion: Within the limitations of this study, most of the dentists who responded to this survey are aware of the SDA concept and have a positive attitude about it. However, they do not frequently apply it in clinical practice. The preferred treatment modality for SDA by many dentists in UAE is implants followed by acrylic RPD. Dentists in this study prefer to propose SDA to patients with limited financial resources and medically compromised patients.

DEDICATION

This thesis is dedicated to my beloved mother, my sisters Aisha, Rowaya and Maryam. Thank you Maryam for being a second mother to my children, thank you for all the sacrifices you made for me. To my husband Sultan whose love, encouragement and prayers made me fulfill this journey with success. To the memory of my beloved father who always believed in me.

To my family, thank you for your support and prayers, thank you for believing in me, I wouldn't have made it without your support.

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To my dear friend Hanan who never underestimated my capabilities and always supported and encouraged me to fight for my goals.

And lastly above all to Allah (Almighty God), appreciate the guidance, strength, power of mind and protection.

DECLARATION

I declare that all the content of this thesis is my own work. There is no conflict of interest with any other entity or organization.

Name: Haleimah Saeed Alhmoudi

Signature:

A handwritten signature in black ink, consisting of a large, stylized loop followed by a short horizontal stroke and a small downward tick.

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ABBREVIATIONS

CDA:	Complete Dental Arch
EMA:	Emirates Medical Association
FPD:	Fixed Partial Denture
GDP:	General Dental Practitioner
SDA:	Shortened Dental Arch
KSA:	Kingdom of Saudi Arabia
OHIP:	Oral Health Impact Profile
OHRQoL:	Oral Health-Related Quality of Life
RBB:	Resin-Bonded Bridge
RPD:	Removable Partial Denture
SPSS:	Statistical Package for Social Sciences
TMD:	Temporomandibular Joint Disorders
TMJ:	Temporomandibular Joint
UAE:	United Arab Emirates
UK:	United Kingdom
WHO:	World Health Organization

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1. INTRODUCTION

A normal healthy person with no developmental disorders develops a total number of 28 (32) teeth; in other words, 14 (16) pairs of opposing functional teeth.(1) When several posterior teeth are missing, the dentist must consider a number of factors to provide care for the partially dentate. One of the important factors to consider is maintaining oral functionality or masticatory ability, which leads dental professionals to the question of how many teeth are needed to satisfy the functional demands of a patient.(2)

Classically, the morphological approach is to develop a treatment plan that accounts for the oral functional requirements of patients, which means that any lost tooth must be replaced and the patient must have at least 28 teeth.(3) However, individuals vary in their functional demands and the number of teeth that satisfy this demand. Therefore, we should focus our restorative treatment on each individual's specific needs and their adaptive capacity.(2)

Another approach to develop a treatment plan for partially edentulous patients is the problem-oriented approach, introduced in the 1980s by the Dutch prosthodontist Arnd Kayser, which relies on the functional requirements of the subject. The dentist should find the patient's exact problem and try to solve it.(3) This functional approach focuses on maintaining a natural, functioning, and healthy dentition, with sound biological criteria, to provide the patient with satisfactory function and adaptive capacity.(4,5)

The Shortened Dental Arch (SDA) is an example of this problem-oriented approach aimed to minimize complex restorative treatment. The SDA can be defined as "a dentition where the most posterior teeth are missing".(6) It can be applied in two ways; either passively by not replacing already extracted molars or actively by extracting non-restorable molars.

Many factors contribute to a compromised dentition. These may include trauma, periodontal disease, caries as well as tooth surface loss which result in a reduction in the number of the functional units, and therefore can render the occlusion unstable.(1)

In complex restorative cases with broken-down dentition, it is not easy for the clinician to take the decision on the number of teeth to be saved and the number to be replaced to reach satisfactory oral function. In many cases, the replacement of all missing teeth is possible, keeping in mind the cost associated with and the real need for complete dental arches.(7,8)

The diet in our modern life does not require a complete and functionally intact dentition. Additionally, occlusal stability and functional requirements can be met with the presence of the anteriors and bicuspid. Therefore, the replacement of lost molars is not necessary unless there is a functional and/or aesthetic requirement that justifies this replacement.(1,2,7,9) This means that in certain cases, replacing missing molars with cantilevers, implant supported prosthesis, Resin-Bonded Bridge (RBB) or distal extension Removable Partial Denture (RPD) can be considered as overtreatment.(2)

The SDA concept is a valid treatment option in cases where anteriors and premolars can provide adequate aesthetics, function, and occlusal stability. It focuses on providing the partially dentate patient with the advantages of oral functionality, improved oral hygiene, and comfort, while avoiding overtreatment and its unnecessary costs and questionable benefits.(1,2,10)

The effect of SDA on patients' masticatory ability, signs and symptoms of Temporomandibular Joint Disorders (TMD), remaining teeth migration, oral comfort and periodontal support has been investigated. Studies found no clinically significant differences between people with SDA and those with complete dental arches regarding the above mentioned criteria.(5,10–12) These results indicate that the classical morphological approach to restore all missing teeth and provide the patient with complete dental arches is not scientifically supported.(12)

In 1992, the World Health Organization (WHO) stated that: “when it is not functionally or aesthetically necessary, and if occlusal disharmonies are not causing myofascial pain or problems of the temporomandibular joint, teeth should not be replaced” and “Prostheses that endanger the remaining dentition and/or supporting tissues are to be discouraged”. The concept

of SDA (bicuspid to bicuspid) seems to be a realistic approach when caries levels are high and resources are limited".(13) Many studies have shown that the SDA is accepted by a great number of dentists, but they do not always apply the concept in their practice.(10,14–19)

2. REVIEW OF THE LITERATURE

2.1 History

For many decades, it was believed that for a healthy oral function and occlusion, a person must have a full set of teeth. This means that the replacement of any lost tooth is necessary to avoid negative consequences in the oral environment. However, some authors had other opinions. De Van (20) stated: “in many times it is much better to preserve what is left instead of replacing what has been lost”. Karlsen (21) mentioned that if the patient can function properly with missing molars, non-replacement should be considered an alternative for such patients. The patients' needs and demands vary and should be individually assessed instead of determining a set number of teeth for all patients. The assertion on requiring a set number of teeth for all patients was questioned by Levin (22) in his paper “the 28-tooth syndrome” indicating that many dentists feel obliged to replace any missing tooth up to the second molar.

The concept of the SDA was first proposed by a Dutch group of dentists.(22) There are around fourteen variations of SDA, with the most preferable situation being the one in which the arches are shortened to the second premolars.(5) The first paper on this concept was published in 1981 by Kayser, followed by further documentation by the Nijmegen group.(1,6) Kayser found that patients develop sufficient adaptive capacity to maintain adequate oral function in SDAs when at least four occlusal units are left, preferably in a symmetrical position. Two occluding premolars are considered as one occlusal unit, whereas two occluding molars are considered as two occlusal units.(6) The SDA concept is still considered controversial by many clinicians, despite the passage of about 40 years since its initial introduction.

SDA has been criticized to have a negative impact on the stomatognathic system, causing problems like teeth spacing and proclination of anterior teeth that results from periodontal breakdown, overloading of the Temporomandibular Joint (TMJ) and overbite. However, all these results are usually related to extremely shortened arches when no occlusal units remain.(5)

2.2 SDA and oral functionality

It is not yet known what is the exact number of teeth that satisfy the functional demand of a subject and it seems that this number may vary from one person to another.(5)

To be able to make a decision of whether to save or extract teeth in patients with broken down dentition requires a thorough examination of the following (5):

- 1- Occlusal activity
- 2- Food patterns
- 3- Age
- 4- Adaptive capacity
- 5- The spatial relationship between maxillary and mandibular teeth
- 6- The periodontal condition of the remaining dentition

Therefore, the wise advice in such cases is to use the problem-oriented approach, so the molars will not need to be replaced unless there are aesthetic or chewing issues. Subjects with severe SDA where less than four premolars are present in each arch and which have chewing or aesthetic complaints may only need to resort to SDA with four occluding units (four premolars in each arch).(3,5)

The chewing ability, food selection and amount of food consumption in people with SDA has been shown to be hampered, but within an acceptable limit.(23) Different studies deduced that the reduction of the quality of mastication is correlated to the loss of teeth. The number of teeth or in particular, the number of occluding pairs is the critical factor in evaluating the masticatory performance.(24–30) This is simply explained by the fact that as the number of teeth is reduced, there will be a reduction in the available occlusal units to perform the chewing function and this reduction will as a result, reduce the maximum bite force.(24,26,30)

By losing the posterior teeth, a person's ability to fragmentize food decreases, resulting in a 50% reduction in chewing efficiency.(25,28) Kreulen et al. (28) found that subjects with SDA

need to perform 70% more chewing cycles. Krall et al. (27) supported the same perception. Meanwhile, other scientists linked chewing efficiency to the number of posterior teeth, and others explained that the number of the remaining teeth determine masticatory performance.(24,26,27) Generally, it can be assumed that there is a compensation mechanism for the shortening of the arch and that by chewing on the longest side and chewing for a longer period before swallowing, this would allow such people to accommodate for their new condition without requiring the compensation of the lost teeth.(11) Moreover, insufficient nutritional consumption of vitamins and fibers in addition to the predilection of confectionaries over nutritious food such as vegetables has been seen in people with reduced dentition.(27,31) Fueki et al found that there is a direct correlation between the run-down of the occlusal platform and the bite force.(30) The masticatory performance determined by the number of the occlusal contacts and the position of the residual teeth are more critical for the subject's chewing performance than the total number of remaining teeth in the mouth.(6,32,33) People with missing molars can usually accommodate themselves to this situation by increasing the number of chewing cycles and consuming larger food particles.(34,35)

Kanno et al. (12) reviewed the papers published by the Dutch group about SDA and found that a fifth of the subjects with SDA suffered from chewing difficulty, as some needed to change their food preparation ways while others needed to chew for longer time than what they used to before losing their molars. The chewing discomfort that can be noticed by the patient is usually caused by missing molars with bounded saddle rather than a free end saddle.(23) The study of Kayser (6) suggested that the presence of less than four occlusal units in a symmetrical position or six occlusal units in an asymmetrical position will result in a reduction of the masticatory performance Therefore, the key for the success of SDA treatment modality is the presence of 20 well distributed teeth.(34,35) There is sufficient adaptive capacity that allows for acceptable oral function in subjects with all premolars present.(5,6,36) For some subjects

with SDA, the chewing ability, type of food, amount of food consumed and the perception of food is reduced, but within an acceptable degree.(23) Generally, subjects with SDA have minimal or no chewing problems.(12) as they still maintain 50-80 % of their chewing ability, which is considered satisfactory from a functional point of view.(37) However, people with extreme SDA where there is no or only one occlusal unit suffered from marked reduction in their chewing ability, compared to those with intact premolars with the presence of one pair of occluding molars, the latter had sufficient chewing ability.(33)

2.3 SDA and TMJ

Many treatment options can be provided for patients with SDA, and that includes no treatment and keeping the dentition limited to SDA.(14,16,17,38) However, the concern was based on a previous hypothesis which relates the loss of molars with the TMDs that can result in symptoms like joint sounds, pain, limited mouth opening etc.(39–42) This makes the clinicians believe that they have to replace any missing molar to preserve the patient's occlusion stability, masticatory performance and TMJ health.(8,12) However, there are no long term prospective studies providing evidence to support these hypotheses, and therefore, the prevention of TMD can no more justify the replacement of missing molars in patients with SDA.(12,42–44)

Loss of posterior teeth can predispose but not cause TMD.(45) It can accelerate the degenerative joint disease development. However, the replacement of these missing molars cannot be suggested as a preventive measure.(42) According to a study done by Witter et al. (46), they found that there was no significant difference in the signs and symptoms of TMD found between subjects with SDA and those with complete dentition. The absence of molar support did not initiate any signs or symptoms of masticatory dysfunction, however, some morphological changes in the TMJ may occur as a sign of adaptation and not considered pathological.(12)

Generally, the correlation between SDA and TMD is still a debate.(47) The periodontal ligament and the periosteum of the alveolar process are rich in nociceptors and mechanoreceptors, and this can support the idea of Hattori et al. (48) that the neuromuscular regulatory system is controlling the biting forces so that it will not exceed the load bearing capacity limit of the periodontal ligament. Therefore, he concluded that SDA does not cause overloading to neither the TMJ nor the teeth.

