

Sri Lanka Dental Journal

Volume : 50
Number : 03
December : 2020



**The Official Publication
of the Sri Lanka Dental Association**

ISSN 1391-07280

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We all know about cloves! But, there are many things we don't know about its benefits.

Asia and South America are the native regions of clove, where it is commonly known as 'devapushpa'. The origin of this name is derived from the term 'God's Flower' due to its distinct aroma and herbal goodness.

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- ▶ Gargle

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Sri Lanka Dental Journal

Volume 50

Number 03

December 2020

The **Sri Lanka Dental Journal** is a refereed journal published three times a year by the Sri Lanka Dental Association in collaboration with the College of Dentistry and Stomatology of Sri Lanka, College of General Dental Practitioners of Sri Lanka and the College of Community Dentistry of Sri Lanka.

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ISSN 1391 - 07280

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Typeset & Printed by:

AK 2 PRO - Udahamulla, Nugegoda.
Tel/Fax : 011 - 2836190

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Volume 50

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EDITORIAL

FOOD FOR THOUGHT - 2ND DENTAL SCHOOL IN SRI LANKA

Sri Lanka has only one Dental Faculty in the country which produces around 75-80 dentists annually. Further around 10-15 foreign qualified Sri Lankan dentists return to the country every year. However, plans are under-way to start a second dental faculty from the next intake of students to the state universities.

The aim of this write-up is to look at this matter in economic efficiency (technical, cost-effectiveness and allocative) perspectives and employment opportunities for dentists in Sri Lanka.

Over many decades traditionally the Ministry of Health employed all the dentists who seek employment in the state sector. However in the latter part of 1990s and early 2000s in the Ministry, cadre vacancies were filled and the newly graduating dentists had to wait for early 3 to 4 years to obtain employment. Even after awaiting such a long time, engaging in private practice; they opt for government jobs no sooner the extra cadre vacancies were created.

In the past and at present more than 95% of the newly graduating dentists obtain employment within the Ministry of Health. This clearly demonstrates that in Sri Lankan context nearly all newly graduating dentists seek employment in the government sector. There are many reasons to join the government service. Stable and relatively attractive salaries and wages, concessionary loans, duty free vehicle permits

and life long pensions after retirement are few to be mentioned.

Sri Lanka has different employment segments for dentists such as the Ministry of Health, University academia, Defense and private sector. It is estimated that present total number of active dentists in the country is around 2100. Out of which Ministry of Health employs around 1600 and its cadre vacancies are saturating soon. Further there are around 430 dental students in the Faculty of Dental Sciences at University of Peradeniya.

In the macroeconomic front; Sri Lanka per capita GDP is USD 3682 while income inequality has remained unchanged for more than four decades in Sri Lanka. The richest 20 per cent enjoy more than half the total household income of the country, while the poorest 20 per cent get only 5 per cent. The situation of the poorest 10 per cent of the households is worse, with the share of household income being just 1.8 per cent or less. Furthermore, income gaps between different regions are even wider than the income inequality at the national level. Moreover, dental care is a commodity with high income elasticity of demand. All above indicates that demand of private dental care will be restricted mainly to affluent districts of Colombo, Kandy, Galle, Matara, Kurunagala etc.

With public sector Health spending less than 2% of GDP, Health Ministry budget is not more than 6% of the total government expenditure and debt to GDP ratio rising above 100%; the question arises whether the Ministry of Health will be able to increase its cadres for dentists indefinitely.

One may argue that there are enough opportunities for dentists abroad. However the statistics shows that not more 2-3 Sri Lankan dentists migrate annually.

As explained above demand for dental care in

the private sector is not so lucrative throughout the country. It is proven by the fact that, almost all newly qualified dentists (in late 1990s and early 2000s) left the private practice to join the Government service, when government employment were given nearly 4 years after graduation.

Above clearly shows that dentists depend on Ministry of Health for jobs. If the Ministry of Health cannot employ the newly graduating dentists where are they going to be employed?

BSc qualified engineer would be employed in any sector, whether it may be industrial, manufacturing, Finance & Banking etc. Same is not valid for dentists; once you are a dentist you got to be employed as a dentist!, at least the Sri Lankan culture expects so.

Moreover the undergraduate dental degree is the most expensive undergraduate programme world over and Sri Lanka is no exception. The cost of training a dentist is around 175% of training a medical doctor in Sri Lanka.

On paper Sri Lanka still has only around 1 dentist to 10,000 population if the head count is taken. If full time equivalent is considered and dual practice is factored this ratio will be around 1 dentist to 7800 population.

It is true that the state higher education sector should expand to cater for more students by increasing the intake for existing faculties and also by opening new faculties. However, this should be done only after a careful evaluation of the needs of the country.

Developing a new dental school and especially a dental teaching hospital is very capital intensive. Especially at a time like this, where the country is in an economic crisis, where the annual financial allocations are not enough to provide even the basic requirements of the education system, spending tons of money on something

like establishing a second dental school, without focusing on more pressing issues and timely requirements, seems irrational and unjustifiable from allocative efficiency perspective.

Expanding the current dental school to meet the capacity of the main employment provider, the Ministry of Health seems to be the more logical rather than establishing a second dental school to cater for a small number of students from cost effectiveness efficiency and technical efficiency perspectives, also.

Consider what happened in our neighbouring country, India; mushrooming of dental colleges in the past few years has led to unemployment among Indian dentists. Thousands of dentists are coming out every year with very low prospects of jobs. Considering the dearth of job opportunities for students opting for BDS, India has made a decision to stop all new dental colleges. The

firm decision was taken by the Dental Council of India (DCI), the body that grants permission to establishments of new dental institutes.

As most of our dental undergraduates are from lower middle income or lower income families there is big question whether they could be able to afford to start a private practice of their own during their early career stage. Dentist to population ratio is just a number if the Health system - both government and private, cannot gainfully employ dentists .

When dentists are not employed gainfully, naturally their living standard will drop and will lead to a deterioration of professional recognition. In the private sector it may even lead to supplier induce demand.

Dileep De Silva Shyama Banneheka
Co-Editors SLDJ

Occlusal considerations in complete dentures - An overview

R.M. Jayasinghe, I.P. Thilakumara

Abstract

Occlusion in complete dentures is an area of concern for many clinicians when managing the patients. Three occlusal schemes are described in the literature for complete dentures depending on the morphology of the posterior artificial teeth used and individual differences in the arches. When non-anatomic denture teeth are considered at least for mandibular arch and occlusal surfaces are flat, monoplane occlusion is accepted. Balanced occlusion uses either anatomic or semi anatomic denture teeth on maxillary and mandibular arches. Lingualized bilateral balanced occlusion is characterized by maxillary palatal cusps contacting mandibular central fossae. According to the current literature, no conclusion is reached regarding which occlusal scheme in complete dentures performs best in terms of patients' quality of life or masticatory performance. Therefore, bilateral balanced occlusion is no more considered ideal occlusion for successful complete dentures. This is to be considered in treatment planning as balanced occlusion consumes more time and more complex for dental surgeons and dental technicians whereas other occlusal schemes can be arranged with less time and less complexity. However, these findings are to be assessed carefully as an appropriate decision on patient satisfaction on the occlusal scheme in complete dentures is to be done at least after 3 months of denture wear following occlusal adjustment. More well- controlled clinical trials

with a large number of participants in the aspects of canine guided occlusion, relationship between alveolar ridge resorption and patient satisfaction with different occlusal schemes are required in order to demonstrate which occlusal scheme fulfills patients' requirements.

Background

Occlusion in complete dentures is considered vital in maintaining health of oral hard and soft tissues and temporomandibular structures. However, it has become an area of concern as most of the clinicians find it difficult to adhere to the concepts when managing the patients. This update is aimed at providing clinical information and understanding of current occlusal practice in designing complete dentures.

Occlusal contacts are planned at the initial appointment and the appropriate diagnosis is made with the help of history, examination and relevant investigations. Inadequate planning could lead to unacceptable occlusal contacts and ultimate dissatisfaction of the patient with outcome. It is always attempted to avoid anterior contacts in centric occlusion in complete dentures in order to eliminate vertical and horizontal stresses on alveolar ridges in the region. Therefore, in establishing the stability in complete dentures, it is essential to have simultaneous and bilateral posterior occlusal contacts in centric relation and at acceptable occlusal vertical dimension (OVD)¹.

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Balanced occlusal concept is described as simultaneous bilateral contacts of upper and lower artificial teeth in both centric and eccentric positions. Although it is essential in complete dentures, never considered in completely dentate or partially dentate patients and considered as pathologic if present. Three occlusal schemes are described in the literature for complete dentures depending on the morphology of the posterior artificial teeth used and individual differences in the arches². Artificial teeth are available in 33°, 20° and 0° (ZDO) in order to use for different occlusal arrangement. When non anatomic denture teeth are considered at least for mandibular arch and occlusal surfaces are flat, monoplane occlusion (MO) is accepted. Balanced occlusion (BO) uses either anatomic or semi anatomic denture teeth on maxillary and mandibular arches. A recent review supports the fact that patients are more satisfied with occlusal schemes using anatomic teeth than with non-anatomic teeth³.

Lingualized occlusion (LO) was developed in order to eliminate disadvantages of both above schemes. While still considered a balanced tooth arrangement, lingualized bilateral balanced occlusion (LBBO) is characterized by maxillary palatal cusps contacting mandibular central fossae. It differs from conventional bilateral balanced occlusion (CBBO) by eliminating the contacts between the mandibular buccal cusps and maxillary central fossae. Occlusal contacts are explained in Figure 1. A systematic review

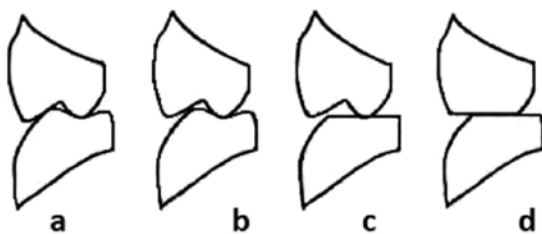


Figure 1. Posterior tooth morphology and arrangement⁴

- (a) anatomical maxillary and mandibular teeth arranged in CBBO
- (b) anatomical maxillary and mandibular teeth arranged in LBBO

- (c) anatomical maxillary tooth and flat mandibular tooth arranged in LBBO

- (d) flat maxillary and mandibular teeth arranged in MO

highlights that use of anatomical teeth in balanced or lingualized scheme is similarly acceptable to patients when masticatory ability, speech, esthetics and comfort are considered. However, they express some evidence that lingualized scheme is beneficial for severely resorbed alveolar ridges when mastication and stability of the complete dentures are concerned⁴.