2.4 SDA and occlusal stability

Maintaining stable occlusion with complete dental arches is the primary goal in prosthetic treatment planning. However, in cases with missing or decayed teeth, achieving such goal is quite challenging since the dentist should keep in mind the technical and financial obstacles of each case.(49–51) The focus in the problem-oriented approach, when the complete dental arches are difficult to be preserved, is to maintain the most strategic teeth in the oral cavity.(5) Since the first permanent molars are the first permanent teeth to erupt in the mouth, they are more susceptible to caries and end up being heavily restored or even lost.(52,53) This is of special concern for people with low economic status, no health insurance and low level of dental education, who do not restore their missing molars and end up living with SDA.(51) Teeth migration and spacing can be seen in subjects with SDA, but the amount of migration can be considered within acceptable limits and clinically insignificant.(12,36)

Witter et al. (36) compared subjects with complete dental arches with those with three to five occlusal units to study the migration of teeth in subjects with SDA. He used interdental contacts, occlusal contacts, attrition, spacing and overbite as the variables to quantify the degree of remaining teeth migration. Subjects were further classified by age as over or under 40 years. The findings showed that overbite, occlusal contact, tooth wear were not been affected by the SDA or the age, but more spacing was found in the SDA group which was considered within acceptable levels. Therefore, SDA should not affect the occlusal stability. The same comparison

was also conducted by Sarita et al. (54), among the Tanzanian population. He found that the adverse effects on occlusal stability such as more occlusal contacts, vertical overlap, spacing and even teeth mobility had been found only among subjects with extremely short dental arches (zero to two pairs of occluding premolars), but no occlusal instability noticed in SDA patients with three or more occluding pairs.(12)

The loss of molar support used to be considered as a risk factor for occlusal instability as a result of severe and uncontrolled teeth migration that leads to mandibular overclosure or what is known as bite collapse.(55,56) This concept has led to the replacement of lost molars as a kind of treatment for the causative factor necessary to avoid occlusal instability.(57) However, as stated earlier, it was proven that although migration of teeth and the resulting spacing can occur in subjects with SDA, this amount of migration is considered acceptable.(36) In other studies, subjects with SDA occlusion were followed up after 3 and 6 years; and they were compared with subjects with complete dental arches. The results showed that over the six-year evaluation period; the SDA provided durable occlusal stability with no significant changes in occlusal contacts except for the minor spacing that occurred soon after the extraction that led to the SDA.(55,58) Individuals develop adaptive capacity to these minor changes which appear to limit themselves and lead to a new occlusal equilibrium and a stabilized occlusion.(58) Therefore, these spaces are considered adaptive more than pathological.(55,58) Interestingly, the results of the same study demonstrated that the use of free end saddle RPD did not prevent any changes in the occlusal stability. Finally, SDA also was not found to cause tooth wear.(58)

2.5 SDA and periodontal support

Witter et al.(59) evaluated the periodontal support for people with SDA with or without RPD and compared it with people with complete dental arches. The periodontal support in this study was examined by measuring the amount of teeth mobility and the alveolar bone height in radiographs. They found that subjects with SDA, with or without RPD in the mandible, had

more mobile teeth and lower alveolar bone scores. When increased occlusal loading, as in a reduced dentition cases, is combined with existing periodontal involvement, it represented a potential risk factor for the loss of teeth.(12)

According to Kayser (5), some subjects with extreme SDAs where there is no or less than four occlusal units present can survive with healthy periodontium and no complaints if their existing periodontal condition is maintained. On the other hand, other researchers observed that when there are no or only one occluding pair of premolars, subjects became more susceptible to tooth wear and mobility.(12,54)

When there is an existing periodontal condition, further periodontal breakdown and tooth loss is expected in subjects with SDA as a result of the combination of both periodontal involvement and increased occlusal loading. Overall, in Witter et al. (12,55) study, after six years of follow up, the amount of bone reduction was the same in both the SDA and the Complete Dental Arch (CDA) groups.

2.6 SDA and prosthetic rehabilitation

Many factors contribute to the patients seeking replacement of their missing posterior teeth. This specially occurs in cases of increased number of missing occlusal units, young age, presence of chewing complaints and asymmetric arch.(60) The decision to plan a treatment for any clinical situation should be based on strong evidence. All the risks and benefits of each treatment option need to be assessed properly as there are various treatment options available; like removable dentures, fixed prosthesis and the use of implants and each has a biological cost.(47,61) This allows us to provide the patient with the most preferable options for his/her situation to provide an effective treatment outcome based on objective scientific criteria. However, some clinical scenarios, such as SDA, are more challenging than others, because of lack of evidence, controversies, search strategies, the availability of variable recommendations and also the clinician's background which can affect this decision.(62–64)

The patient must always be provided with all treatment options available for his/her case which should include the option of no treatment and accepting the space he/she has (SDA). It is the patient's right to decide the treatment that suits him/her depending on their financial status, aesthetic demands, functionality etc. after providing them with the advantages and the disadvantages of each treatment option.(37) Patient preference is an essential factor for optimal treatment decision making.(65,66)

Traditionally, the routine dental practice was to restore the shortened dental arches with a bilateral free-end saddle RPD, aiming to restore aesthetic, masticatory ability and the stability of the opposing complete denture wherever present. Nevertheless, many studies reported a high biological cost for such type of treatment as being associated with high incidence of caries and periodontal breakdown, especially in elderly patients where there is growing evidence of the incidence of root surface caries that is associated with the wearing of RPDs. On the other hand, studies have reported that 30-50% of patients who were provided with RPD did not wear them or only wear them very few times.(10,11,55,67) Furthermore, in cases where there is three to five occlusal units, the provision of free end RPD did not provide any improvement in the oral function, and in fact, required further treatments and mechanical adjustments.(11,67,68) This also explains why many patients discontinue the use of the provided free end RPDs.(11)

When there is a need to extend the dental arch with RPD (properly fabricated RPDs have a rigid design that stabilizes the occlusion), the design needs to be periodontally friendly. No more than the most necessary molars need to be replaced. Additionally, maintenance follow up visits and meticulous oral hygiene are obligatory to preserve the abutment and non-abutment teeth. When this protocol is not followed, the periodontal breakdown especially of abutment teeth is likely possible.(5,69–71)

The missing posterior teeth can also be replaced with fixed prostheses, which are much preferred by patients. A more conservative, minimally invasive and fixed option that is

preferred to be used in this condition is the cantilevered resin bonded bridge. This prosthesis is simple, provides good occlusal stability, lessens caries incidence, reduces negative effect on the TMJ and allows safe failure. Besides, it has the advantage of more normal contour and less bulk that contributes to its higher preference by patients.(61,72–74) Durey et al. (75) properly described patient assessment, bridge design and the clinical tips to provide a long lasting RBB, he also mentioned that it is the preferred treatment option for short spans. The location of the RBB, whether it is in the anterior or posterior region, was not found to affect its success.(74) A prospective study, by King et al. (76) evaluated 771 RBBs and reported a ten year estimated survival rate of 80.4% with minimal or no preparation needed, with the most likely mode of failure being debonding and such complications can be fixed by simply recementing the prosthesis. RBBs are associated with high patient satisfaction both aesthetically and functionally and have low biological cost.(73,76,77)

Other options to replace missing molars are implants. The use of implants in the posterior region reduced the risk associated with the conventional Fixed Partial Dentures (FPDs) which require support, retention and resistance from the adjacent teeth and eliminate the need to use compromised teeth as prosthesis abutment, since prosthesis can be supported without the use of abutment teeth. Implants can be considered a preferred treatment for missing posterior teeth and provide many advantages over RPD for many reasons; implants are associated with more stable occlusion, improved support, simplification of the prosthesis and preservation of bone. Furthermore, it can be considered a less invasive restorative treatment for the remaining dentition which improves the patient's long term oral health. Planning implants for missing molars depends on many variables such as available space, occlusion, number and position of the implants, type of the prosthesis and the overall treatment plan. Implants are associated with a high 10-year survival rate (more than 90%).(78,79)

Generally, in the posterior region, the placement of multiple single-tooth implants shows extremely well performance. In addition, certain implant designs can preserve the available bone and provide good stability.(80) However, more studies are needed to validate treatment with implant-supported fixed prosthesis for SDA subjects.(60)

RPD is a common treatment modality especially for missing molars. Yet, keeping into consideration that both RBB and RPD have almost the same five year survival rates,(60,61) it is preferable to restore the missing molars with RBB for the following reasons; RPD has been associated with greater incidence of TMD, caries,(60,73) adverse effect on the periodontium, (47,72,73,81) while providing little improvement of chewing ability, oral comfort, OHRQoL and occlusal stability for the subjects with SDA.(11,60,67,82) Additionally, it requires more maintenance visits than RBB.(60,61) RBB appears to be more conservative on the remaining dentition, and is associated with less plaque accumulation, less caries incidence, less periodontal break down and more oral comfort and patient satisfaction than RPD.(60,61,73,77) Consequently, providing an SDA subject with no treatment or RBB is preferred to prescribing RPD.(60,61)

The financial situation of the subject is essential in the prosthetic treatment decision, and for those with limited resources it limits the options to either replacing the missing posterior teeth with RPD or restoring the dentition to provide premolar occlusion with or without fixed prosthesis.(6,66,81) SDA concept is found to be a more cost effective treatment strategy than RPD replacement therapy.(83)

Greater restorations in subjects with SDA may have many explanations; it may be that this group of subjects (with SDA) are at high risk of caries, periodontal diseases and other dental conditions that led to the loss of their molars at the first place, but more likely to be a replacement of a previous restoration either because of a filling fracture or secondary caries. This is the more likely reason since more than 50% of restorations provided to patients are a

replacement of a previous restoration.(81,84) Some have the idea that the overloading of teeth in SDA subjects may cause fillings failure, but this is less likely to be the cause if we considered that subjects with SDA have much less occlusal forces than subjects with CDA.(81,82)

Tooth loss is a normal expected consequence in the geriatric population, however most of the elderly patients are still retaining some of their natural teeth until later in life.(85) Such patients require careful long-term treatment planning and close monitoring, because of their age-related factors like poor vision and poor manual dexterity that impair their ability to perform good oral hygiene for both their natural dentition and prosthesis.(85,86) The medical condition of the patient is an additional factor that can limit the treatment options available, especially for implants.(87,88) Elderly patients are at risk of xerostomia particularly because of the medications they are taking, which make them at risk of caries, candida and bacterial infections as well as poorly fitting dentures.(86) For such cases, the recommendation of preserving SDA can be considered a favorable treatment option to avoid the risks or side effects associated with other options like implants or RPD.(47)

2.7 SDA and oral health-related quality of life

As a general explanation, to evaluate Oral Health-Related Quality of Life (OHRQoL), Oral Health Impact Profile (OHIP) needs to be measured by answering a questionnaire with specific questions. High OHIP scores indicate additional problems and therefore relate to a lower OHRQoL.(89) The oral function of a subject is reflected on his/her OHRQoL and it plays an important role in the evaluation of the oral function, since it affects both the dental health and also has psychological and social effects.(90)

The shortening of the dental arch has a direct influence on the OHRQoL. However, this influence is somehow controversial, since some authors suggest that the loss of one occlusal unit will have a negative effect on the OHIP score, which means an impairment in the OHRQoL.(91) On the other hand, others found that subjects with SDA are generally satisfied

with their oral status to an equivalent degree as those with complete or restored dental arches.(92)

The provision of RPD for an SDA subject did not result in an improvement in OHRQoL, except when anterior teeth were missing.(93) In a study by Witter et al. (67) free-end RPDs did not appear to help oral comfort while SDA was found to provide a sufficient amount of oral comfort. Besides, when pain or distress was compared between subjects with SDA, subjects with CDA, and subjects with distal extension RPD, significant differences were found between the groups.(12)

Some observational studies show that there is an impairment of the OHRQoL in subjects with SDA(91), and the replacement of these missing teeth can have a positive impact on the OHRQoL.(93,94) Since most of these studies are observational, this limits the validity of the findings. On the other hand, other authors did not observe a negative impact of SDA on OHRQoL.(12,95,96) One can therefore argue that subjects who are not comfortable with their SDA, meaning that they have problems with it (negative OHRQoL impact), will seek prosthetic replacement. On the other hand, those who have no issues will accommodate and seek no further treatment.(60,97) The OHRQoL for people replacing their missing molars with RPD or using the SDA concept was found to be similar, and it remained stable even after 10 years of follow-ups.(89,98) Reissmann et al. (89) found that after 10 years of follow up, both RPD and SDA are predictable treatment options and neither is superior over the other for subjects with missing molars. Additionally, both RPD and SDA have the same OHRQoL, so it is recommended to bring the patient up to a level of information that would allow him/her to know the advantages and disadvantages of each treatment modality, therefore a shared-decision making will then be possible.