As described in the literature, key factors in any type of occlusal scheme for complete dentures in maintaining patient satisfaction and improved masticatory function are the way the teeth are placed on the arch, orovestibular position and the contacts between opposing teeth⁵.

Balanced occlusion

Conventional bilateral balanced occlusion (CBBO) is considered appropriate for improved adaptation of mucosa supported complete dentures⁶ as it provides good retention and stability⁷. Further, it is associated with higher patient satisfaction than MO in relation to chewing and appearance⁸. This type is preferred over monoplane occlusal scheme due to better chewing ability and masticatory function as less force is required to masticate through the food bolus in the cusped than cusplless teeth. Better masticatory efficiency in CBBO is related to greater distribution of contacts between opposing occlusal surfaces during masticatory movements. Initial adaptation to the dentures seemed to be facilitated when the CBBO was used as the occlusal scheme⁶. However, it has been discussed that maintenance of this type of occlusion is poor due to differences in rates of denture teeth wear⁹. Better patient satisfaction with BO seems to be questionable when compared to canine guided occlusion (CGO) or LO which has been in the literature for a long time⁸. However, more well controlled clinical trials with a large sample are required in order to identify which

occlusal scheme fulfills patients' requirements by considering the stage of alveolar ridge resorption¹⁰.

Monoplane occlusion

Monoplane occlusal scheme describes the zero-degree inclination of the cusps in order to centralize the masticatory force. Occlusal forces are directed towards posterior teeth, center of support by eliminating all antero posterior and medio lateral inclinations³. Teeth with zero-degree angle also exert less force on mucosa than cusped teeth¹¹. However, it leads to less chewing efficiency and less aesthetics making patient less satisfied with the prostheses. Balanced or non balanced occlusion can be established with monoplane scheme.

Sear introduced monoplane occlusion with balancing ramps or tooth at the distal part of the mandibular arch which comes in contact only in eccentric excursions¹². Ramp provides tripodal effect of contacts of denture bases in eccentric relation, there is smooth contact anteriorly on teeth and posteriorly on the balancing ramp. Alternatively, mandibular second molars can be inclined to provide contact with the maxillary denture in all excursions, similarly maxillary second molars are also inclined but left out of contact in centric position. Balancing ramp improves horizontal stability of the denture. De Van has used the same principle without the balancing ramp making it a non balanced type of occlusal scheme¹³.

The use of monoplane occlusal scheme is beneficial specially when the skeletal relationship is either class 2 or 3 or when there is a discrepancy in width between the arches. It provides the patient with more freedom in centric as centric relation is established in an area as opposed to a point.

Results of a randomized controlled trial highlighted that the patients were more satisfied with LO and anatomic posterior occlusal schemes

than ZDO. However, more research with a long period of follow-up is needed to confirm these results¹⁴.

Therefore, it is suggested that if the patient has satisfactory levels of alveolar bone and other occlusal designs could be tolerated, monoplane occlusion should be avoided clinically. Further, this type is preferred as an option for patients with highly resorbed alveolar ridges or with temporomandibular dislocations as it transmits less pressure than cusped teeth.

Lingualized occlusion

Lingualized occlusion has been introduced in 1941 and it involves occlusion of maxillary palatal cusps with mandibular occlusal surfaces in all centric and eccentric relations. Therefore, setting teeth would be easier when compared to balanced occlusal scheme. In 1955, Chastain G. Porter, described the use of nonanatomic teeth with no cusp height and sharp cutting ridges. His introduction of altering the mandibular teeth made working contacts only on the lingual half of the occlusal surfaces.

A recent systematic review indicated that bilateral balanced occlusion does not provide better quality of life/satisfaction or masticatory performance. Lingualized occlusion can be named as a predictable occlusal scheme for the improvement of quality of life/satisfaction and masticatory performance in complete denture wearers while canine guidance is useful to reduce muscular activity¹⁵. Further, less occlusal interference and surface contacts between maxillary and mandibular teeth and fewer mandibular denture dislodgement during lateroprotrusive movement of the mandible are available in this type than bilateral balanced occlusion. Number of authors have discussed advantages of lingualized occlusion as good esthetics, good food bolus penetration, simple technique, additional stability in parafunction and ease of adjustment¹⁶.

One research report describes as lingualized

occlusion better than bilateral balanced scheme as it is associated with better masticatory performance index and as a result, less occlusal force is required for improved masticatory performance. Further, LO confers more denture stability while chewing¹⁷. A systematic review overall suggests that LO is preferred by edentulous patients in terms of masticatory performance and satisfaction over BO³.

Canine guided occlusion

Canine guided occlusion (CGO) is a commonly used occlusal scheme for dentate individuals. Although it is unsuitable for complete dentures due to higher possibility of tipping of dentures compromising patient comfort and stability, it may be indicated for patients with mildly resorbed alveolar ridges¹⁸. A randomized comparison between bilateral balanced occlusion and canine guidance had shown that there is no significant difference between two types when speech and retention of maxillary denture were assessed. Further, complete dentures with canine guidance had displayed more satisfaction in aesthetics, mandibular denture retention and masticatory ability¹⁹. They explain that the dentures with canine guidance could reduce undesirable lateral forces, thereby minimize the rate of artificial teeth wear and maintain the anatomic structure of cusps, providing higher efficiency of cutting and grinding. Another double blinded crossover clinical trial in 2010 revealed that BO scheme does not improve masticatory efficiency compared to CGO²⁰. Another study compared the effect of CGO vs BO and identified that there was no statistically significant difference on oral health quality of life of those patients in two occlusal schemes²¹.

Implant supported complete dentures (ISCD)/fixed prostheses

Implant supported complete dentures (ISCD) are becoming popular due to multiple advantages over conventional ones such as improved retention, stability and patient comfort. However, it has been reported in the literature that occlusal

contacts are considered a determining factor for success or failure of those prostheses²². However, according to the available literature, selection of occlusal scheme for ISCD is controversial. Review reports also emphasize the need of minimum four implants for mandible whereas six for maxilla²³. It also describes the distribution of loads by all the implants, location and number of implants, occlusal materials and occlusal schemes are important factors to consider at the planning stage.

Suggestions made to reduce occlusal overload on implants include reducing cantilever type, increasing number of implants, increasing occlusal contact points, assessing parafunctional habits, narrowing the occlusal table and reducing cuspal inclines²⁴. Some report that, if occlusal overload is associated with marginal bone loss, the micromovements could cause development of peri-implantitis²⁵. Occlusal overload has been considered as a major factor for biomechanical complications, including screw loosening, prosthesis failure and fracture of screws, coronal material or the implant²⁶. Reducing shear (nonaligned) forces, aiming for compressive forces and light to medium occlusal contacts in maximum intercuspation will favor towards successful restorations on implants. However, occlusal adjustments may be necessary and maintenance of good occlusal force distribution helps in keeping longevity of the implants.

Further, there has not been any consensus reached regarding long-term fracture potential of occlusal materials (acrylic, metal, porcelain and improved composites) on implants for ISCD. Although many authors recommend balanced occlusion for ISCD, it has not been strongly supported by the literature. Mostly, similar recommendations for conventional prostheses have been described for selecting balanced/ lingualized/ monoplane schemes for ISCD. However, it has been emphasized that the occlusion scheme selected should be based on balanced occlusion ensuring no interference in eccentric positions²⁷. According

to some reports, lingualized balanced occlusion is preferred in tissue-borne and implant-borne overdentures²³. However, when a single ISCD is opposed by fully borne anchored bridge, a mutually protected occlusion is indicated as there is no force on implants in centric position.

Occlusal vertical dimension (OVD)

Assessment of occlusal vertical dimension is an integral part in complete denture prosthodontics. Increased freeway space which could be associated with edentulism can further compromise facial profile, phonetics, masticatory performance and esthetics²⁸. An error in determining OVD is considered a major contributory factor for the failure in complete dentures. Pre extraction methods of assessing OVD are based on the assumption that the patient's OVD at the dentate state is the ideal measurement when esthetics, function and comfort are considered²⁹. These are the measurements of profile and cephalometric tracing, intra oral dimensions (measuring the vertical distance between maxillary and mandibular fixed landmarks or dots placed in the attached gingiva of the maxillary and mandibular arches) and pre-extraction phonetics and photographs. However, these are valid when the dentate patient is with acceptable OVD and in a stable occlusion³⁰. As now available, digital face scanning has better features of simplicity, quick image acquisition and possibility of saving records digitally. Moreover, with relevant software, digital image visualization allows accurate measurement of distances between facial landmarks³¹. Many instances, patients present without any pre-extraction record. Available post-extraction methods are establishment of physiologic rest position, assessment of facial esthetic appearance, swallowing, craniofacial measurements, cephalometric measurements, phonetics, evaluation of current/ previous dentures and finger length measurement. Although assessment of resting vertical dimension (RVD) and OVD is the most used, the measurement bears a greater possibility of error by the clinician. A systematic review has highlighted that all post

extraction methods are controversial and show a higher diversity in the measurements³⁰. Therefore, they have recommended a combination of methods to overcome those limitations of each technique.

Patient assessment

A good history is critical for the diagnosis of the patient. Examination and radiographic assessment are mandatory depending on the extent of the method of treatment planned. Recording maxilla mandibular relations are associated with many controversies³². There is no evidence regarding use of face bow results in improved clinical outcome in complete denture prosthodontics³³. A randomized clinical trial by Kawai et al had shown that there is no significant difference in patient satisfaction or perceived quality of conventional dentures when two groups (with face bow Vs. without face bow) were compared³⁴. Omar et al has identified in the randomized controlled study that the conventional complete dentures be better constructed without face bow and without secondary casts (made with master impressions using border moulded custom trays) in order to save time and money as omissions of steps had only a minor role in the outcome³⁵. However, there are no clinical trials available regarding use of face bow in full arch fixed prosthodontic work and good quality clinical trials are needed in order to arrive at a conclusion for their value³². Use of different types of articulators is controversial in the complete denture prosthodontics. However, the recording is valuable as it assists in identifying dynamic occlusion. Therefore, it is described by some authors as if an articulator can produce patients' jaw movements, it helps more in development of designed occlusal scheme³⁶. Further, use of articulators does not reduce dental surgeon's responsibility in assessing occlusion and articulation. Jaw relation records generated using Computer- aided design (CAD/ CAM) and manufactured using digital data would improve the outcome of complete denture prosthodontics. However, they still have certain limitations in application in complete dentures.

A clinical remount for complete dentures has been recommended in order to reduce clinically identified areas of discomfort and reduce the need of review appointments. However, development of a reliable and valid patient satisfaction questionnaire is necessary to determine conclusively whether the clinical remount improves patient-perceived satisfaction and masticatory performance³⁷.

Summary

According to the current literature, no conclusion is reached regarding which occlusal scheme in complete dentures performs best in terms of patients' quality of life or masticatory performance. Therefore, according to the current understanding, bilateral balanced occlusion is no more considered ideal occlusion for successful complete dentures. This is to be considered in treatment planning as balanced occlusion consumes more time and more complex for dental surgeons and dental technicians whereas other occlusal schemes can be arranged with less time and less complexity. However, these findings are to be assessed carefully as an appropriate decision on patient satisfaction on the occlusal scheme in complete dentures is to be done at least after 3 months of denture wear following occlusal adjustment. Further, there is lack of evidence to show a relation between optimal occlusal scheme with residual alveolar ridge anatomy. More well- controlled clinical trials with a large number of participants in the aspects of canine guided occlusion, relationship between alveolar ridge resorption and patient satisfaction with different occlusal schemes are also required in order to demonstrate which occlusal scheme fulfills patients' requirements in complete denture prosthodontics.

Conflict of interest

Authors declare that they do not have any conflict of interest towards any part of the manuscript.

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Management of impacted maxillary canines

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Abstract

Maxillary canines are strategically important teeth in terms of esthetics and function. It is the second commonest impaction after mandibular third molars and presents more challenges in terms of orthodontic management. In this article, an overview of the problem of impacted canines has been presented and the prevalence, various theories of etiology, sequelae of the problem, clinical and radiological options in diagnosis, as well as the surgical, and orthodontic considerations in the management of impacted maxillary canines that the clinician needs to be aware before certain decisions are made and the factors that influence such decisions are discussed. Further up-to-date current evidence from randomized control trials and systematic reviews are presented.

Introduction

Tooth impaction is defined as an intraosseous position of the tooth after the expected time of the eruption. Whereas the anomalous intraosseous position of the canine before the expected time of eruption can be defined as a displacement. The canine develops in the deepest area of the maxilla and follows the longest and most tortuous path before its eruption. According to Coulter et al, maxillary canines travel almost 22 mm from their position at the age of 5 years to their position at 15 years¹. Maxillary

canine impaction is a commonly encountered problem in orthodontic practice. Some times its management may need a multidisciplinary approach involving many specialties. Accurate and early diagnosis, localization of impacted teeth, and the timing of treatment are important determinants of management. Lack of monitoring, early intervention and delays of treatment can cause complications such as displacement of permanent teeth, loss of vitality of neighbouring teeth, dentigerous cyst formation, internal root resorption of canine and adjacent teeth, external root resorption of canine and adjacent teeth, recurrent pain and recurrent infections.

Prevalence

Although the prevalence of maxillary canine impaction is low for any population, there is considerable ethnic variation. The lowest rate has been reported as 0.27% among the Japanese². Various prevalence studies in Europe have reported this figure as 2.2%³, 1.7%⁴, and 1.74%⁵. Lövgren et al in their recent study presented a reduced rate of prevalence (1.1%) when interceptive treatment was systematically implemented⁶. Maxillary canine impactions are more common among females with a female to male ratio of 2: 1. Out of all maxillary impactions, it is estimated that 8 % are bilateral. In regard to labio-palatal location, 4.5% crowns

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lie labially, 34.1% lie in the line of the arch, and 61.4% cases lie palatally.

Aetiology

Maxillary canine impaction can often occur due to a lack of space in the dental arch secondary to early loss of deciduous canine. Crowding tends to delay the eruption of the maxillary canine. A greater percentage of buccally impacted canines and canines in the line of the arch is associated with dental arch crowding. Severe crowding can change the path of the eruption in developing maxillary canine thus forces the tooth to displace in the buccal direction. The exact aetiology of palatal canine impaction is unknown. But there are two common theories to explain this phenomenon, the guidance theory, and the genetic theory. Proponents of the “guidance theory of palatal canine impaction” propose that local factors such as congenitally missing lateral incisors, supernumerary teeth, odontomas, transposition of teeth, and other mechanical determinants that interfere with the path of eruption of the canine may predispose to this anomaly⁷. During its development canine has a strong mesial development path which

alters when it’s being guided downward by distal aspects of lateral incisor root. However, in the absence of this guiding influence canine continues its initial path in a mesial and palatal directed way. This will lead teeth to get impacted in the palatal area. Development of maxillary canine high in the maxilla with the longest eruption path, and being among the last teeth to develop may increase the potential of being subjected to the above mechanical disturbances. The genetic theory implies a strong hereditary influence in palatal canine displacement. Palatal canine displacement is closely associated with a chain of genetically linked phenomena, including small size maxillary lateral incisors, aplasia of second premolars, infraocclusion of primary molars, and enamel hypoplasia⁸. Other aetiologies include trauma, disturbance in tooth eruption sequence, retention of primary canine, premature root closure, and rotation of tooth buds (Table 1).

Diagnosis

Timely detection of maxillary canine impaction is important to reduce treatment time, the complexity of treatment, and complications.

Table 1. Overview of aetiology of impacted canines

Genetic	Environmental	
	Systemic	Local
1. Hereditary	1. Febrile diseases	1. Tooth size arch length discrepancy
- Celidocranial dysostosis	2. Endocrine diseases	2. Prolonged retention of deciduous canine
- Gorlin Goltz syndrome	- Pituitary dwarfism	3. Early loss deciduous canine
- Hereditary gingival fibromatosis	- Hypothyroidism	4. Abnormal position of tooth bud
2. Malposed tooth germ	3. Nutritional deficiencies	5. Decreased rate of root resorption
3. Arch length discrepancy	- Vitamin D Deficiency	6. Premature root closure
4. Alveolar clefts	4. Irradiation	7. Ankylosis
		8. Dilaceration of the root
		9. Idiopathic condition
		10. Absence of eruption
		- guidance due to absence of adjacent teeth
		- presence of supernumerary teeth or odontomas

Early detection should be made in children around 9 to 10 years old, although a wide variation of eruption times been reported. Careful clinical examination and comprehensive radiological analysis is the key to an accurate diagnosis. The following must be considered during the assessment of the patient⁹.

1. The amount of space in the arch for the unerupted canine
2. The morphology and position of the adjacent teeth
3. The contours of the bone
4. The mobility of teeth
5. The radiographic assessment to determine the position of the canine; its apex, crown, and direction of the longitudinal axis

Visual inspection

During clinical examination, the clinician should look for the presence of labial or palatal bulge, over-retained primary canine, asymmetric eruption pattern of right and left permanent canines, missing or presence of small lateral incisor, signs of root resorption in incisors, exaggerated distally tipped or retroclined/proclined lateral incisors and type and severity of the malocclusion.

Palpation

During its normal development process, maxillary canine should be palpated above its deciduous counterpart buccally two to three years before the eruption. To assess the canine, the alveolar process of the primary canine region should be palpated using the tip of the index fingers of both hands on both buccal and palatal sides¹⁰. A maxillary canine bulge is palpated buccally as a distinct round bulge in older children with normal eruption potential, whereas it is palpated higher as a swelling in the alveolar process related to the root of the deciduous canine when it is displaced¹⁰. Palpation of smooth alveolar surface mesial to the root of the deciduous canine is regarded as abnormal while concave alveolar surface mesial to the primary canine apex indicates potential

eruption disturbance in children aged between 8 – 11 years old. It is also important to manipulate the deciduous canine to find out whether it is mobile. However mobile primary canine itself is not an indicator of normal eruption of its normal successor¹¹.

Radiography

Radiographic supervision of unerupted maxillary canine is not necessary before the age of 10 years old¹⁰. Ericsson and Kurol suggested suspecting the possibility of canine impaction and further radiological assessment if¹¹,

1. Asymmetry on palpation or a pronounced difference in the eruption of canines between the left and right side exists.
2. The canines cannot be palpated in the normal positions and the occlusal development is advanced, suggesting an abnormal path of eruption,
3. The lateral incisor is late in eruption or shows a pronounced buccal displacement or proclination.

Based on these criteria, Ericson and Kurol found that around 8% of children over 10 years old need supplementary radiographic assessment to find out canine impaction¹¹. A single periapical radiograph is a requisite to identify impaction, cystic changes, and other pathologies like root resorption. In 92% of cases, canine positions can be assessed with sufficient accuracy with periapical radiographs¹². However, this should be supplemented with other films to precisely locate the tooth and surrounding tissue. Occlusal films are also important as they show the position of the canine in relation to the midline. In 1910, Clark introduced the “parallax technique” (tube shift method) and it is the most popular method in locating the impacted canine¹³. Tube shift can be done in either horizontal or vertical direction. In the horizontal parallax technique two periapical radiographs taken by shifting the tube in the horizontal direction and changing the angulation of the x-ray beam to a reference tooth adjacent to canine. If the maxillary canine is labially

impacted it moves in the opposite direction to the tube whereas palatally impacted canine moves in the same direction as the tube (SLOB). The vertical parallax method was introduced by Keur in 1986¹⁴ and it involves the use of a rotational panoramic radiograph and an occlusal radiograph. The occlusal radiograph is taken at an angle of $+60^{\circ}$ - 65° to the occlusal plane and in a panoramic radiograph; the tube is positioned in front of the patient's head at an angle of 7° to the occlusal plane. Because of this position of the panoramic tube, palatally impacted canine moves in the same direction with the tube shift for an occlusal radiograph. But a study done by Armstrong et al concluded, horizontal parallax method using two periapical radiographs or one occlusal and one periapical radiograph is superior to the vertical parallax method in locating ectopically placed maxillary canines¹⁵. True lateral view (as lateral cephalogram) paired with vertex occlusal view or posteroanterior view of the skull also provides three-dimensional positional and comprehensive information but higher radiation dosage over-weighs the benefits of these extraoral radiographs.