Finally, the effect of restoring an SDA subject with implant supported prosthesis on OHRQoL needs further investigation.(98)

2.8 Survival of SDA

One of the concerns regarding applying SDA treatment modality is its longevity, putting in mind that SDA subjects mostly had dental conditions that lead to SDA, making them at increased risk of dental diseases.(81)

Based on a study by Gerritsen et al. (81) the SDA can survive up to 27 years and even longer, with the total number of treatments provided being comparable to those with CDA.

2.9 Dentist attitude towards the SDA concept

The SDA concept is globally accepted by a wide range of dental practitioners, health care authorities and patients because of the increasing numbers of elderly dentate patients with variable economic status. However, the SDA concept is not widely practiced.(12,47)

Only few studies are available to evaluate dentists' attitude towards the SDA concept. And although many of these studies show supportive opinions towards the SDA approach, there is a recent increase in the studies that are opposing the SDA concept.(47)

In the Netherlands, when the dentists were surveyed about the application of the SDA concept in their dental practice, it was found that they apply it to less than 10% of their patients and that the patients were generally satisfied with it. This supports the use of the SDA concept for elderly patients, especially those who are not suitable for complex restorative treatments due to health or financial restrictions. Generally, the clinicians found it useful to use the SDA concept in their clinical practice.(12,14)

Kasim et al. (99) suggested that the use of the SDA concept in Malaysia will be helpful in shortening the long waiting lists for dentures in governmental centers. The result of his survey showed that dentists in Malaysia have good knowledge and perception of the concept. Still more effort is needed to implement it in their practice Also, dentists in Jordan were aware as well about the SDA concept, especially younger dentists with fewer years of experience. They have a positive attitude about the concept especially because it is a cost effective approach.

However, they do not really apply it in their dental practice to more than 10% of their patients.(100) These findings were in agreement with other studies performed in other countries like the United Kingdom (UK), India, Netherlands and Tanzania.(14,16,33,101)

In the Kingdom of Saudi Arabia (KSA), Alammari found that dentists accepted the concept when they were informed about it. However, there is a lack in the knowledge and understanding of the concept in KSA. Besides, the financial benefit for the dentists limits its use in private practice.(19) Another study also in the KSA found that less than 10% of KSA dentists apply the concept in their practice. Dental residents felt that applying the concept may be associated with TMD, tooth wear and teeth migration. The same study also showed that less than 10% of patients refused this type of treatment when proposed to them.(15) The same was found among Australian dentists in Victoria who were not aware about the concept, but found it acceptable, practical and effective to be used for elderly patients.(17)

The Swedish General Dental Practitioners (GDPs) community have a positive attitude towards the SDA concept. They claimed that SDA subjects are satisfied with their functional ability and aesthetics.(102)

Some of the studies that were against the concept, claimed that SDA was associated with a reduction in the biting force.(60) And difficulties in eating was related to the reduction in the number of occluding units, (24–26,28,31) and an increased risk of TMD.(45)

Although the concept appears to be widely accepted among dentists who believe that this approach provides satisfactory function, aesthetics and oral comfort, they do not tend to implement it in their real clinical practice and instead provide their patients with RPD.(65)

While there is a need for additional studies of longer duration and with more specific inclusion criteria, it seems that the SDA concept deserves to remain as a treatment option in the absence of evidence against its use.(47)

3. AIM

The application of the SDA concept among dentists in the UAE and patients' response to this type of treatment has not yet been investigated. Therefore, this study aims to:

- 1- Evaluate the awareness of dentists about SDA concept and its application in their practice.
- 2- Investigate the preferred treatment modality for SDA patients and the factors that affect this decision among dentists in the UAE.

4. MATERIALS AND METHODS

4.1 Research Ethics Board approval

Approval for the study was obtained from the Research and Ethics Committee at Hamdan Bin Mohammed Collage of Dental Medicine (reference number: MBRU-IRB-2020-020) (Appendix 1), Ministry of Health And Prevention (reference number: MOHAP/DXB-REC/MMM/No. 47/2020) (Appendix 2).

4.2 Study design

This is a cross sectional study involving the collection of data on the knowledge of dentists in the UAE regarding SDA and whether they apply it in their regular practice or not.

4.3 Sampling technique and sample size

GDPs and specialists registered with the Emirates Medical Association (EMA) in Dubai were eligible to participate. An online survey (Appendix 3) was shared by email to all dentists registered under EMA. A sample size calculation determined that 677 participants should be included in the current study considering a 20% non-response rate.

The calculation of sample size was based on the 34.4% awareness degree on SDA among the responding dentists in Alammari (2017) study in KSA using the following formula:

$$N = Z_{\alpha/2}^2 \frac{pq}{B^2}$$

Where $Z_{\alpha/2} = 1.96$ and S is SD from the previous study and B is the width of 95% CI, given by

$$B = z_{\alpha} \frac{pq}{\sqrt{n}}$$

Using the above equation and data from the study done by Alammari (2017), where p= 34.4% and the sample size is 154, the above equation with given data yields a sample of 542 participants.

4.4 Inclusion criteria

All dentists registered with the EMA.

4.5 Exclusion criteria

None

4.6 Data collection

A modified questionnaire used in a previous study in KSA by Alammari (2017) was sent to all dentists registered in EMA, a total of 901. Alammari used a self-designed structured questionnaire and validated it using a pilot study. The original questionnaire consisted of 13 questions, which we modified it into 19 questions. Additional questions added, besides consent-related questions, include questions on latest academic qualification, years of experience, and specialty. A letter explaining the aim of the study and providing brief information about the SDA concept being a problem-oriented approach as described by Kayser was provided with the questionnaire.

The questionnaire contained additional questions on the dentist's gender and type of dental practice, in addition to asking about the treatment that dentists ordinarily apply to patients with existing SDA conditions and the main objective of the treatment.

Another question is to determine the dentist's knowledge about SDA: "Have you heard about the SDA concept as outlined in the attached information?" These items assess the dentist's experience with the application of the SDA concept: perceived level of experience, percentage of patients treated by actively applying the concept, patient's reaction on proposal to adopt SDA and opinion about oral function of patients with SDA.

Two items assess the dentists' perceived opinion about the problem-oriented approach and the SDA concept: (1) "Do you agree with the problem-oriented approach as outlined in the attached information?" and (2) "Do you agree with the criteria for shortening dental arches as outlined in the attached information?". Finally, two items concern the implementation of the problem-

oriented approach and the shortened dental arch concept in UAE in terms of acceptance among dentists and application in dental practice.

Dentists were informed that the study is anonymous, and the data was analyzed collectively. Questionnaires were sent through emails. The first email was sent on 08-06-2020, followed by a reminder email after 2 weeks and a second reminder after 3 months (on 4-10-2020).

Reminder emails were sent after a period of 2 weeks. Thereafter, reminder emails were sent after 2 months. Comparison of proportions was conducted using the chi-square test and the level of significance used was 5%.

4.7 Statistical analysis

Data was entered using Statistical Package for Social Sciences (SPSS) for Windows (IBM-SPSS) version 25.0 (SPSS Inc., Chicago, IL, USA). Measure of percentage was performed as descriptive statistics for categorical variables. The data was described and analyzed in contingency and frequency tables, and means and standard deviations were calculated using independent Student's t-test for analyses of groups of dentists with respect to gender, specialty, country of last academic degree, years of experience and dental organization. To study explanatory patterns regarding the variables (gender, type of dental practice, specialty, country of last academic degree and the years of experience) influencing dentists' choice of treatment in an SDA and the frequency of SDA usage, a chi-square analysis was used. These categorical variables were cross-tabulated to examine the independency between variables. For such variables, the χ^2 -square test or Fisher's exact test, as appropriate, was used. A P-value of less than 0.05 is considered significant in all statistical analyses.

5. RESULTS

5.1 Attributes of the responding dentists

Out of the 901 questionnaires distributed through EMA, 363 of the recipients responded, which accounts for a response rate of 40.3%. There were more males (n=239, 66.9%) among the respondents than females (n=118, 33.1%). The majority of the respondents were UAE graduates (n=204, 56.2%) and 36.1% (n=131) were graduates from other countries. Regarding the number of years in the profession for the participants in this study, 41.5% (n= 149) had more than ten years of experience, while 39.8% (n=143) and 18.7% (n=67) had 3-10 and less than 3 years of experience, respectively. Most of the participating dentists were GDPs (58.1%). The majority of respondents were practicing in the government sector (54.9%) while 45.1% were in the private sector. The characteristics of the sample under study are summarized in

Table 1.

Table 1: Characteristics of the sample under study

Items	No (%)
Gender	
Male	239 (66.9)
Female	118 (33.1)
Year of experience	
< 3 years	67 (18.7)
3-10 years	143 (39.8)
> 10 years	149 (41.5)
Highest qualification	
GDP	209 (58.1)
Specialist	151 (41.9)
Specialty	
Prosthodontist	51 (14.0)
Orthodontics	29 (8.0)
Oral medicine and radiology	2 (0.6)
Pediatric	26 (7.2)
Endodontic resident	21 (5.8)
Periodontics	8 (2.2)
Oral surgery	19 (5.2)
Country of last academic degree	
UAE	204 (56.2)
Expatriate	131 (36.1)
Dental practice	
Government clinic	195 (54.9)
Private clinic	160 (45.1)

5.2 Awareness about SDA and selected mode of treatment for SDA

Two third of the dentists participating in the study (n=237, 65.8%) had already heard about the SDA concept. Although the majority of the surveyed dentists have heard about the SDA concept, more than half of them do not implement it (54.7%) or rarely use it (14.2%) in their practice (Table 2).

Table 2: Knowledge about SDA and selected mode of treatment

Items	No (%)
Heard about SDA	
No	123 (34.2)
Yes	237 (65.8)
Using SDA in practice	
No	196 (54.7)
Yes, always	14 (3.9)
Yes, rarely	51 (14.20)
Yes, sometimes	97 (27.1)
Always replacing missing Molar	
No	177 (49.2)
Yes	183 (50.8)
Treating a patient with missing posterior teeth	
No treatment	6 (1.7)
Acrylic RPD	129 (35.5)
Cantilever Bridge	15 (4.1)
Implant	169 (46.6)
Metallic	44 (12.1)
Replace missing Molar	
Both (mastication + aesthetics)	159 (44)
To improve aesthetics	2 (0.6)
To improve masticatory ability	160 (44.3)
To satisfy patient's demand	40 (11.1)

There was no considerable difference between the number of dentists who always replace missing molars and those who do not, 50.8% (n= 183) and 49.2% (n= 177), respectively. Those who preferred to replace the missing molars chose to replace these teeth with implant supported prosthesis (n= 169, 46.6%), followed by acrylic removable partial dentures (n=129, 35.5%). The most selected reason for replacing the molars was improving mastication (n=160, 44.3%) followed by improving both the mastication and aesthetics (n=159, 44%), while 11.1% of the dentists replace the missing molars mainly upon patient's request (Table 2).

Among the surveyed dentists, 65.8% (n=237) were aware of the SDA concept, but a substantial proportion (n=126, 35%) were unaware of it and came to know about SDA concept only when reading this survey (Table 3). A significant association was found when the time to know about SDA was compared with the country of last academic degree (P-value = 0.001), with dentists graduated from other countries knowing about it earlier in their career than UAE graduates (Table 4). A significant difference between UAE and non-UAE graduates was detected (P-value 0.030) regarding having a previous idea about SDA, where non-UAE graduates seemed to have an earlier background about SDA (n=95, 73.1%) than UAE graduates (n=127, 62.6%) (Table 5).

Table 3: Time to know about SDA

Item	No (%)
Time to know about SDA	
Just now	126 (35)
< 5 years back	123 (34.20)
5-10 years	58 (16.1)
>10 years back	53 (14.7)

Table 4: Relationship of dentist's highest qualification with time to know about SDA and the patient's reaction to SDA

	UAE	Non-UAE	Total	P-value
Time to know about SDA				
Just now	81 (40.1%)	34 (26.0%)	115 (34.5%)	0.001
< 5 years back	72 (35.6%)	41 (31.3%)	113 (33.9%)	
5-10 years	29 (14.4%)	24 (18.3%)	53 (15.9%)	
>10 years back	20 (9.9%)	32 (24.4%)	52 (15.6%)	
Patient's reaction after proposed SDA				
Agree immediately	16 (8.0%)	5 (3.9%)	21 (6.4%)	0.055
Agree after explanation	69 (34.5%)	62 (48.1%)	131 (39.8%)	
Didn't propose SDA to my patients	95 (47.5%)	54 (41.9%)	149 (45.3%)	
Objection	20 (10.0%)	8 (6.2%)	28 (8.5%)	

Table 5: Relationship between country of last academic degree with knowledge about SDA and selected mode of treatment

	UAE	Non-UAE	Total	P-Value
Heard of the SDA				
No	76 (37.4%)	35 (26.9%)	111 (33.3%)	0.030
Yes	127 (62.6%)	95 (73.1%)	222 (66.7%)	
Use the SDA in Practice				
No	121 (59.9%)	59 (45.4%)	180 (54.2%)	0.010
Yes	81 (40.1%)	71 (54.6%)	152 (45.8%)	
Replacing missing molar				
No	107 (52.7%)	57 (43.8%)	164 (49.2%)	0.071
Yes	96 (47.3%)	73 (56.2%)	169 (50.8%)	
Treat missing posterior teeth				
No treatment	5 (2.5%)	0 (0.0%)	5 (1.5%)	0.047
Acrylic RPD	76 (37.3%)	39 (29.8%)	115 (34.3%)	
Cantilever Bridge	9 (4.4%)	5 (3.8%)	14 (4.2%)	
Implant	95 (46.6%)	63 (48.1%)	158 (47.2%)	
Metallic RPD	19 (9.3%)	24 (18.3%)	43 (12.8%)	
Replace missing molars				
To improve masticatory ability	87 (42.6%)	62 (47.7%)	149 (44.6%)	0.543
To improve aesthetics	1 (0.5%)	1 (0.8%)	2 (0.6%)	
Both (mastication +aesthetics)	91 (44.6%)	57 (43.8%)	148 (44.3%)	
To satisfy patient's demand	25 (12.3%)	10 (7.7%)	35 (10.5%)	

5.3 Relationship between different factors and SDA awareness and mode of treatment for SDA

5.3.1 Highest qualification

Results revealed that specialists were more aware about the SDA concept and apply it more frequently in the clinical practice than the GDPs (P-value = 0.000, 0.041 respectively). When comparing time to know about SDA between Specialists and GDPs, the difference was statistically significant (P-value 0.004). Most of the GDPs knew about SDA just when they received this survey (n=87, 42.0%), while the majority of the Specialists knew about it less than 5 years back (n=52, 34.4%) (Table 6).

Table 6: Relationship between highest qualification with time to know about SDA and patient's reaction to SDA proposal

	GDP	Specialist	Total	P-value
Time to know about SDA				
Just now	87 (42.0%)	39 (25.8%)	126 (35.2%)	0.004
< 5 years back	70 (33.8%)	52 (34.4%)	122 (34.1%)	
5-10 years	27 (13.0%)	30 (19.9%)	57 (15.9%)	
>10 years back	23 (11.1%)	30 (19.9%)	53 (14.8%)	
Patient's reaction after proposed SDA				
Agree immediately	17 (8.3%)	8 (5.4%)	25 (7.1%)	0.010
Agree after explanation	67 (32.5%)	70 (47.3%)	137 (38.7%)	
Didn't propose SDA to my patients	108 (52.4%)	55 (37.2%)	163 (46.0%)	
Objection	14 (6.8%)	15 (10.1%)	29 (8.2%)	

A high percentage of GDPs preferred to replace the missing molars (n=120, 57.4%), while the majority of the Specialists preferred not to replace them (n=88, 59.1%) (P-value = 0.001). When molars were decided to be replaced, Specialists preferred to use implants as the first treatment of choice (n=78, 51.7%). However, GDPs selected both implants (n=89, 42.6%) and acrylic RPDs (n=87, 41.6%) as the preferred treatment options (P-value = 0.004) (Table 7).

Table 7: Relationship between the highest qualification with knowledge about SDA and the selected mode of treatment for SDA

	GDP	Specialist	Total	P-Value
Heard of the SDA				
No	87 (41.6%)	36 (24.2%)	123 (34.4%)	0.000
Yes	122 (58.4%)	113 (75.8%)	235 (65.6%)	
Use the SDA in Practice				
No	124 (60.2%)	71 (47.3%)	195 (54.8%)	0.041
Yes	82 (39.8)	79 (52.7)	161 (45.2)	
Replacing missing molar				
No	89 (42.6%)	88 (59.1%)	177 (49.4%)	0.001
Yes	120 (57.4%)	61 (40.9%)	181 (50.6%)	
Treat missing posterior teeth				
No treatment	3 (1.4%)	3 (2.0%)	6 (1.7%)	0.004
Acrylic RPD	87 (41.6%)	41 (27.2%)	128 (35.6%)	
Cantilever Bridge	12 (5.7%)	3 (2.0%)	15 (4.2%)	
Implant	89 (42.6%)	78 (51.7%)	167 (46.4%)	
Metallic	18 (8.6%)	26 (17.2%)	44 (12.2%)	
Replace missing molars				
Both (mastication +aesthetics)	92 (44.2%)	66 (43.7%)	158 (44.0%)	0.438
To improve masticatory ability	88 (42.3%)	71 (47.0%)	159 (44.3%)	
To satisfy patient's demand	26 (12.5%)	14 (9.3%)	40 (11.1%)	

5.3.2 Gender

Generally, both male and female practitioners had a background about the SDA concept. However, females (n=71, 60.7%) seem to replace missing molars more frequently in their practices than males do (n=109, 45.8%) (P-value 0.006). Males (n=155, 48.3%) thought that replacing missing molars will improve both mastication and aesthetics, while females (n=63, 53.4%) believed mastication is improved by replacing molars (Table 8). There was no difference between males and females in their choice of treatment to replace missing molars where for both the groups, implants was the first choice followed by acrylic RPDs.

Table 8: Relationship between gender with knowledge about SDA and selected treatment mode

	Male	Female	P-value
Heard of the SDA			
No	83 (34.9)	40 (34.2)	0.498
Yes	155 (65.1)	77 (65.8)	
Use the SDA in Practice			
No	136 (57.6)	57 (48.7)	0.160
Yes	200 (42.4)	60 (51.3)	
Replacing missing molar			
No	129 (54.2)	46 (39.3)	0.006
Yes	109 (45.8)	71 (60.7)	
Treat missing posterior teeth			
No treatment	4 (1.7)	2 (1.7)	0.839
Acrylic RPD	90 (37.7)	37 (31.4)	
Cantilever Bridge	10 (4.2)	5 (4.2)	
Implant	107 (44.8)	58 (49.2)	
Metallic	28 (11.7)	16 (13.6)	
Replace missing molars			
Both (mastication +aesthetics)	155 (48.3)	42 (35.6)	0.026
To improve masticatory ability	96 (40.3)	63 (53.4)	
To satisfy patient's demand	27 (11.3)	13 (11)	

5.3.3 UAE vs Non-UAE graduates

A significant difference was detected (P-value 0.010) when the application of SDA concept in practice was compared between UAE and non-UAE graduates. The majority of UAE graduates did not use the SDA concept in their practice (n=121, 59.9%), while the majority of non-UAE graduates did apply it in their practice (n=71, 54.6%). There was a high preference by both groups to replace the missing molars with implants (P-value 0.047). Both groups selected the improvement of mastication and aesthetics as the main two reasons to replace missing molars (Table 5).

5.3.4 Years of experience

A statistically significant association (P-value = 0.018) was found when years of clinical experience was compared with the awareness of SDA. The awareness of the concept increases with the increase in the years of experience (Table 4). However, no association was found between the years of experience and applying the concept in the clinical practice (P-value =

0.118). With regards to the preferred treatment modality to replace missing molars, a statistically significant difference was detected between the years of experience and type of treatment provided (P-value = 0.004). The majority of dentists with less than 3 years of experience (n=35, 52.2%) preferred to replace missing molars with acrylic RPD, while implant is the preferred treatment option for dentists with more years of experience. A significant association also was detected between years of experience and the reasons for molars replacement (P-value = 0.023) (Table 9).

Table 9: Relationship between years of experience with knowledge about SDA and treatment practice and selected mode of treatment

	Years of experience			Total	P-Value
	< 3 years	3-10 years	> 10 years		
Heard of the SDA					
No	30 (44.8%)	53 (37.3%)	39 (26.4%)	122 (34.2%)	0.018
Yes	37 (55.2%)	89 (62.7%)	109 (73.6%)	235 (65.8%)	
Use the SDA in Practice					
No	45 (67.2%)	79 (55.6%)	70 (47.9%)	194 (54.6%)	0.118
Yes	22 (32.8%)	63 (44.4%)	76 (52.1%)	161 (45.4%)	
Replacing missing molar					
No	28 (41.8%)	81 (57.0%)	65 (43.9%)	174 (48.7%)	0.037
Yes	39 (58.2%)	61 (43.0%)	83 (56.1%)	183 (51.3%)	
Treat missing posterior teeth					
No treatment	2 (3.0%)	3 (2.1%)	1 (0.7%)	6 (1.7%)	0.004
Acrylic RPD	35 (52.2%)	46 (32.2%)	45 (30.2%)	126 (35.1%)	
Cantilever Bridge	3 (4.5%)	4 (2.8%)	8 (5.4%)	15 (4.2%)	
Implant	17 (25.4%)	79 (55.2%)	72 (48.3%)	168 (46.8%)	
Metallic	10 (14.9%)	11 (7.7%)	23 (15.4%)	44 (12.3%)	
Replace missing molars					
Both (mastication +aesthetics)	21 (31.3%)	70 (49.3%)	67 (45.0%)	158 (44.1%)	0.023
To improve masticatory ability	38 (56.7%)	49 (34.5%)	71 (47.7%)	158 (44.1%)	
To satisfy patient's demand	8 (11.9%)	22 (15.5%)	10 (6.7%)	40 (11.2%)	

5.3.5 Type of dental practice

A higher percentage of private sector dentists (n=94, 58.8%) chose to replace missing molars, while dentists in the government sector preferred not to replace missing molars (n=108, 56.0%) (P-value = 0.004) (Table 10).

Table 10: Relationship between type of dental practice (private vs. government) with knowledge about SDA and selected mode of treatment

	Dental Practice		Total	P-Value
	Government	Private		
Heard of the SDA				
No	64 (33.2%)	56 (35.0%)	120 (34.0%)	0.401
Yes	129 (66.8%)	104 (65.0%)	233 (66.0%)	
Use the SDA in Practice				
No	113 (58.9%)	79 (49.7%)	192 (54.7%)	0.281
Yes	79 (41.1%)	80 (50.3%)	159 (45.3)	
Replacing missing molar				
No	108 (56.0%)	66 (41.3%)	174 (49.3%)	0.004
Yes	85 (44.0%)	94 (58.8%)	179 (50.7%)	
Treat missing posterior teeth				
No treatment	4 (2.1%)	2 (1.3%)	6 (1.7%)	0.985
Acrylic RPD	68 (34.9%)	57 (35.6%)	125 (35.2%)	
Cantilever Bridge	8 (4.1%)	7 (4.4%)	15 (4.2%)	
Implant	91 (46.7%)	74 (46.3%)	165 (46.5%)	
Metallic	24 (12.3%)	20 (12.5%)	44 (12.4%)	
Replace missing molars				
Both (mastication +aesthetics)	77 (39.5%)	80 (50.0%)	157 (44.2%)	0.253
To improve masticatory ability	93 (47.7%)	64 (40.0%)	157 (44.2%)	
To satisfy patient's demand	24 (12.3%)	15 (9.4%)	39 (11.0%)	

5.4 Dentists' opinions related to risks and benefits of the SDA concept

Great variation was observed in reviewing the dentists' opinions towards the SDA concept regarding appearance, chewing function, speech and oral comfort (Table 11). The general opinion among the participating dentists was that there were some risks associated with SDA. The majority believed that SDA is associated with teeth migration (n=211, 59.9%), teeth wear (n=196, 55.8%), and/or TMD (n=163, 45.3%) (Table 12). In the evaluation of the advantages associated with SDA, there was a high agreement score for: "simplify oral hygiene", "allows for simpler treatment planning", "allows the patient to keep their own natural teeth longer" and "allows better patient economy" (Table 12). Both genders were found to have the same attitude regarding risks and benefits of SDA (Table 13).