Although conventional radiographs provide satisfactory diagnostic images, they may not provide accurate information about pathologies caused by an impacted tooth on adjacent teeth such as root resorption. Cone-beam computed tomography (CBCT) provides 3D information with great resolution. Radiation dosage is less compared to conventional CT and with recent developments; it has become similar to a panoramic radiograph. With conventional radiography, around 12.5% of impacted maxillary canines showed root resorption on adjacent incisors¹². But with CBCT greater percentage of cases showed root resorption associated with adjacent teeth^{16,17,18}. According to current evidence CBCT is the only reliable diagnostic method for exact 3D localization of impacted canine and root resorption associated with adjacent teeth^{18,19}. Further CBCT can be employed in surgical planning, surgical

simulation, surgical navigation and surgical template designing to facilitate surgical interventions. However, when the impact of CBCT on financial costs and orthodontist's treatment decision on management is evaluated, it can be concluded that most of the treatment decisions are made irrespective of radiological methods and most authors were not supporting the routine use of CBCT in patients with impacted maxillary canines²⁰.

Treatment

Interceptive treatment

Extraction of deciduous canine to facilitate the eruption of permanent canine is considered a preventive method of canine impaction. Ericsson and Kurol have investigated 46 ectopic canines in 35 children aged between 10 to 13 years (mean age 11.4 years) and found that in 36 of 46 (78%) cases canine pathways were normalized after extraction of primary canine²¹. Also, the prognosis was less favourable if the overlap of lateral incisor by the canine crown is increased or angle between the long axis of the canine crown and mid-sagittal plane is widened. In 64% of cases, canine pathway normalized if canines were overlapped adjacent lateral incisor by more than half of lateral incisor root, and 91 % of canines were normalized if it overlapped the lateral incisor by less than half of its root. Also, they recommended that if no improvement of the canine pathway occurs in 12 months of time, normalization should not be expected and alternative treatment methods should be considered. Power and Short examined 47 palatally placed canines in 11.3 (mean age) year old children and found normalization of the canine pathway after extraction of deciduous canine in 62% of the cases²². Also in the same study, 19 % of the cases showed some improvement of the eruptive pathway after the extraction of deciduous canine. Adrian Becker²³ recommended the following criteria to be taken into consideration before planning the extraction of deciduous canine.

1. Early diagnosis of palatal displacement of the canine.
2. Patients should be between 10-13 years old or with delayed dental development.
3. Accurate identification of the position of the apex should be made and confirmed to be in the line of the arch.
4. The medial overlap of the canine tip should be less than half of the way across the root of the lateral incisor root. (in panoramic view, Figure 1)
5. The angulation of the long axis of the canine should be less than 55° to the mid-sagittal axis.



Figure 1. (a) Panoramic radiograph of a 11-year-old child showing an impacted right maxillary canine (arrow) of which, the medial overlap of the tip is less than half the way across the root of the lateral incisor and the angulation of the long axis is less than 55° to the mid-sagittal axis. (b) The clinical appearance of the same child. Bulge of the canine is denoted by *.

When isolated extraction compared with the untreated control group, it showed a success rate of 65.2% whereas the untreated group showed 36% improvement of the eruption pathway²⁴. In the same study, they looked at an interceptive group involving extraction of deciduous canine, and the use of cervical headgear for 3 months after extraction which showed an 87.5% success rate. Rapid maxillary expansion in early mixed dentition also is an effective interceptive method in increasing eruptive potential of palatally displaced canines (65.7%) when it is compared with a non-treated control group²⁵. A similar study showed that more positional changes and short eruption times for palatally displaced canines when patients underwent extraction of deciduous canine compared with untreated controls (spontaneous eruption of 69 % and 39% respectively with mean eruption time of 15.6 +/- 5.6 months in the extraction group and 18.8 +/- 5.8 months in the control group)²⁶.

Surgical exposure and orthodontic traction (Orthodontic mechanotherapy)

In all cases, it is not possible to identify impaction at an early stage. The patient may present to the dental clinic later at his/her permanent dentition. Also, the interceptive approach may not be successful in certain cases. These cases may require a comprehensive orthodontic treatment approach. As these patients present at the stage of permanent dentition, local anomaly as well as patients existing malocclusion must be thoroughly assessed and a comprehensive treatment plan should be made.

General principles of orthodontic mechanotherapy:

1. The appliance must able to align and level all erupted teeth in the dental arch rapidly and also allow space creation to accommodate the impacted tooth.
2. Once alignment, levelling, and space creation achieved the all erupted teeth in the arch transformed into a rigid anchorage unit by using heavier base arch wire to provide

maximum anchorage during disimpaction.

3. Surgical exposure of the crown should be performed in a way that ensures maximum periodontal support at the end of treatment.
4. Use of an auxiliary to place traction on the tooth from a rigid fixed appliance. (Auxiliary should provide light continuous force with a wide range of activity).
5. If the impacted canine is located mesial to the lateral incisor and if there is no direct way from canine to created space, then the canine should be diverted away from the obstruction and canine should be move along a new unobstructed pathway.

Ways of space creation for impacted canine:

1. Existing spaces within the incisor region.
2. Improving arch form with fixed appliance.
3. Increasing arch length (correction of rotated molars, distalization of maxillary molars)
4. Extraction of teeth (in case of severe crowding or existing class II relation that needs correction with class II mechanics).

For the surgical exposure of impacted canines, there are two recommended approaches.

Closed exposure technique: In this method, a flap is raised to expose the canine and an attachment is bonded to the tooth at the same time. Then the flap is closed fully and only the ligature wire is passed through the gingiva from the recovered tooth.

Open exposure technique: In this approach, the canine is uncovered surgically by removing bone and mucosa and a pack is placed to avoid the growth of surrounding tissue over the tooth. After wound healing (within 3-8 weeks) pack is removed and attachment is placed.

Proponents of each method claim one is more advantages over the other technique. But current evidence indicates that there is no difference in the duration of surgical treatment, pain perception, duration of the canine eruption,

periodontal outcome, and aesthetic outcome between two techniques^{27, 28}.

Apically repositioned flap: This method is more suitable for buccal canines with minor vertical displacements. In this technique, an adequate amount of attached gingiva is repositioned as a part of the split-thickness flap above the impacted tooth (as a mucogingival junction). This tissue follows the tooth as it moves downwards and ensures good periodontal support in the end. It also provides suitable access to apply orthodontic force directly to the archwire.

Tunnel Approach: This is a procedure used to treat deeply placed intraosseous canines associated with a retained deciduous canine. This technique allows physiological eruption pattern of the canine to the centre of the alveolar ridge²⁹. In this approach, the buccal bone is preserved and the impacted tooth is drawn through a tunnel in the bone created by the vacated socket of extracted deciduous canine. A full-thickness labial flap is raised including attached gingiva and the impacted tooth is exposed from its buccal aspect, leaving buccal bone plate inferior to exposure site. The deciduous canine is extracted simultaneously and the socket is widened to allow passage of impacted tooth and the ligature wire. Further this technique has shown better physiologic attachment levels without gingival recession and an adequate amount of gingiva.

Method of attachments and applying traction: Brackets, an eyelet, hook, or button can be used as an attachment to bond on the enamel surface of the impacted tooth after surgical exposure. Several methods are described to apply traction on the impacted tooth for moving it to proper alignment. Elastic threads, elastic chains, Ni-Ti coil springs, and gold chains are readily available and easy to use. Also, certain clinicians prefer light wires, ballista spring (Figure 2), springs soldered to palatal or labial base wires, and Kilroy I, and II springs to apply traction on the tooth. Whatever method used the principles are

- Use of light force to move impacted tooth (not more than 60g).
- Maintain the created or available space by tying teeth mesial and distal to canine or by the placement of coil spring.
- Use of the heavier base archwire to avoid intrusive movement of anchor teeth.



Figure 2. (a) Ballista spring (arrow) in passive state. (b) Activated Ballista spring to place traction on left maxillary canine*

Orthodontic mini-screws have been proved to be reliable and convenient skeletal anchorage method in canine management. Mini-screws are placed on the alveolar process to improve initial angulation of the tooth and it provides the advantage of placing traction without placement of orthodontic appliance on rest of the arch.

Irrespective of the method employed, first premolar should not be extracted until canine is successfully pulled into the correct position of the arch. Otherwise, canine is extracted and premolar is preserved.

Retention after mechanotherapy: To prevent rotational relapse, fiberotomy or fixed orthodontic retainers are indicated in certain

cases. But a recently published study concluded that there is no statistically significant difference in post-treatment changes associated with and without retention in adolescent patients who underwent treatment for maxillary impacted canine³⁰. This study also showed that vacuum formed retainer was successful for impacted canines with moderate pre-treatment crowding. Further, they concluded the largest amount of post-treatment changes occurred during the first 10 weeks of retention in the non-retention group.

Autotransplantation

Autotransplantation is an atraumatic removal of the impacted tooth and reimplantation of the tooth in the surgically prepared socket in the donor site. This is a good treatment option when an impacted tooth is severely displaced if the patient is reluctant to undergo prolonged orthodontic treatment or reluctant to wear an orthodontic appliance if there is existing space for transplant tooth. The success rate of transplantation depends on patient's age (below 16 years), developmental stage of the transplanted tooth, surgical technique, and surgeons' skills, and the extra alveolar dry time before tooth transplantation. Current evidence has shown greater survival rates (88.2%) and considered an acceptable treatment option³¹. But complications like progressive root resorption and ankylosis associated with replacement resorption should also be taken into consideration during treatment planning.