Table 11: Opinions regarding SDA

	Satisfactory	Acceptable	Unsatisfactory	Don't Know
Chewing Function	104 (29)	159 (44.3)	42 (11.7)	54 (15)
Dental Appearance	112 (31.7)	150 (57.5)	40 (11.3)	51 (14.4)
Oral Comfort	110 (32.1)	139 (40.5)	39 (11.4)	55 (16)
Speech	141 (40.4)	143 (41)	15 (4.3)	50 (14.3)

Table 12: Opinion regarding SDA's risks and benefits

	Agree	Disagree	Don't Know
SDA contributes to			
TMJ Disorders	163 (45.3)	78 (21.7)	119 (33.1)
Teeth Wear	196 (55.8)	70 (19.9)	85 (24.2)
Teeth Migration	211 (59.9)	77 (21.9)	64 (18.2)
Speech Problem(s)	99 (28.3)	173 (49.4)	78 (22.3)
The SDA will			
Simplify oral hygiene for patients	253 (71.5)	46 (13)	55 (15.5)
Allow better patient economy	235 (67.1)	45 (12.9)	70 (20)
Allow for simpler treatment planning	253 (71.7)	49 (13.9)	51 (14.4)
Allow patients to keep their own teeth longer	196 (56)	73 (20.9)	81 (23.1)
Reduce the risk of over-treatment	233 (66.2)	50 (14.2)	69 (19.6)

Table 13: Association between gender and attitude towards using SDA

SDA contributes to	Male	Female	P-value
TMJ Disorders			
Agree	108 (45.6)	54 (45.8)	0.233
Disagree	46 (19.4)	31 (26.3)	
I don't know	83 (35)	33 (28)	
Teeth Wear			
Agree	128 (55.9)	65 (55.6)	0.996
Disagree	46 (20.1)	24 (20.5)	
I don't know	55 (24)	28 (23.9)	
Teeth Migration			
Agree	141 (61)	67 (57.8)	0.180
Disagree	45 (19.5)	32 (27.6)	
I don't know	45 (19.5)	17 (14.7)	
Speech Problem(s)			
Agree	67 (29.4)	31 (26.5)	0.779
Disagree	110 (48.2)	61 (52.1)	
I don't know	51 (22.4)	25 (21.4)	
The SDA will simplify oral hygiene for patients			
Agree	162 (69.5)	87 (74.4)	0.193
Disagree	36 (15.5)	10 (8.5)	
I don't know	35 (15)	20 (17.1)	
Allow better patient economy			
Agree	151 (65.9)	80 (69)	0.262
Disagree	27 (11.8)	18 (15.5)	
I don't know	51 (22.3)	18 (15.5)	
Allow for simpler treatment planning			
Agree	165 (71.4)	84 (71.8)	0.958
Disagree	32 (13.9)	17 (14.5)	
I don't know	34 (14.7)	16 (13.7)	
Allow patients to keep their own teeth longer			
Agree	131 (57.5)	62 (53)	0.139
Disagree	40 (17.5)	31 (26.5)	
I don't know	57 (25)	24 (20.5)	
Reduce the risk of over-treatment			
Agree	147 (63.9)	82 (70.1)	0.506
Disagree	35 (15.2)	14 (12)	
I don't know	48 (20.9)	21 (17.9)	

5.5 Relationship between different factors and the dentists' opinions related to risks and benefits of the SDA concept

5.5.1 Highest qualification

Both Specialists and GDPs agreed that SDA contributes to TMDs (P-value = 0.000) and teeth migration (P-value = 0.011). Both also disagreed that SDA is associated with any speech problems (P-value 0.015) (Table 14).

5.5.2 Gender

Both genders had the same opinion that SDA provides satisfactory chewing function, dental appearance, oral comfort, and speech. Both genders agreed that SDA has some disadvantages like TMDs, tooth wear, teeth migration but disagreed of it being associated with any speech problems (Table 13).

5.5.3 UAE vs. Non-UAE graduates

Participants who graduated from universities in UAE and non-UAE countries expressed similar opinions of the SDA concept and had the same attitude towards chewing function, dental appearance, oral comfort and speech. The only exception was regarding the teeth migration (P-value = 0.001) as a significantly higher percentage of UAE graduates (n=130, 65.3%) agreed that teeth migration is considered a negative consequence of not replacing missing molars compared to dentists who graduated from universities in other countries (n=67, 53.2%) (Tables 15 and 16).

Table 14: Association between highest qualification and attitude towards using SDA

SDA contributes to	GDP	Specialist	Total	P-value
TMJ Disorders				
Agree	104 (50.0%)	59 (39.3%)	163 (45.5%)	0.000
Disagree	27 (13.0%)	51 (34.0%)	78 (21.8%)	
I don't know	77 (37.0%)	40 (26.7%)	117 (32.7%)	
Teeth Wear				
Agree	121 (59.3%)	74 (51.0%)	195 (55.9%)	0.092
Disagree	33 (16.2%)	37 (25.5%)	70 (20.1%)	
I don't know	50 (24.5%)	34 (23.4%)	84 (24.1%)	
Teeth Migration				
Agree	121 (59.3%)	89 (61.0%)	210 (60.0%)	0.011
Disagree	37 (18.1%)	40 (27.4%)	77 (22.0%)	
I don't know	46 (22.5%)	17 (11.6%)	63 (18.0%)	
Speech Problem(s)				
Agree	65 (32.0%)	34 (23.4%)	99 (28.4%)	0.015
Disagree	87 (42.9%)	85 (58.6%)	172 (49.4%)	
I don't know	51 (25.1%)	26 (17.9%)	77 (22.1%)	
The SDA will simplify oral hygiene for				
Agree	144 (70.9%)	107 (71.8%)	251 (71.3%)	0.887
Disagree	28 (13.8%)	18 (12.1%)	46 (13.1%)	
I don't know	31 (15.3%)	24 (16.1%)	55 (15.6%)	
Allow better patient economy				
Agree	130 (64.7%)	103 (70.1%)	233 (67.0%)	0.321
Disagree	25 (12.4%)	20 (13.6%)	45 (12.9%)	
I don't know	46 (22.9%)	24 (16.3%)	70 (20.1%)	
Allow for simpler treatment planning				
Agree	139 (68.5%)	112 (75.7%)	251 (71.5%)	0.289
Disagree	30 (14.8%)	19 (12.8%)	49 (14.0%)	
I don't know	34 (16.7%)	17 (11.5%)	51 (14.5%)	
Allow patients to keep their own teeth				
Agree	111 (55.2%)	85 (57.8%)	196 (56.3%)	0.540
Disagree	39 (19.4%)	32 (21.8%)	71 (20.4%)	
I don't know	51 (25.4%)	30 (20.4%)	81 (23.3%)	
Reduce the risk of over-treatment				
Agree	128 (63.7%)	104 (69.8%)	232 (66.3%)	0.223
Disagree	27 (13.4%)	22 (14.8%)	49 (14.0%)	
I don't know	46 (22.9%)	23 (15.4%)	69 (19.7%)	

Table 15: Association between country of last academic degree and opinion regarding the SDA concerns related to chewing function, dental appearance, oral comfort and speech

	UAE	Non-UAE	Total	P-value
Chewing Function				
Satisfactory	57 (28.2%)	38 (29.2%)	95 (28.6%)	0.729
Acceptable	94 (46.5%)	53 (40.8%)	147 (44.3%)	
Unsatisfactory	23 (11.4%)	17 (13.1%)	40 (12.0%)	
I don't know	28 (13.9%)	22 (16.9%)	50 (15.1%)	
Dental Appearance				
Satisfactory	62 (31.2%)	39 (30.5%)	101 (30.9%)	0.980
Acceptable	84 (42.2%)	54 (42.2%)	138 (42.2%)	
Unsatisfactory	25 (12.6%)	15 (11.7%)	40 (12.2%)	
I don't know	28 (14.1%)	20 (15.6%)	48 (14.7%)	
Oral Comfort				
Satisfactory	62 (31.0%)	40 (33.6%)	102 (32.0%)	0.931
Acceptable	83 (41.5%)	45 (37.8%)	128 (40.1%)	
Unsatisfactory	24 (12.0%)	15 (12.6%)	39 (12.2%)	
I don't know	31 (15.5%)	19 (16.0%)	50 (15.7%)	
Speech				
Satisfactory	85 (42.7%)	46 (36.8%)	131 (40.4%)	0.366
Acceptable	82 (41.2%)	51 (40.8%)	133 (41.0%)	
Unsatisfactory	6 (3.0%)	8 (6.4%)	14 (4.3%)	
I don't know	26 (13.1%)	20 (16.8%)	46 (14.2%)	

Table 16: Association between country of last academic degree and opinions related to risks and benefits of the SDA concept

SDA contributes to	UAE	Non-UAE	Total	P-value
TMJ Disorders				
Agree	100 (49.3%)	53 (40.8%)	153 (45.9%)	0.117
Disagree	35 (17.2%)	34 (26.2%)	69 (20.7%)	
I don't know	68 (33.5%)	43 (33.1%)	111 (33.3%)	
Teeth Wear				
Agree	112 (56.3%)	69 (55.2%)	181 (55.9%)	0.465
Disagree	36 (18.1%)	29 (23.2%)	65 (20.1%)	
I don't know	51 (25.6%)	27 (21.6%)	78 (24.1%)	
Teeth Migration				
Agree	130 (65.3%)	67 (53.2%)	197 (60.6%)	0.001
Disagree	30 (15.1%)	42 (33.3%)	72 (22.2%)	
I don't know	39 (19.6%)	17 (13.5%)	56 (17.2%)	
Speech Problem(s)				
Agree	64 (32.3%)	27 (21.6%)	91 (28.2%)	0.065
Disagree	90 (45.5%)	72 (57.6%)	162 (50.2%)	
I don't know	44 (22.2%)	26 (20.8%)	70 (21.7%)	
The SDA will simplify oral hygiene for patients				
Agree	141(71.9%)	93 (71.0%)	234 (71.6%)	0.818
Disagree	24 (12.2%)	19 (14.5%)	43 (13.1%)	
I don't know	31 (15.8%)	19 (14.5%)	50 (15.3%)	
Allow better patient economy				
Agree	124 (63.3%)	92 (72.4%)	216 (66.9%)	0.203
Disagree	27 (13.8%)	15 (11.8%)	42 (13.0%)	
I don't know	45 (23.0%)	20 (15.7%)	65 (20.1%)	
Allow for simpler treatment planning				
Agree	138 (70.1%)	96 (74.4%)	234 (71.8%)	0.282
Disagree	27 (13.7%)	20 (15.5%)	47 (14.4%)	
I don't know	32 (16.2%)	13 (10.1%)	45 (13.8%)	
Allow patients to keep their own teeth				
Agree	111 (56.3%)	68 (54.0%)	179 (55.4%)	0.466
Disagree	39 (19.8%)	32 (25.4%)	71 (22.0%)	
I don't know	47 (23.9%)	26 (20.6%)	73 (22.6%)	
Reduce the risk of over-treatment				
Agree	131 (66.2%)	85 (66.9%)	216 (66.5%)	0.024
Disagree	22 (11.1%)	25 (19.7%)	47 (14.5%)	
I don't know	45 (22.7%)	17 (13.4%)	62 (19.1%)	

5.5.4 Years of experience

Similarly, the comparison between different years of experience with dentists' attitude towards risks and benefits of SDA showed that as years of experience increases, there is a higher agreement that SDA provides better patient economy (P-value = 0.04) (Tables 17 and 18).