Surgical removal

Surgical removal of the impacted canine would be a viable clinical option, if the patient refuses orthodontic treatment, if there is early evidence of root resorption of adjacent teeth, if the canine is ankylosed and cannot be transplanted, if the impaction is too severe and degree of malocclusion is so canine cannot be transplanted/repositioned and presence of pathologies like dentigerous cysts. Also if good contact between the lateral incisor and the first premolar is present and the patient is willing to undergo orthodontic

treatment to camouflage first premolar as canine this option should be considered. This is a valid treatment option for deciduous canine with a good prognosis and surgical removal is planned. The canine space can be managed by replacing premolar into the canine position or restoring the space by prosthesis or osseointegrated dental implant. If premolar substitution is planned, slight extrusion, negative crown torque and mesio-palatal rotation are recommended for optimum aesthetic results. In labially displaced and crowded cases removal of canine would not be advisable although it can temporarily improve aesthetics but can compromise and complicate orthodontic treatment results.

No active treatment

If no treatment has been carried out it is important to review patients initially biennially with supplemental radiographic evidence to monitor for root resorption, cyst formation, and transmigration.

Conclusion

The impacted maxillary canine is a fairly prevalent dental anomaly and early diagnosis and timely intervention can reduce the complexity of future treatment. Also, severely impacted canines need comprehensive management involving orthodontists, oral surgeons, and oral radiology specialist. It is also important to stay updated on current evidence and best practice methods.

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Medical emergencies on the Dental chair

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Abstract

Any dental surgeon may come across a few medical emergencies in his/her dental practice which may happen at a time he/she is unprepared. All dental surgeons should possess a sufficient knowledge and skills to handle a medical emergency in their Dental practice setting. It is very important that all dental practitioners are capable of recognizing an emergency without any delay and Initiating treatment promptly. Medical emergencies are of two main types, some are immediately life-threatening emergencies and need prompt effective resuscitation. Others are not immediately life threatening but need urgent attention. Medical emergencies in the dental practice that have been reported include vasovagal syncope (63%), angina (12%), hypoglycaemia (10%), epileptic seizures (10%), choking (5%), asthma (5%) and anaphylaxis. Vasovagal syncope is the most common emergency, accounting for approximately two thirds of all emergencies. A basic and simple approach for management of emergencies would be to; Attend to Airway, Breathing, Circulation and Disability and support the vital parameters as you find anything wrong, look for a cause for the problem and try to sort it out. Start specific treatment for the problem while calling for help-from a nearby medical person or call ambulance service 990. All dental staff should be trained and should receive regular updates in the management of medical emergencies and possess up-to-date evidence regarding managing medical emergencies.

Introduction

Any dental professional can encounter a medical emergency at any time during his/her practice. The frequency of dental emergencies that happen on the dental chair is much less and true emergencies are rather rare. It is this infrequency of occurrence and the long lapse since last learning or training in handling an emergency that makes difficult for an average dental surgeon to handle an emergency efficiently. However, it is very important that all dental practitioners are capable of recognizing an emergency without any delay and initiate treatment promptly. The objective of this review article is to provide basic information about commonly occurring medical emergencies in dental practice and their management.

Medical emergencies are of two main types, some are immediately life-threatening emergencies and need prompt effective resuscitation. Others are not immediately life threatening but need urgent attention. However, both types need early suspicion, early initiation of treatment including calling for help and team work.

Medical emergencies can happen to a patient, a member of the staff or a person who is merely accompanying a patient¹. Many factors can increase the likelihood of such incidents including increasing number of older persons seeking dental care, therapeutic advances in the medical practice, growing trend towards longer dental appointments and increasing use and administration of drugs in dentistry. Emergencies

can sometimes be anticipated as a result of having obtained a thorough medical history². More than 54 percent of the emergencies have been reported during or right after local anesthesia. The types of treatments cited with the greatest percentage of emergencies are two procedures associated with potential high patient anxiety tooth extraction and pulp extirpation³. It is important to recognize and diagnose what is happening in order to manage the particular emergency appropriately. Dental practitioners and their staff need to have appropriate skills, training and equipment available to deal with potentially life-threatening conditions^{4,5}. These emergencies range from the minor such as the common fainting to a cardiac arrest.

Incidence of medical emergencies

A survey of 4000 dental surgeons conducted by Fast and others revealed an incidence of 7.5% emergencies per dental surgeon over a 10-year period⁶. Medical emergencies in the dental practice that have been reported include vasovagal syncope (63%), angina (12%), hypoglycaemia (10%), epileptic seizures (10%), choking (5%), asthma (5%) and anaphylaxis⁷. Vasovagal syncope is the most common emergency, accounting for approximately two thirds of all emergencies reported⁸. Mohideen et.al. has also shown that most frequent medical emergency in the dental office is syncope representing 50%, the next most frequent is mild allergy at 8% followed with hyperventilation occur at 7% of all emergencies. The scope of treatment by the dentist requires preparation, prevention and then immediate level of required management. The dentist must be trained well efficiently to manage frightening medical emergency conditions and associated problems instantaneously to save the life of the patient which make the dental surgeons to more competent and confident in their clinical practice⁹.

This discussion is aimed at reviewing management of common medical emergencies in a dental practice.

A basic and simple approach for management of emergencies would be to;

1. Attend to Airway, Breathing, Circulation and Disability and support those vital parameters as you find anything wrong. Open the airway, by head tilt and chin lift, check for breathing by looking at the chest. (old practice of listening and feeling for breath sounds by bringing the resuscitating medical person's face close to the victim's mouth and nose cannot be encouraged due to concerns regarding contracting Covid-19) start on 100% oxygen, start an intravenous drip through an IV cannula with a normal saline. Check for presence of carotid pulse. Check for level of consciousness through AVPU. A-Awake, V-responds to verbal commands, P-responds to pain, U-unresponsive. If there is no breathing, it is a cardiac arrest for all practical purposes. A person with no respiration either has no pulse by now or has a faint pulse which is going to stop within the next few seconds. Start chest compressions immediately, suck out secretions and start bag & mask ventilation. If the victim has breathing and pulse, but unconscious turn the patient to recovery position.
2. Look for a cause for the problem and try to sort it out. e.g. if a patient has a difficulty in breathing, try to see whether this breathing difficulty is due to exacerbation of Bronchial asthma, Chronic Obstructive pulmonary disease, aspiration of a foreign body, heart failure or a myocardial infarction etc. e.g., giving 2 puffs of patient's inhaler might relieve the patient's difficulty in breathing.
3. Start specific treatment for the problem. e.g., keeping a sublingual GTN tablet if it is an angina.
4. Call for help-from a nearby medical person or call ambulance service 1990 and direct the patient to the nearest emergency medical facility after stabilizing vital parameters. An unstable patient should, never be transferred in an ambulance without appropriate supervision. A patient is fit for transferring only after some basic stabilization of vital parameters.

5. If the patient recovers from the emergency, you should liaise with relevant medical specialists and proper referral letters should be written. Discharge the patient from the dental clinic with an attendant or a member of the family.

(A) Syncope:

Syncope is a sudden, transient loss of consciousness that usually occurs secondary to a period of cerebral ischemia. Patient may be nauseated, pale and weak with sweaty or cold clammy skin⁹. Predisposing factors for Syncope are fear, anxiety, emotional stress, severe pain, sight of blood / dental instruments and hot, humid, crowded environment etc.

Management

- Place the patient in semi prone position on the dental chair, a couch or floor to facilitate blood flow to brain
- Check for the presence of pulse, respiration and measure blood pressure.
- Remove instruments, mouth gags or other movable items from the mouth.
- Suck out secretions and make the mouth dry, open the airway
- Administer 100% oxygen if available; otherwise let the patient breathe room air.
- Do not try to insert anything to open the mouth
- Do not give anything to the patient to drink until he gains full consciousness
- The patient may be given some glucose or a drink with sugar when he/she is awake.

If there is a bradycardia, administer 0.5–1mg Intramuscular (IM) or Intravenous (IV) atropine. For hypoglycaemic patients, administration of 25%-50% IV glucose or if the patient is awake giving a soft drink should be done.

(B) Mild Allergies

Allergic reaction is an immune reaction to a substance to which the patient has been previously sensitized. Symptoms may be itchy skin rash, flushing, angioedema, rhinitis and laryngeal oedema^{10,11}.

Management: An oral antihistamine like Chlorpheniramine (4 mg) or IM Promethazine HCL (25mg) should be administered.

(C) Epileptic Seizure

Seizures are due to sudden discharge of stimuli by cerebral neurons leading to convulsions. Seizures are generally preceded by prodromal symptoms like flashing of lights, tingling sensation and headache. There can be excessive salivation, urinary incontinence, tongue biting and noisy breathing.

Management: Discontinue treatment, remove instruments from the mouth. Place the patient in lateral position. Open and maintain patent airway, suck out secretions/let oral secretions drool out and avoid pulmonary aspiration. If seizures stop and breathing is normal, allow the patient to sleep under supervision. If seizure persists more than 5 minutes, then titrated IV midazolam 1-2mg together with oxygen 15litre/min should be administered. With difficult iv access use buccal infiltration or intranasal administration of Midazolam⁹. Recommended dosages are 10 mg for adults and child >10 years, 7.5mg for child 5-10 years, 5 mg for Child 1–5 years. One repeat dose may be given after 10 minutes. For hypoglycemic patients administer 25 - 50 ml of 50% IV Dextrose.

(D) Angina Pectoris

Classical angina presents as an intermittent chest pain induced by a known stress. It generally is felt in the chest with radiation to left side shoulder, arm, hand, neck, face and mandible. Pain is gradual in onset lasts for 2-5 minutes accompanied by nausea, sweating, dyspnoea and dizziness. In unstable angina, patient may get ischaemic type of chest pain more frequently or with less exertion with or without ECG changes.

Management: Stop the procedure, position the patient upright and reduce anxiety. Supine position may increase the subjective intensity of pain⁹. Monitor vital signs and provide 100%

Oxygen. Use GTN sublingual tablet or spray -Spray 1 or 2 metered doses of (400mcg each) with no more than 3 metered doses within a 15 min period. Sublingual tablets 0.5mg every 5 min with no more than three tablets for 15 minutes⁹. If pain is not relieved by 3 doses of GTN over a 10-minute period then suspect a myocardial infarction^{9,12,13}.