Table 17: Association between years of experience and opinion regarding the SDA concerns related to chewing function, dental appearance, oral comfort and speech

	Years of experience			Total	P-value
	< 3 years	3-10 years	> 10 years		
Chewing Function					
Satisfactory	21 (31.8%)	31 (21.8%)	52 (35.1%)	104 (29.2%)	0.064
Acceptable	31 (47.0%)	74 (52.1%)	52 (35.1%)	157 (44.1%)	
Unsatisfactory	5 (7.6%)	15 (10.6%)	22 (14.9%)	42 (11.8%)	
I don't know	9 (13.6%)	22 (15.5%)	22 (14.9%)	53 (14.9%)	
Dental Appearance					
Satisfactory	19 (28.8%)	46 (33.1%)	46 (31.3%)	111 (31.5%)	0.917
Acceptable	32 (48.5%)	57 (41.0%)	61 (41.5%)	150 (42.6%)	
Unsatisfactory	8 (12.1%)	16 (11.5%)	16 (10.9%)	40 (11.4%)	
I don't know	7 (10.6%)	20 (14.4%)	24 (16.3%)	51 (14.5%)	
Oral Comfort					
Satisfactory	17 (25.4%)	47 (34.8%)	46 (33.1%)	110 (32.3%)	0.902
Acceptable	29 (43.3%)	54 (40.0%)	55 (39.6%)	138 (40.5%)	
Unsatisfactory	8 (11.9%)	14 (10.4%)	16 (11.5%)	38 (11.1%)	
I don't know	13 (19.4%)	20 (14.8%)	22 (15.8%)	55 (16.1%)	
Speech					
Satisfactory	26 (39.4%)	58 (42.0%)	57 (39.9%)	141 (40.6%)	0.942
Acceptable	27 (40.9%)	58 (42.0%)	56 (39.2%)	141 (40.6%)	
Unsatisfactory	3 (4.5%)	4 (2.9%)	8 (5.6%)	15 (4.3%)	
I don't know	10 (15.2%)	18 (13.0%)	22 (15.4%)	50 (14.4%)	

Table 18: Association between years of experience and attitude towards using SDA

SDA contributes to	Years of experience			Total	P-value
	< 3 years	3-10 years	> 10 years		
TMJ Disorders					
Agree	29 (43.9%)	54 (37.8%)	78 (52.7%)	161(45.1%)	0.078
Disagree	11 (16.7%)	37 (25.9%)	29 (19.6%)	77 (21.6%)	
I don't know	26 (39.4%)	52 (36.4%)	41 (27.7%)	119 (33.3%)	
Teeth Wear					
Agree	33 (50.8%)	77 (55.4%)	85 (59.0%)	195 (56.0%)	0.859
Disagree	14 (21.5%)	28 (20.1%)	27 (18.8%)	69 (19.8%)	
I don't know	18 (27.7%)	34 (24.5%)	32 (22.2%)	84 (24.1%)	
Teeth Migration					
Agree	38 (56.7%)	83 (59.3%)	87 (61.3%)	208 (59.6%)	0.592
Disagree	13 (19.4%)	30 (21.4%)	34 (23.9%)	77 (22.1%)	
I don't know	16 (23.9%)	27 (19.3%)	21 (14.8%)	64 (18.3%)	
Speech Problem(s)					
Agree	19 (28.8%)	38 (27.7%)	42 (29.2%)	99 (28.5%)	0.939
Disagree	30 (45.5%)	69 (50.4%)	72 (50.0%)	171 (49.3%)	
I don't know	17 (25.8%)	30 (21.9%)	30 (20.8%)	77 (22.2%)	
The SDA will simplify oral hygiene for patients					
Agree	45 (70.3%)	97 (68.8%)	108 (74.0%)	250 (71.2%)	0.886
Disagree	9 (14.1%)	19 (13.5%)	18 (12.3%)	46 (13.1%)	
I don't know	10 (15.6%)	25 (17.7%)	20 (13.7%)	55 (15.7%)	
Allow better patient economy					
Agree	39 (61.9%)	87 (62.6%)	107 (73.8%)	233 (67.1%)	0.043
Disagree	12 (19.0%)	15 (10.8%)	18 (12.4%)	45 (13.0%)	
I don't know	12 (19.0%)	37 (26.6%)	20 (13.8%)	69 (19.9%)	
Allow for simpler treatment planning					
Agree	45 (69.2%)	93 (66.9%)	112 (76.7%)	250 (71.4%)	0.115
Disagree	10 (15.4%)	18 (12.9%)	21 (14.4%)	49 (14.0%)	
I don't know	10 (15.4%)	28 (20.1%)	13 (8.9%)	51 (14.6%)	
Allow patients to keep their own teeth longer					
Agree	86 (59.3%)	194	39 (60.0%)	93 (66.4%)	0.145
Disagree	35 (24.1%)	72 (20.7%)	13 (20.0%)	14 (10.0%)	
I don't know	24 (16.6%)	81 (23.3%)	13 (20.0%)	33 (23.6%)	
Reduce the risk of over-treatment					
Agree	39 (60.0%)	93 (66.4%)	99 (68.8%)	231 (66.2%)	0.197
Disagree	13 (20.0%)	14 (10.0%)	22 (15.3%)	49 (14.0%)	
I don't know	13 (20.0%)	33 (23.6%)	23 (16.0%)	69 (19.8%)	

5.5.5 Type of dental practice

There was a significant agreement between dentists working in the government sector and dentists working in the private sector that SDA provides acceptable chewing function and dental appearance (P-value= 0.031, 0.023 respectively) (Table19). Additionally, dentists in both government and private sectors highly agreed that SDA allows patients to keep their teeth for longer periods of time (P-value= 0.20) (Table 20).

Table 19: Association between attitude of using SDA and opinion regarding the SDA concerns related to chewing function, dental appearance, oral comfort and speech

	Dental Practice		Total	P-value
	Government	Private		
Chewing Function				
Satisfactory	67 (34.4%)	35 (22.3%)	102 (29.0%)	0.031
Acceptable	85 (43.6%)	71 (45.2%)	156 (44.3%)	
Unsatisfactory	21 (10.8%)	20 (12.7%)	41 (11.6%)	
I don't know	22 (11.3%)	31 (19.7%)	53 (15.1%)	
Dental Appearance				
Satisfactory	70 (37.2%)	38 (24.1%)	108 (31.2%)	0.023
Acceptable	72 (38.3%)	75 (47.5%)	147 (42.5%)	
Unsatisfactory	24 (12.8%)	16 (10.1%)	40 (11.6%)	
I don't know	22 (11.7%)	29 (18.4%)	51 (14.7%)	
Oral Comfort				
Satisfactory	66 (35.7%)	41 (27.0%)	107 (31.8%)	0.133
Acceptable	71 (38.4%)	66 (43.4%)	137 (40.7%)	
Unsatisfactory	24 (13.0%)	15 (9.9%)	39 (11.6%)	
I don't know	24 (13.0%)	30 (19.7%)	54 (16.0%)	
Speech				
Satisfactory	83 (44.4%)	53 (34.2%)	136 (39.8%)	0.118
Acceptable	72 (38.5%)	70 (45.2%)	142 (41.5%)	
Unsatisfactory	10 (5.3%)	5 (3.2%)	15 (4.4%)	
I don't know	22 (11.8%)	27 (17.4%)	49 (14.3%)	

Table 20: Association between type of dental practice and attitude towards using SDA

SDA contributes to	Dental Practice			P-value
	Government	Private	Total	
TMJ Disorders				
Agree	91 (46.9%)	71 (44.7%)	162 (45.9%)	0.104
Disagree	48 (24.7%)	28 (17.6%)	76 (21.5%)	
I don't know	55 (28.4%)	60 (37.7%)	115 (32.6%)	
Teeth Wear				
Agree	112 (59.9%)	80 (51.0%)	192 (55.8%)	0.224
Disagree	36 (19.3%)	34 (21.7%)	70 (20.3%)	
I don't know	39 (20.9%)	43 (27.4%)	82 (23.8%)	
Teeth Migration				
Agree	116 (62.0%)	90 (57.0%)	206 (59.7%)	0.537
Disagree	41 (21.9%)	36 (22.8%)	77 (22.3%)	
I don't know	30 (16.0%)	32 (20.3%)	62 (18.0%)	
Speech Problem(s)				
Agree	60 (32.1%)	38 (24.4%)	98 (28.6%)	0.287
Disagree	88 (47.1%)	81 (51.9%)	169 (49.3%)	
I don't know	39 (20.9%)	37 (23.7%)	76 (22.2%)	
The SDA will simplify oral hygiene for patients				
Agree	143 (75.3%)	105 (66.5%)	248 (71.3%)	0.158
Disagree	20 (10.5%)	26 (16.5%)	46 (13.2%)	
I don't know	27 (14.2%)	27 (17.1%)	54 (15.5%)	
Allow better patient economy				
Agree	127 (67.2%)	103 (66.5%)	230 (66.9%)	0.832
Disagree	26 (13.8%)	19 (12.3%)	45 (13.1%)	
I don't know	36 (19.0%)	33 (21.3%)	69 (20.1%)	
Allow for simpler treatment planning				
Agree	144 (76.2%)	104 (65.8%)	248 (71.5%)	0.103
Disagree	22 (11.6%)	27 (17.1%)	49 (14.1%)	
I don't know	23 (12.2%)	27 (17.1%)	50 (14.4%)	
Allow patients to keep their own teeth longer				
Agree	119 (63.0%)	75 (48.1%)	194 (56.2%)	0.020
Disagree	34 (18.0%)	37 (23.7%)	71 (20.6%)	
I don't know	36 (19.0%)	44 (28.2%)	80 (23.2%)	
Reduce the risk of over-treatment				
Agree	130 (68.4%)	99 (63.5%)	229 (66.2%)	0.624
Disagree	25 (13.2%)	24 (15.4%)	49 (14.2%)	
I don't know	35 (18.4%)	33 (21.2%)	68 (19.7%)	

5.6 Dentists' opinion of criteria for proposing the SDA concept

In answering the question on dental situations in which dentists would propose the SDA concept, most of the responding dentists chose to propose SDA to patients with low economic incomes (n=207,57.0%), followed by medically compromised patients (n=157, 43.3%) (Table 21, Figure 1).

Table 21: Situations that dentists propose SDA

Situations to propose SDA	No (%)
Caries confined to molar region	78 (21.5%)
Good prognosis of anteriors and premolars	140 (38.6%)
Old patient (over 50 years)	143 (39.4%)
Limited restorative care	117 (32.2%)
Medically compromised patient	157 (43.3%)
Financially limited patient	207 (57.0%)

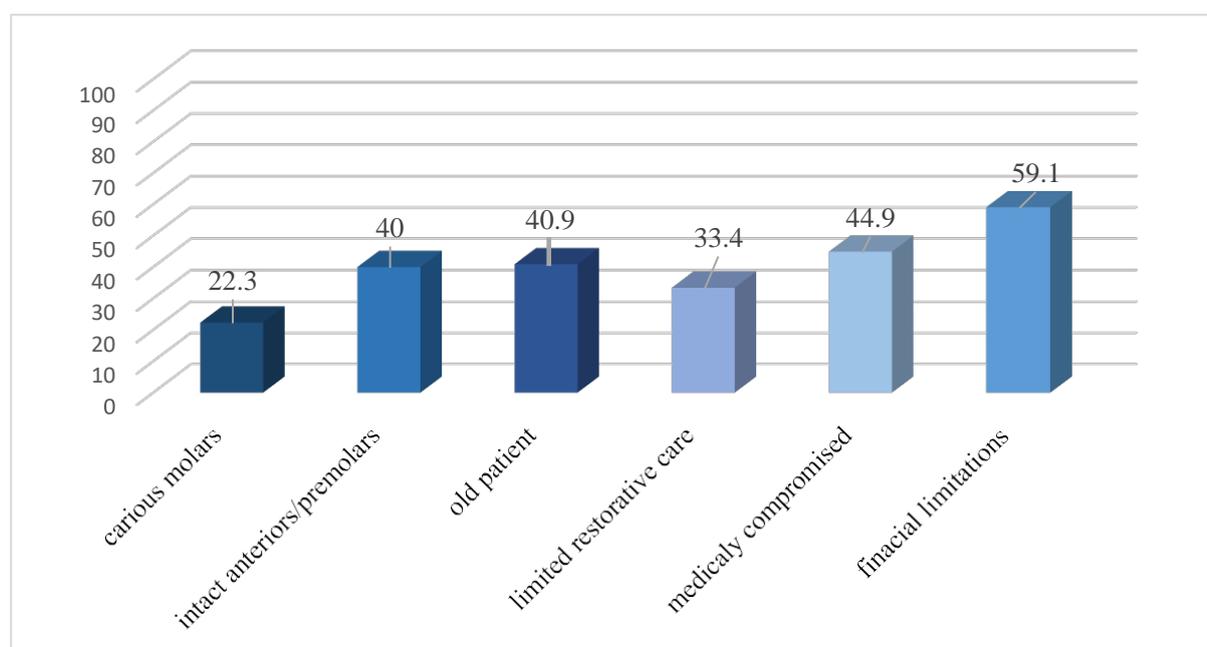


Figure 1: Situations in which dentists prefer to propose SDA to their patients

5.7 Dentists' assessment of patients' acceptance of the SDA concept

A high percentage of dentists reported not proposing the SDA concept to their patients (n=165, 46.3%). The patients' response to the suggestion of the SDA as a treatment option was assessed by the respondents as follows: agreed after explanation was provided (38.5%); agreed

immediately (7%); and objections (8.1%). A low percentage of dentists expressed that patients would agree to SDA immediately without an explanation (n=25, 7%) (Table 22).