(E) Myocardial Infarction

MI is caused by deficient coronary arterial blood supply to a region of myocardium due to obstruction from atherosclerotic coronary artery that results in cellular death and necrosis. Suspect MI when anginal pain is not relieved by GTN. There may be weakness, nausea, sweating, pallor, cold / sweaty skin, restlessness, dizziness, dyspnoea and syncope. Associated pump failure results in hypotension, palpitations, slow pulse to tachycardia and pulmonary edema^{9,12,13,14}.

Management: Position the patient upright, supine if the patient is faintish⁹. Assess circulation, airway and breathing. Administer high flow oxygen, 15 L/min. Aspirin 300 mg, Clopidogrel 300 mg and Atorvastatin 40mg orally. If pain continues, administer Morphine 2 to 5 mg IM / IV with High Flow Oxygen^{9,12,13}.

(F) Acute Asthma

Asthma occurs due to bronchoconstriction and mucous oedema. It generally presents as dyspnoea, wheezing cough or chest tightness. With acute severe asthma patient may be unable to speak, tachycardic and confused. With life-threatening asthma there will be a "Silent chest" on auscultation, cyanosis, sweating, flushing of face, bradycardia and hypotension^{9,14}. In status asthmatics, wheezing persists despite therapy. Symptoms are dehydration, dyspnoea and cyanosis¹⁴.

Management: Prop up the patient and administer 2 puffs from salbutamol inhaler. If the patient is unable to inhale, nebulize with 5mg (1ml) of Salbutamol solution or use a volumetric spacer

(100 mcgs/ puff) and deliver 4-6 puffs. If there is no improvement in 15 seconds, then consider SC/ IM administration of 1:1000 dilution of adrenaline 0.3 ml. If no response is observed in 2-3 min oral or IV administration of hydrocortisone sodium succinate 100 to 200 mg should be considered. If condition persists administer IV aminophylline and call EMS to transfer the patient to hospital. O₂ 15 L/min should be delivered whilst waiting medical help^{9,13,14}.

(G) Heart Failure

It could be left or right ventricle failure or biventricular failure where ventricles are unable to pump blood forwards. Left ventricular failure may also be associated with acute MI⁹. Left ventricular failure presents with dyspnoea or chest pain, pulmonary oedema, haemoptysis, hypotension, cyanosis, palpitations and tachycardia. Right ventricular failure presents with swollen legs & ankles, pitting oedema and hepatosplenomegaly^{14,15}.

Management: Immediately position the patient upright. Administer Oxygen and assess breathing, pulse & blood pressure. Administer venodilators such as GTN 0.4 - mg SL spray or 0.5mg SL tablets every 5 min up to 3 tabs to reduce preload. GTN is not advised for hypotensive patient. Morphine 2-4 mg IV / SC/ IM may also be given^{14,15}.

(H) Anaphylaxis

This is a severe allergic reaction to a substance, to which the patient has already been sensitized. It is a life-threatening emergency characterized by bronchospasm, hypotension and angio-oedema. There may be burning sensation of skin, cyanosis, swelling of face, tongue and lips, abdominal pain, pain & tightness in chest, difficulty in breathing, cough, laryngeal oedema, stridor and tachycardia. If symptoms become severe it may lead to cardiac arrhythmias, loss of consciousness and cardiac arrest.

Management: The patient should be placed in

supine position with legs raised. Check airway, breathing, blood pressure and pulse. Administer high flow oxygen at a rate of 10 litres/min. Administer IM 1:1000 Adrenaline 0.5 ml (0.5 mg) to support circulation and to dilate bronchioles. If there is no improvement in patient's response, repeat the dosage every five minutes until arrival of medical help. Initiate CPR if needed. Promethazine 25mg IM and Hydrocortisone 200 mg IV should also be administered. A normal saline drip should be started through an IV cannula.

(I) Airway obstruction

This generally is due to an aspirated instrument/object or a dislodged tooth and is a life-threatening emergency. In severe airway obstruction, patient may be holding neck unable to speak, struggling to breathe, distressed and may be cyanosed.

Management: "Heimlich maneuver" on dental chair – dentist should stand on a side of the patient and place the patient's head in the neutral position. Press the patient's abdomen by placing heel of one hand above the umbilicus and below the rib cage and second hand directly on top of first hand and deliver quick inward and upward thrusts. Repeat the procedure until relief from obstruction. This thrust is followed by turning patient to one side to clear oral cavity⁹. Also, the patient can be asked to turn to a side on the dental chair with head down (Trendelenburg position) and get the patient to cough forcefully and continuously to expel the foreign object. If the foreign object is in the oropharynx, retrieve it with a forceps^{9,14,15}.

(J) Cardiac Arrest

Cardiac arrest is the worst medical emergency that any medical personnel have to face. If a patient is not responding and not breathing it is a cardiac arrest. Common causes for a cardiac arrest in a dental practice would be myocardial infarction, hypoxia and hypotension. Other reversible causes for a cardiac arrest are hypothermia, hypercarbia, tension pneumothorax, tension pneumothorax and toxins, which are very unlikely to happen on a dental chair.

Management: Resuscitation has to be started immediately. Place the patient supine with slight elevation of feet remove instruments in the mouth. Chest compressions should be started immediately at the middle of the lower half of the sternum at a rate of 120/min. Open the patient's airway by head tilt and chin lift or jaw thrust, suck out secretions and deliver breaths through a bag and a face mask with 100% oxygen. It is essential to call for help with a defibrillator, resuscitation drugs and equipment. Early detection of the rhythm of the cardiac arrest and early defibrillation if it is a shockable rhythm is mandatory.

(K) Hyperventilation Syndrome

Hyperventilation is ventilation more than that is required which results in hypocapnia (low CO₂ level in blood) due to excessive loss of CO₂. This is characterized by rapid breathing, palpitations, sweating, anxiety, chest discomfort, tachycardia, dizziness, lightheadedness, altered consciousness, numbness and tingling of extremities with peripheral paraesthesia, muscle pain, cramp, stiffness and tremors due to sympathetic stress response^{9,13,14}.

Management: Stop the procedure, position the patient in a way comfortable for him and advice to relax. Get the patient to rebreathe the expired air since expired air into a bag or hands cupped over face closing mouth and nose for 10 times. Ask the patient to repeat the cycle until the relief of symptoms. Do not administer O₂ for hyperventilating patients. No drugs are usually required but if symptoms persist administer IM/ Oral Diazepam 10 mg or IM Midazolam 3 -5 mg. If the patient becomes unconscious, place him in supine position, maintain airway and initiate CPR until the patient recovers consciousness^{9,13,14}.

(L) Hypoglycaemia

This is reduced blood glucose levels below 3.9mmol/L or 70mg/dl. This generally occurs when patients do not take oral foods or drinks due to painful dental conditions or in patients with Diabetes who take their medications without a

proper meal. They present with sweating, blurred vision, slurred speech, tremors, pale, weakness cold and clammy skin, nausea & hunger, depressed respiration, rapid pulse, hypotension, head ache, irritability, bizarre behaviour, disorientation, drowsiness, unconsciousness, seizure and coma.

Management: Awake patients can be given sugar or glucose powder, or a sugary drink to be consumed. Recheck blood sugars after about 10min and repeat oral sugars. If the patient is too drowsy or unconscious, place the patient in lateral position, start 100% oxygen and administer iv 25-5-% glucose 50ml.

(M) Hyperglycaemia (Diabetic Ketoacidosis and Diabetic Coma)

Blood glucose levels above 7.0mmol/L or 126mg/dl when fasting. patients would present with hyperventilation with acetone breath, hypotension, rapid and weak pulse polyuria, dry skin, thirst, abdominal pain, altered consciousness and coma.

Management: Rehydrate the patient with IV fluids -0.9% saline, 1L in 30 min + KCL 20mmol, then another 1L in one hour. Insulin 10U IV stat or 20 U IM insulin stat then check blood sugar levels hourly and use soluble Insulin accordingly. If the patient is unconscious place him in lateral position, start 100% Oxygen.

(N) Adrenal Insufficiency

This is a condition with hypo-secretion of cortisol which can lead to a life-threatening crisis. There may be a history of discontinuing steroids. Clinical features include fatigue, pallor, sweating, pyrexia, hyperpigmentation, vomiting, diarrhoea, craving for salt and water, intense pain in abdomen, hypoglycaemia, hypotension, rapid / weak pulse, confusion, convulsions, circulatory collapse which leads to unconsciousness^{9,13,14}.

Management: Place patient in Trendelenburg position. Assess circulation and breathing and maintain air way. Administer high flow Oxygen

5-10 L/mn. Review patient's medical history and monitor vital signs. Administer 100 mg IM / IV hydrocortisone or IM dexamethasone 4 mg. If patient is hypotensive administer IV fluids (1 L normal saline or 5% dextrose). If patient is Hypoglycaemic - IV 50% Dextrose 50-100mL or Glucagon 1-2 mg IM should be administered.

(O) Adrenaline Overdose

This is due to administration of a large dose or repeated doses of Adrenaline. Clinical features include pallor, weakness, palpitations, anxiety, flushing, sweating, trembling, uneasiness, tachycardia, respiratory failure, headache and dizziness^{9,14}.

Management: Place the patient in recovery position. Administer high flow Oxygen. Monitor Vital Signs. Administer vasodilator GTN (2 sprays or 2 sublingual tablets) with continuous monitoring of blood pressure. If patient is hypertensive administer IV Labetalol or Atenolol^{9,14}.

(P) Local Anaesthetic (LA) Toxicity

This generally is due to administration of a large dose or repeated doses of local anaesthesia, or inadvertent intravenous administration of LA or unexpected absorption of LA to nearby blood vessels. Clinical symptoms include circumoral numbness, tinnitus, headache, blurring of vision, anxiety, confusion, palpitations, arrhythmias, tremor, seizures, hypotension, bradycardia, respiratory arrest and cardiac arrest.

Management: Place the patient in supine or recovery position. Check airway, breathing, circulation and level of consciousness. Start on Oxygen and manage symptoms. If patient is having seizures, then administer iv/im Midazolam up to 2.5 - 5 mg. If patient is hypotensive give IV fluids^{9,14}.

(Q) Bleeding

Primary bleeding happens during the procedure. Common causes are- drugs like Clopidogrel,

Aspirin, Dipyridamole, Warfarin & Heparin, direct injury to small blood vessels, liver impairment, coagulation factor deficits, local sepsis or poorly controlled blood pressure.