Table 22: Dentists’ assessment of patients’ responses to SDA treatment proposal

Patient’s reaction after proposing SDA	No (%)
Agree immediately	25 (7)
Agree after explanation	137 (38.5)
Didn’t propose SDA to my patients	165 (46.3)
Objection	29 (8.1)

5.8 Relationship between different factors and dentists’ assessment of patients’ acceptance of the SDA concept

5.8.1 Years of experience

Years of dental experience showed an association with the reported patient reaction towards SDA (P-value = 0.011). Dentists with more than 10 years of clinical experience indicated that their patients agreed to SDA as a treatment option when it was explained to them (n=71, 48.6%), while the majority of dentists with less than 3 years or 3 to 10 years of experience did not propose SDA to their patients, 52.2% (n=35) and 51.1% (n=72), respectively (Table 23).

Table 23: Relationship between years of experience with time to know about SDA and patient’s reaction to SDA

	Years of experience			Total	P-value
	< 3 years	3-10 years	> 10 years		
Time to know about SDA					
Just now	34 (50.7%)	51 (35.9%)	40 (27.0%)	125 (35.0%)	0.000
< 5 years back	28 (41.8%)	49 (34.5%)	45 (30.4%)	122 (34.2%)	
5-10 years	3 (4.5%)	33 (23.2%)	22 (14.9%)	58 (16.2%)	
>10 years back	2 (3.0%)	9 (6.3%)	41 (27.7%)	52 (14.6%)	
Patient’s reaction after proposed					
Agree immediately	6 (9.0%)	9 (6.4%)	10 (6.8%)	25 (7.1%)	0.011
Agree after explanation	16 (23.9%)	49 (34.8%)	71 (48.6%)	136 (38.4%)	
Didn’t propose SDA to my patients	35 (52.2%)	72 (51.1%)	57 (39.0%)	164 (46.3%)	
Objection	10 (14.9%)	11 (7.8%)	8 (5.5%)	29 (8.2%)	

5.8.2 Type of dental practice

Similarly, a statistically significant association was detected between the type of clinical practice and patient reaction towards the proposal of SDA (P-value 0.006). Although 45.8% (n=160) of the participating dentists, whether working in private or governmental sectors, reported not to propose SDA to their patients, this percentage for private sector dentists (n=85, 53.1%) was significantly higher than government dentists (n=75, 39.7%) (Table 24).

Gender, highest qualification and country of last academic degree did not affect patient's acceptance of the concept.

Table 24: Relationship between type of dental practice with time to know about SDA and patient's reaction to SDA

	Type of Dental Practice		Total	P-value
	Government	Private		
Time to know about SDA				
Just now	67 (34.7%)	56 (35.0%)	123 (34.8%)	0.908
< 5 years back	67 (34.7%)	54 (33.8%)	121 (34.3%)	
5-10 years	29 (15.0%)	28 (17.5%)	57 (16.1%)	
>10 years back	30 (15.5%)	22 (13.8%)	52 (14.7%)	
Patient's reaction after proposed SDA				
Agree immediately	14 (7.4%)	11 (6.9%)	25 (7.2%)	0.006
Agree after explanation	77 (40.7%)	59 (36.9%)	136 (39.0%)	
Didn't propose SDA to my patients	75 (39.7%)	85 (53.1%)	160 (45.8%)	
Objection	23 (12.2%)	5 (3.1%)	28 (8.0%)	

6. DISCUSSION

SDA is a problem-oriented approach in which a patient's functional demand guides the clinician to the number of teeth that needs to be replaced. These demands vary from one patient to another. Therefore, a clinician needs to focus on each individual's specific needs and adaptive capacity. Kayser et al. (2,3) studies showed that SDA minimizes complex restorative treatments. There is no scientific evidence for the concept of providing the patient with a complete set of teeth. Kanno and Carlsson in their literature review on SDA found no clinically significant differences in oral comfort, chewing, aesthetics, TMD symptoms between subjects with complete dental arches and those with 3 to 5 occlusal units. They concluded that SDA can be considered a valid treatment modality that needs to be considered in treatment planning for SDA patients.(12) The concept was also supported by WHO as a realistic option especially when the caries risk is high and recourses are limited.(13)

This cross-sectional study surveyed dentists in the UAE with different specialties, backgrounds, and work environments to determine their understanding and application of the SDA concept in their practice. It aimed at investigating the attitudes of UAE dentists towards the SDA concept and the factors that affect the decision made regarding the prosthetic rehabilitation of an SDA patient.

The response rate was 40.3% which is considered lower than other similar studies conducted in KSA, Malaysia and Jordan, which had response rates of 72.1%, 84% and 70.7%, respectively.(19,99,100) However, it was close to and, in some cases, higher than the response rates of other studies conducted in the UK (42%), Australia (40.3%), KSA (13.4%) and South Africa (23%).(15,17,38,103) The low response rate may be related to the use of an online survey that was sent to the participants by email, as it has been reported that electronic questionnaires have lower response rates compared to physical ones.(104) Furthermore, the data collection took place during the period of the COVID-19 pandemic, from June till October

2020, for which an online survey was the only method to conduct such study. One of the obstacles often faced with online surveys is that individuals have overloaded inboxes, with only few emails regularly checked. Additionally, most people use the internet for entertainment purposes, making them ignore other elements.(105,106) The response rate may also be affected by the nature of the subject matter investigated, which makes those who are not interested in the subject neglect responding to the survey. Regardless of these disadvantages, online surveys are the future since the world is moving towards the full incorporation of digital given it is associated with lower cost, faster response rates, and allows for ease of data manipulation.(106,107)

Also, low non-response rate was noticed for different items of the questionnaire with the highest non-response rate recorded when participants were asked about their opinion of oral comfort with SDA. The higher non-response rate for this item can be due to the nature of rating patients' oral comfort by dentists, with the dentists possibly considering it a product of the patient's perception.

In the results tables used in this study it can be noticed that the total numbers are sometimes less than the total number of respondents and sometimes it is more than that, this is related to the design of the questionnaire that permits the respondents to proceed to the next question without completing or answering the previous question. Besides there were 2 questions that permits the use of more than one answer for the same question which are: "In which situations would you propose the SDA? (you can choose more than one option)" and "How do you usually treat a patient with missing posterior teeth (Free-end)?(you can choose more than one option)" and that explains the difference in the totals for some of the questions in this study.

6.1 Dentists' awareness of SDA and its application in their practice

The majority (n=237, 65.8%) of UAE dentists were aware of the SDA concept which is comparable with the level of awareness of dentists in a similar study in Australia (61%) and much higher than that of another study in KSA (34.4%).(17,19) One exception was Jordan, where it was noticed that dentists in Jordan had a higher degree of awareness of the SDA concept (82.1%).(100) On the other hand, 34% of respondents were not aware of the SDA concept. This can be considered a high proportion even though the SDA has been described as a viable treatment option in the dental literature for over two decades, However, this percentage is considered much lower than the 62.3% reported in KSA.(19) Among those dentists aware of the SDA, the frequency of application was considerably low. The study results were in accordance with many studies in different countries, where SDA was found to be accepted by the clinicians as a concept, but not often applied in clinical practice.(10,14–19,99,108,109) With regards to the replacement of missing molars in this study, the percentage of dentists who chose to replace missing molars (n=183, 50.8%) was very close to the percentage who preferred not to (n=177, 49.2%). This indirectly suggests that there is a high percentage of UAE dentists who chose to apply a problem-oriented approach in their practice.

Dentists who had graduated from non-UAE countries were more aware about SDA and used it more frequently in their practice than UAE graduates. This can be attributed to the incorporation of the SDA concept in their dental school curriculums. Abu-Awwad et al. (100) reported no association between levels of education and awareness of SDA; in fact, the opposite was noticed in this study where the majority of GDPs learned about SDA upon receiving this survey, whereas specialists had earlier knowledge about it. This difference may be due to dental schools not incorporating the SDA concept into their undergraduate curricula, and the specialists were mostly exposed to the concept in their postgraduate studies. Our results also showed that the level of awareness increased with the increase in the years of experience. This

might be related to dentists with more years of experience having learnt about it during their continuing education programs. The conclusion that the level of knowledge about SDA concept was higher as the years of experience increased is opposite to the results of similar studies in Australia and Jordan where dentists with fewer years of experience were more aware of SDA than dentists with more clinical experience.(17,100) However, despite the increase in the knowledge with advanced years of experience, our study did not find an association between the years of experience and applying the concept in the clinical practice.

Interestingly, there was almost no difference in the number of dentists who preferred to replace missing molars and those who did not regularly replace the missing molars (n=183, 50.8% and n=177, 49.2% respectively). This can indicate that some dentists are possibly implementing the concept without really knowing the terminology or the evidence behind it, or that they are selecting it for financial reasons. It could also be related to the fact that the majority of UAE dentists had a previous awareness of SDA. GPs reported replacing missing molars (n=120, 57.4%) more frequently than specialists (n=61, 40.9%), which can be related to their lack of knowledge about SDA. In the present study, female dentists were more likely to select posterior tooth replacement for SDA patients than male dentists which is in agreement with a previous study in Sweden where their data showed that gender plays a role in the application of SDA in practice.(108)

Half of the participating dentists voted for replacing missing molars, claiming that this will improve the masticatory ability and also aesthetics for SDA patients, which was in accordance with Abuzar et al study, Australia, where 77% of participating dentists preferred to replace missing molars.(17) In contrast, the majority of UAE dentists believed that SDA provides acceptable chewing function and dental appearance, which deemed this replacement unnecessary as this can be considered as overtreatment unless the replacement was done in

cases where SDA is contraindicated such as in preexisting TMD, parafunctional habits, and marked pathological tooth wear.(110)

6.2. The preferred treatment modality for SDA patients

The optimal treatment decision-making is based on patient preference. Therefore, all possible treatment options need to be provided, so that the patient can choose the option that suits his/her aesthetic demands, functional needs, financial status etc.(37,65,66)

When posterior tooth replacement was deemed necessary by the dentists in the present study, implant was the treatment of choice for the majority of the participants (n=169, 46.6%) followed by acrylic RPD (n=129, 35.5%). This was not the case for KSA and UK dentists, where the preferred treatment modality chosen was metallic RPD (53.9% and 67.2% respectively),(19,65) while in Tanzania the majority prefer to use acrylic RPD for SDA cases.(18) However, dentists in Jordan (84.9%) agreed with UAE dentists on the implants option. Implants have become the trend for the replacement of missing teeth because of their high survival rates and the ability to provide the fixed option that is preferred by most patients.(78,79) Implants can be considered a good and relatively conservative way of restoring posterior teeth when compared with conventional FPD, where adjacent teeth are required to provide support, retention, and resistance for the prosthesis, whereas with an implant used to replace a missing molar, the adjacent teeth will not be involved and remain intact. Besides, when compared with RPD, implants provides better occlusal stability, simpler prostheses and more bone preservation.(111) The majority of dentists with less than 3 years of experience (n=35, 52.2%) preferred to replace missing molars with acrylic RPD, while implants are the preferred treatment option for dentists with more years of experience. The provision of acrylic RPD is a simple, safe non-surgical option and can be done by dentists with less experience, but with more clinical training and experience dentists gradually move to implants that require more clinical skills and training.

A high percentage of GDPs preferred to replace the missing molars (n=120, 57.4%), while most of the Specialists preferred not to replace them (n=88, 59.1%) (P-value = 0.001). This is in accordance with the fact that Specialists showed better awareness of SDA than GDPs and therefore are more likely to think of SDA as a treatment option. This result is comparable with the results of the Abuzar study in Australia in which the postgraduate dentists were more aware of the concept than the basic dental degree holders, though the difference was not significant.(17)

A higher percentage of private sector dentists (n=94, 58.8%) chose to replace missing molars, while dentists in the government sector preferred not to replace missing molars (n=108, 56.0%) (P-value = 0.004). This can be attributed to the business elements of dental practice interfering with private dentists' decision making on the replacement of missing molars. Most private dentists are compensated for their work through a commission-based method of payment, where a fee-per-item payment system delivers them a percentage of the fee collected from the patient. Generally, treatment in the government sector is free of charge. This suggests that dentists in the government sector are keen on keeping the patient's own natural teeth for longer periods of time, while the proposal of SDA can have a negative economic impact on dentists working in the private sector.

6.3 Dentists' opinions related to the risks and benefits of SDA

Generally, the results showed a positive attitude towards SDA as a treatment option by the participating dentists. Dentists in this study believed that SDA provides acceptable chewing function, dental appearance, oral comfort, and speech. This is comparable with other studies in which dentists agreed that dental arches comprising healthy teeth up to the second premolars can serve satisfactory aesthetics, oral comfort and function.(2,12,67) In the present study, dentists considered SDA a practical treatment option since it can simplify oral hygiene, allow for simpler treatment planning, improved patient economy as well as allowing patients to keep

their natural teeth longer. These results are in accordance with other studies that also showed a positive attitude to the SDA concept.(12,15,17,65) However, provision of SDA as a prosthetic rehabilitation option is guarded by the patient's age, adaptive capacity, dietary habits, periodontium health, etc. which requires thorough clinical examination. This is considered a problem-oriented approach in which molars will not be replaced unless there is a negative impact on the patient's aesthetics and function.(5)

Overall, participating dentists considered that there are only few risks resulting from SDA. They mentioned teeth migration, wear and TMD as possible risks associated with not providing molar support for SDA patients. Although participating dentists agreed that SDA provides acceptable chewing function, dental appearance, oral comfort, and speech, they still believe that this is not optimal and molars need to be replaced to improve both mastication and aesthetics. This is why half of the participating dentists (n=183, 50.8%) always replace missing molars.

6.4 Proposing SDA to patients and patients' acceptance

A high percentage of UAE dentists did not propose SDA to their patients (n=165, 46.3%), despite the fact that they were aware of it (n=237, 65.8%). This may indicate that hearing about SDA may not necessarily mean having a good knowledge about it and that is why most of dentists did not think about proposing it to their patients. It is important that clinicians can provide appropriate advice and practical treatment options, including SDA, to patients.

Dentists with more than 10 years of clinical experience indicated that their patients agreed to SDA as a treatment option when it was explained to them while the majority of dentists with less than 3 years or 3 to 10 years of experience did not propose SDA to their patients. This is likely due to the fact that dentists with fewer years of experience were less aware of the concept. Most of the responding dentists selected to propose SDA to patients with low economic incomes (n=207, 57.0%), followed by medically compromised patients (n=157, 43.3%). This

seems sensible since providing SDA as an option can reduce the financial burden on the patients as well as reduce the medical risks for medically compromised patients. Cost was reported as the main reason to propose SDA to patients in a similar study in Jordan (54.2%).(100) However, inability to pay for a dental treatment can be applied to any type of prosthetic care and not necessarily SDA cases. Hence, it is essential that clinicians provide the SDA option only when it really meets patient's functional demands, aesthetic requirements, and adaptive capacity. Also, for medically compromised patients, when there is an indication for SDA, it can reduce the medical risks caused by complex restorative treatments, and the subsequent needed maintenance care by both the patient and the clinician.

Around 38.5% of the participating dentists reported that their patients agreed to SDA after providing the patients with proper explanation. Abuzar et al. (17) in his study in Australia, reported a good response from patients on SDA when benefits were explained to them. This conveys a good level of awareness among patients and a strong communication skills of dentists. On the other hand, 8.1% of the participating dentists reported rejection from their patients to SDA after proposal. This is lower than the percentage reported in KSA (18%), yet it is comparable with the results of the Malaysian study (8.3%).(19,112) The patient's financial status plays a critical role in accepting treatment with SDA as reported by 63% of dentists in a study in Australia and 45.2% dentists in a study in Malaysia.(17,112)

Some clinical options, such as SDA, are more challenging than others because of lack of evidence, controversies, search strategies, the availability of variable recommendations, as well as the background of clinicians.(62–64) Generally, SDA provides a less complicated type of treatment that is also less expensive and time consuming. Such treatment modality perfectly suits subjects in countries with low economic and dental resources. Based on the outcomes of this study, it seems that SDA is not being taught in UAE undergraduate dental universities. Its incorporation will provide a more ethical and functional way of treating patients while

minimizing the risks on older and medically compromised group of patients, reducing waiting lists for prosthetic rehabilitation cases, and providing an economically positive impact by reducing the chances of overtreatment.

6.5 Limitations of the current study

Although using an online questionnaire is considered a cost-effective, fast and simple method that can cover a large group of people, it is associated with certain limitations. These include the inability to explain the questions to the respondents when it is not clear as well as not being able to control who actually answers the questions.

Second, the specialties included in this study include Orthodontists and Paediatric Dentistry Specialists, where one can argue that their type of work may not involve rehabilitation of SDA cases. However, in the private sector, many of the Specialists are practicing restorative dental treatment along with their own speciality and this sometimes includes treatment planning of SDA cases.

6.6 Future studies

Further investigations are required to study the effect of different treatment modalities for SDA cases on patient satisfaction and oral health. Surveying patients treated with SDA will provide an adequate level of knowledge on the level of patients' satisfaction and their OHRQoL. Future studies that cover larger sample sizes are advisable. Moreover, more studies are needed to validate treatment with implant-supported fixed prosthesis for SDA subjects. Finally, the application of the concept not only on older people, but also on medically compromised patients and patients with special needs of different age groups, needs to be studied.

7. CONCLUSIONS

UAE dentists are generally aware of the SDA concept and have a positive attitude about it, yet they do not usually apply it in clinical practice. The preferred treatment modality for SDA cases are implants followed by acrylic RPD.

Dentists in the UAE believe that SDA provides acceptable chewing function, dental appearance, oral comfort and speech. They also consider SDA to be a practical treatment option that simplifies treatment planning, allows patients to keep their natural teeth for longer as well as being suitable for patients with limited financial sources. On the other hand, participating dentists associated SDA with some risks including tooth wear, teeth migration and TMD.

A good percentage of respondents observed that patients accepted SDA after proper explanation. Moreover, dentists in this study believe that SDA is a good treatment option for patients with low economic status followed by medically compromised patients. However, there is a need to increase SDA awareness and acceptance among UAE dentists and patients.

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9. APPENDICES

APPENDIX 1: MBRU IRB approval



28 April 2020

Dr Haleimah AlHmoudi
Resident Prosthodontics
HBMCMD

RE: MBRU-IRB-2020-020

Dear Dr Haleimah,

Thank you for submitting to the IRB study titled "A Survey of The Application of The Shortened Dental Arch by Dentists in the UAE" for expedited review. The Board has reviewed the same at its meeting of 28 April 2020 and has agreed to approve the same.

Kindly note that no consent form is needed as consent is already included in the introduction to the survey i.e., consent is automatically implied if the subject fills out the survey.

The study can now commence. Any change in protocol must be notified to the Board.

For any questions, please contact the Institutional Review Board irb@mbru.ac.ae.

Thank you for your interest in MBRU's IRB.

Sincerely,



Professor Alexander Milosevic
Deputy Chairman, MBRU-IRB

RE: MBRU-IRB-2019-022

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APPENDIX 2: MOHAP Research Ethics Committee approval



Ministry of Health and Prevention Research Ethics Committee

Study Title: A survey of the application of the shortened dental arch by dentists in the UAE.

Subject: Approval Reference No: **MOHAP/DXB-REC/ MMM/No. 47/2020**

**Dear Dr Fatemeh Amir Rad,
Dr. Haleimah AlHmoudi,**

In regards to the above mentioned Study protocol, this is to confirm that on the meeting dated (09/05/2020), the Ministry of Health and Prevention Research Ethics Committee has reviewed the study protocol as well as all the documents submitted in the submission file from the ethical point of view and has approved the conduct of above mentioned study.

Opinion: Approval

Committee members:

Name	Designation	Role in committee
Dr. Suad Hannawi	Consultant Rheumatologist	Chairman
Dr. Haifa Hannawi	Consultant Dentist	Deputy chairman
Dr.Muna AL Mutawa	Specialist Ophthalmologist	Member
Yusra Swaidat	Senior charge technician	Coordinator
Samya Al Mulla	Pharmacist	Member

Please find below a list of approved documents:

Document	Version/date
Application Form	Ministry of Health and Prevention Application Form-amended version
Protocol	Study protocol
Information sheet and Informed Consent Form	Online information sheet and consent
Data Collection	Study questionnaire
Investigator/s CV	CV of Principal Investigator
GCP Certificate/s	GCP Certificate of investigator

APPENDIX 3: Dentists' attitude to SDA questionnaire

Dear dental professional,

We are inviting you to participate in this survey. The following questionnaire will require approximately 5 minutes to complete. Please answer all questions as honestly as possible and return the completed questionnaire promptly.

Many thanks for your participation.

The Shortened Dental Arch (SDA) is a functional, aesthetic, and natural dentition of no more than twenty teeth with an intact anterior region but a reduced number of occluding pairs of posterior teeth. This condition is frequently seen as molars are often lost by caries and periodontal disease (Kayser, 1981).

This study aims to determine the attitude of dentists in the UAE to the SDA.

The researcher requests your consent for participation in a study about SDA. This consent form asks you to allow the researcher to view your answers and to use your comments to enhance understanding of the topic. The form also asks your permission to use the answers as data in this study. Please be aware that you will remain anonymous throughout this questionnaire.

Participation in this study is completely voluntary. Please be aware that you may decide not to answer any specific question. The researcher will maintain the confidentiality of the research records or data, and all data will be destroyed in after the completion of data analysis.

Thank you in advance for your participation!

Contact Information:

This research has been reviewed and approved by MBRU Research Ethics Committee. If you have any further questions or concerns about this study, please contact:

Name of researcher: Dr. Haleimah Saeed AlHmoudi

Tel: 00971559616116

E-mail: Haleimah.alhmoudi@residents.mbru.ac.ae
(mailto:haleimah.alhmoudi@residents.mbru.ac.ae)

The contact of MOHAP research coordinator in case you have any ethical complains.

Name: Yusra Swaidat

I. I agree to participate in the research study. I understand the purpose and nature of this study and I am participating voluntarily. I understand that I can withdraw from the study at any time, without any penalty or consequences.

- yes
- No

II. I grant permission for the data generated from this questionnaire to be used in the researcher's publications on this topic.

- yes
 - No
-

1. Your gender

- Male
- Female

2. Dental Practice

- Government Clinic
- Private Clinic

3. Are you a

- General Dental Practitioner
- Specialist

4. If you are a specialist, mention your specialty

5. Mention the country of last academic degree taken:

6. Years of experience

- Less than 3 years
- 3-10 years
- More than 10 years

7. Have you heard of the Shortened Dental Arch (SDA)?

- Yes
- No

8. Do you use the SDA in your practice?

- No
- Yes, rarely
- Yes, sometimes
- Yes, always

9. Do you always replace missing molars?

- Yes
- No

10. How do you usually treat a patient with missing posterior teeth (Free-end)?(you can choose more than one option)

- Acrylic RPD
- Metallic RPD
- Cantilever Bridge
- Implant(s)
- No need for treatment

11. Why would you replace missing molars?

- To improve masticatory ability
- To improve esthetics
- Both (mastication + esthetics)
- To satisfy patient's demand

12. What is your opinion of the SDA regarding the following?

	Satisfactory	Acceptable	Un-Satisfactory	I don't Know
Chewing Function				
Dental Appearance				
Oral Comfort				
Speech				

13. SDA contributes to:

	Agree	Disagree	I don't Know
TMJ Disorders			
Teeth Wear			
Teeth Migration			
Speech Problem(s)			

14. The SDA will:

	Agree	Disagree	I Don't Know
Simplify oral hygiene for patients			
Allow better patient economy			
Allow for simpler treatment planning			
Allow patient to keep their own teeth longer			
Reduce the risk of overtreatment			

15. When did you come to know about the SDA?

- More than 10 years back
- 5-10 years
- Less than 5 years back
- Just now

16. What is your patient reaction after you propose the SDA?

- Objection
- Agreed immediately
- Agreed after explanation
- Didn't propose SDA to my patients

17. In which situations would you propose the SDA? (you can choose more than one option)

- Caries confined to molars region to
- Good prognosis of anteriors and premolars
- Old patient (Over 50 years)
- Limited restorative care
- Medically compromised patients
- Financially limited patients