Try to see whether it's a surgical bleeding by gentle cleaning & drying of the mouth. Direct compression with gauze or ice packs, pressure packs of resorbable oxidized cellulose (Surgicel), Adrenaline packs, suturing under local anaesthesia with Adrenaline, Tranexamic acid mouthwash followed by intravenous or oral Tranexamic acid 500-1000mg 8hrly will be helpful depending on the severity of bleeding.⁹ Patients with continuous oozing or bleeding will have to be admitted to the dental ward and investigated to find a cause (full blood count, blood picture, clotting profile, liver function tests etc.) for the bleeding with consultation with the haematologist. NSAIDs should be avoided in patients with extra bleeding.

Training

All dental staff should be trained and receive regular updates in the management of medical emergencies and possess up-to-date evidence regarding managing medical emergencies¹⁶. Running regular mock scenarios/drills involving the team approach is advised.

Maintaining the knowledge and competence to deal with medical emergencies is an important aspect of all dental care professionals' continuing professional development¹⁷.

Conclusion

Every dental practitioner has a duty of care to ensure that an effective and safe service is provided for all patients. Adequate staff training and availability of appropriate drugs and equipment are essential for the management of emergencies of dental clinic. Prevention of medical emergencies as much as possible by ensuring good history taking, relevant physical examination and suitable investigations is better than facing unexpected medical emergencies.

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Solid variant of alveolar rhabdomyosarcoma: a rare entity in a 3-month-old child

A.H.M. Shazli, R.P. Ekanayake, D.K. Dias

Abstract

Rhabdomyosarcomas are malignant tumors of skeletal muscles. Though It accounts for only 4-8 percent of all pediatric cancer, it is the most common soft tissue sarcoma of children and young adults. Here, we are reporting a rare case of a 3-month-old child who had a growing lump in the right side infra-orbital region. Incisional biopsy was done. The histopathological features together with immunohistochemical findings were consistent with those of Alveolar Rhabdomyosarcoma. Extent of the tumor and presence of any distant metastasis were investigated. Surgical resection of the tumor was done followed by reconstruction with Glabellar flap. The child underwent chemotherapy and was followed up in the oncology clinic for 4 months without recurrences. Soon after that, the child presented with local recurrence. Despite further surgical resection of the tumor and radiotherapy, patient continued to deteriorate and developed brain metastasis 10 months later. Eventually the child died 16 months after the initial presentation. This case emphasizes the need for suspecting and investigating malignancy in children who present with swellings in the head and neck region. It further suggests the need for overly aggressive therapy despite concerns over morbidity.

Key words: Rhabdomyosarcoma, Sarcoma in infants, Facial Reconstruction, Glabellar Flap.

Introduction

Rhabdomyosarcomas (RMS) are malignant tumors of skeletal muscles and one of the most common soft tissue sarcomas of children and young adults though it accounts for only 4-8 percent of all pediatric cancers¹.

RMS mostly occur in the age group between 3 and 12 years². Around two-thirds of Rhabdomyosarcomas arise in the head and neck region, but it can arise in genitourinary organs, limbs and may also rarely occur elsewhere¹. It is believed that RMS is a result of embryonic mesenchymal tissue proliferation³. These tumors show aggressive growth pattern with extensive local infiltration often metastasizing through the hematogenic and or lymphatic routes. RMS shows a higher recurrence rate⁴. The prognosis of Rhabdomyosarcomas depends on the subtype while the five-year overall survival for Rhabdomyosarcoma in children ranges from 74 to 77 percentage¹.

RMS is histologically divided into four types- Embryonal, Botryoidal, Pleomorphic and Alveolar. Out of these the embryonic type is the commonest while the alveolar type has the worst prognosis⁵.

Surgical excision in combination with chemotherapy and/or Radiotherapy is commonly used as primary treatment modality for

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Rhabdomyosarcoma⁶.

Case

A 3-month-old male infant was referred to the OMF unit of TH/Karapitiya for a growing lump on the right-side face for one month duration (Figure 1). On examination, the child had a reddish, round swelling of 2cm×2cm in size over the right side infra orbital region, which had ill-defined margins and was firm in nature. An incisional biopsy was done and the histopathological features together with immunohistochemical findings were consistent with those of Solid variant of Alveolar Rhabdomyosarcoma (ARMS, Figure 2).

Magnetic Resonance Imaging of the brain and mid face showed the extent of the tumor. The lesion in the right-side maxillary region has reached up to the adjacent bones but still has not invaded the nasal cavity, orbit, or maxillary sinus (Figure 3). Computed Tomography (CT) scan of thorax revealed no distant metastatic deposits. Surgical resection of the tumor was done (Figure 4). To make sure that the tumor is completely removed, intra-operative frozen sections were also used. Reconstruction was done with Glabellar flap (Figure 4,5). The excisional biopsy report revealed that all the margins are clear from the tumor except for the deep margin



Figure 1. Pre-operative picture of the swelling in the Right side infra-orbital region

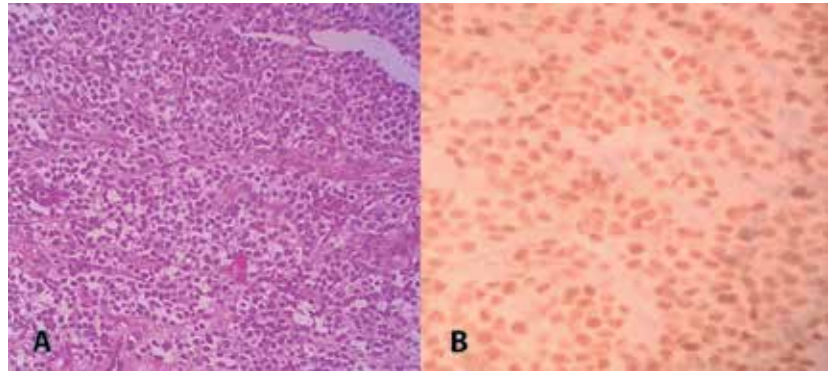


Figure 2. The hematoxylin and eosin-stained photomicrograph under low power (A) shows small blue round to oval tumor cells arranged in a vague alveolar pattern. Myo D1 positive cells are evident in the photomicrograph(B)



Figure 3. MRI showing the extent of the lesion. Lesion is indicated by the arrow. Notably the lesion has not entered the nasal cavity or the maxillary sinus.



Figure 4. Intra operative picture showing how the Glabellar flap is designed and raised for the reconstruction of the surgical defect.



Figure 5. Post-operative picture of the child (Reviewed after 1 month)

which is close (2mm). It was decided to go for the second surgery considering the aggressive nature of the condition. In the second surgery, the deeper margin was further resected followed by flap-division and recontouring. The child has undergone chemotherapy post-operatively and was followed up in the oncology clinic without any recurrence until 4 months duration. Then the child presented with local recurrence. Despite further surgical resection of the tumor and radiotherapy, patient continued to deteriorate and developed brain metastasis 10 months later. Eventually the child died 16 months after the initial presentation.

Discussion

The majority of cases of RMS are diagnosed in children less than 6 years of age⁷, but RMS is uncommon in infants with only a handful of cases reported to date in the literature. As of this case, there is a slight male predilection for occurrence of RMS⁸.

Studies show that most of the (40%) Rhabdomyosarcoma (RMS) occur in the head and neck region¹ and out of them, orbit is the commonest location⁹. ARMS is usually found in the deep musculature of the extremities². Infants and younger children tend to have embryonal RMS while adolescent and young adults tend to have Alveolar RMS. ARMS prevalence shows a bimodal peak within 2-6 years of age and another in adolescents and young adults with a mean age of 15-20 years². The rarity of having ARMS at this stage of the life, makes this case worth to report.

A careful histological, Immunohistochemical analysis is required to differentiate ARMS from other more frequent and aggressive lesions affecting the concerned sites. The histopathological differential diagnosis should include Ewing's Sarcoma/Primitive Neuro Ectodermal Tumor, Lymphoblastic Lymphoma and Neuroblastoma. In our case, the incisional biopsy specimen section revealed highly cellular tumor composed of cells with monomorphous

round nuclei. Cells were vaguely separated into nests by delicate fibrous septae while subtle alveolar morphology was evident. Further Immuno-histochemical studies showed strong nuclear positivity for the Myo-D1 stain and a diffuse membranous positivity for CD 56 (Figure 2).

The alveolar type of rhabdomyosarcoma is composed mainly of ill-defined collections of poorly differentiated round or oval tumor cells that often show central loss of cellular cohesion and formation of irregular "alveolar" spaces. The individual cellular collections are separated and surrounded by frameworks of dense, frequently hyalinized fibrous septa. This appearance renders the term alveolar pattern-classical variant¹⁰. In some cases, portions of the tumor lack the characteristic alveolar pattern entirely and are composed only of solidly packed groups or masses of tumor cells, as is seen in this case. This is termed as solid variant of ARMS¹¹. This solid variant tends to occur in younger children as compared to the classical variant which tend to occur in older children and adolescents (10-25 years) with predilection for deep soft tissues of the extremities. It is difficult to come to a conclusion regarding whether the solid variant per se has any prognostic relevance due to the scarcity of literature with particular interest.

RMS lacks any characteristic/pathognomonic features, which in turn can lead to potential misdiagnosis. This may have a negative implication in the prognosis.

Treatment for RMS warrants multidisciplinary approach consisting of surgical resection of the tumor followed by chemotherapy with or without radiotherapy since RMS tends to metastasise¹². This child was treated with surgery followed by chemotherapy. Previous studies have demonstrated that age is a prognostic factor in RMS as poorer outcomes are seen in infants than in older children^{6,13}. A potential explanation for inferior outcome in infants could be less

aggressive local therapy due to concerns over morbidities.

Conclusion

Alveolar Rhabdomyosarcoma poses a greater challenge because of its aggressive and treatment resistive nature. Infants with RMS appear to show worse prognosis than older patients, partially because of high rates of local failure. Concerns regarding morbidity in infants and the reluctance to apply aggressive local control measures may lead to higher rates of local failure and eventually may lead to death.

Acknowledgement

The authors extend their sincere thanks to the patient's family, the doctors, nurses and other health care assistants who were involved in the management of this patient.

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An Audit on frequency and cost of repairs and replacements of orthodontic appliances at the orthodontic laboratory, University Dental Hospital, Peradeniya

W.B.M.C.R.D. Weerasekera, D.D. Vithanachchi, T.M.A. Rodrigo

Abstract

Background: Regular use of removable orthodontic appliances leads to fracture and changes which necessitate repairs and replacements. However, no proper records on these procedures are kept in the division of Orthodontics.

General Objective: To determine the frequency and the cost of repairs and replacements of orthodontic appliances at the Orthodontic Laboratory of the University Dental Hospital, Peradeniya.

Materials and Methods: An audit was performed for damaged and lost removable appliances and fixed supplementary devices for a period of 09 months from January to December in 2018.

Results: A total of 231 cases were identified. The male to female ratio of the patients was 55:45. The repairs accounted for 26% of the total workload. The highest rate of breakages (50.6%) was among 13-15-year-old patients. The needs for replacement and first time repairs were 9.5% and 33.3% respectively. The Adam's clasp was the component most frequently fractured which accounted for 44.6%. Additional burden on the hospital due to repairs and replacements was 872h and 56725 of Sri Lankan Rupees during the study period.

Conclusion: The cost and burden of repairs and replacements of orthodontic appliances for the division was very high. Therefore, it is recommended that instructions to the patients should be strengthened on care for the appliances, especially to the 13-15-year-olds. It is also vital for the technical officers to have a program to update in the construction of Adam's clasps. After revisiting the recommendations for 06 months by the stakeholders in orthodontic care, a re-audit would be undertaken in order to assess the effectiveness of the remedial actions taken.

Key words: clinical audit, orthodontic appliances

Introduction

Time duration for orthodontic treatment is considerably long and consumes a significant time period of one's life. The average duration for comprehensive orthodontic treatment is 20.2 \pm 4.5 months with fixed appliances and 13.4 \pm 10.3 months with removable appliances^{1,2}. If the removable appliance therapy is executed only with one appliance, it would take only 6.4 \pm 3.9 months. A multitude of factors contribute to the duration of orthodontic treatment and the commonly identified causes are factors related to the patient, severity of the malocclusion, clinician's expertise and mechanics of treatment³. Cost efficiency is an

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important concept in the modern-day health care system and prolonged time may be detrimental to the patient as well as orthodontic practice. Therefore, accurate prediction of a realistic time scale for treatment is necessary to instill patient satisfaction at the very first visit.

Orthodontic mechanotherapy is provided with custom made removable appliances fabricated at a local laboratory by skilled orthodontic technicians. Meanwhile, a fixed orthodontic appliance is made up of ready-made components which often accompany customized accessories constructed at the local level. Therefore, it is inevitable that, a percentage of these fabrications would subject to breakages and losses due to various reasons.

It is understood that repairs and replacements of removable appliances and supplementary fixed orthodontic devices contribute immensely to the routine workload in an orthodontic laboratory. Whilst the repairs or replacement of an appliance is done in the laboratory, the patient is deprived of the continuous wearing of the appliance which leads to treatment delay. Therefore, an audit on this aspect is useful for the stakeholders involved in the process of treating orthodontic patients as it gives an insight into the additional workload created by the repair of broken appliances or construction of a new appliance as a mode of replacement for an irreparable or lost appliance.

The clinical audit is a quality improvement process which aims to improve delivery of patient care through a systematic review of care against explicit criteria⁴. If an audit is performed systematically as a habit, it would be helpful to improve the quality of patient care by minimizing the amount of repairs and replacements. In an audit, if the current situation and causes are detected, remedial action could be taken in order to minimize the extra burden on the patient, clinician and the laboratory technician. Even though it is practically impossible to eliminate

the extra burden completely, it is possible to reduce the burden. It could be done by revisiting the guidelines on various events such as improvement of the skills of the technicians and education of the patients on appliance care.

An audit performed in the Department of Orthodontics in the Southend University Hospital, UK for a period of 12 weeks has revealed that there were 67 appliances requiring 13 repairs and 54 replacements⁵. Based on these findings, they have implemented changes on the charges for repairs and replacements done by the NHS Foundation Trust. Likewise, based on the findings of our audit, we have suggested changes to the existing system, and would perform an audit cycle at 6-month intervals.

The General Objective of the current study was to determine the total amount of repairs and replacements of orthodontic appliances performed for a period of 09 months, in the orthodontic laboratory of the University Dental Hospital, Peradeniya. Determining the demographic pattern of the presentations, the total number of repairs and replacements done, component and appliance types involved in repairs and the cost and the time taken for the procedures were the specific objectives.

Materials and Methods

An audit was performed prospectively for appliances with damaged components, lost or irreparable removable appliances and fixed supplementary devices for a period of 09 months from January to December in 2018 except in March, April and May during which the services were interrupted due to an administrative matter. A data collection sheet was prepared and data were collected by the co-investigators in the orthodontic unit when they encountered cases which needed repair or replacement of an orthodontic appliance. The details recorded were the demographic data of the patient, type of the appliance, fractured component of the appliance, cost calculation for the used materials

and estimation of the time devoted for repairs or construction of a new appliance as a replacement for missing or unrepairable appliance.

A rough estimation of the materials used and the lowest unit price quoted in the latest price lists for the materials used were multiplied to obtain the cost for each specific repair or replacement. The time taken for different types of repairs was measured using a stop watch in the mobile phone by the chief investigator in two occasions and the average time was calculated.

Data were entered in SPSS 21 and descriptively analyzed. The results are presented as frequencies and percentages.

Results

A total of 231 cases needing repairs or replacements were presented during the 09 months of study.

The male to female ratio was 55:45. The repairs accounted for 26% of the total workload (Fig.1). Meanwhile, the highest rate of breakages according to the age was among 13 -15year-olds (Fig.2) and the rate of breakages was (50.6%). Out of the total repairs and replacements, the need for a new replacement was 9.5%. Appliances which needed repair for the first time were 33.3%. It was revealed that the most frequently broken component was the Adam's clasp and it was 40.3% and the second most common repair was the acrylic base plate which accounted for 29% (Fig.3). The type of appliance which required repair or replacement mostly was the upper or lower removable appliances and it was 75.8% (Fig.4). Additional burden on the hospital due to repair and replacements was found to be 872 hours of technical time and the cost was calculated as 56725 in Sri Lankan Rupees.

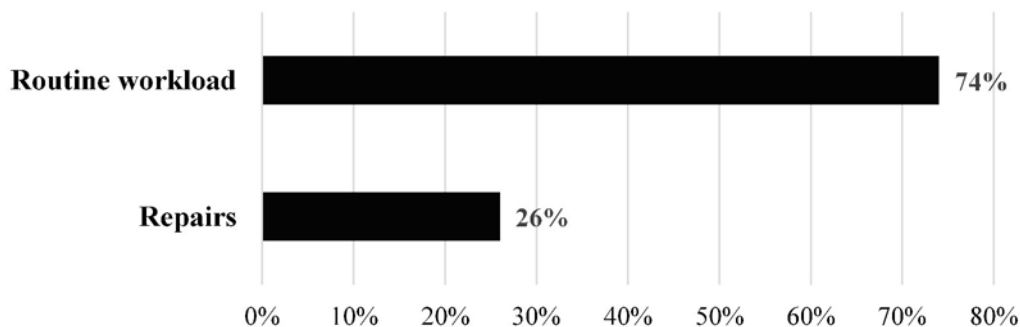


Figure 1. The repairs and replacements vs. routine work load

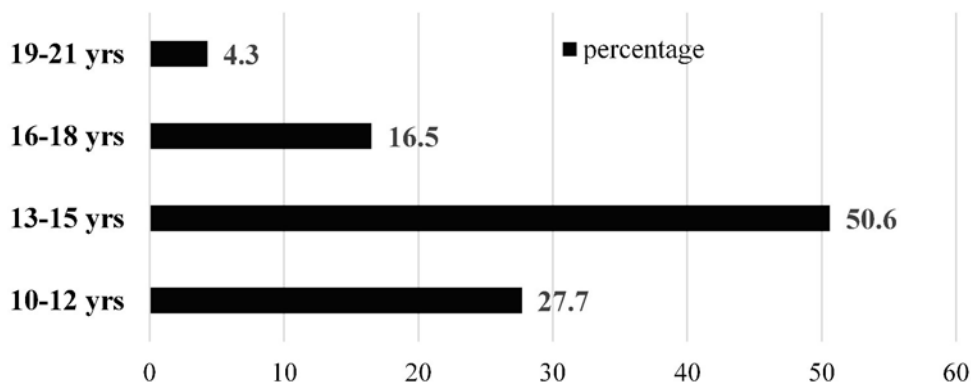


Figure 2. The requirement for repairs or replacements according to the age of the patient

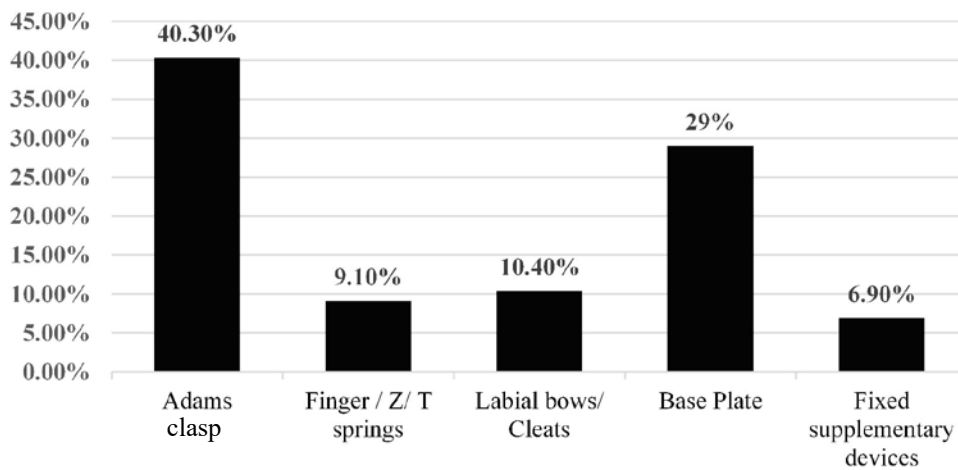


Figure 3. The frequency of the fractured components

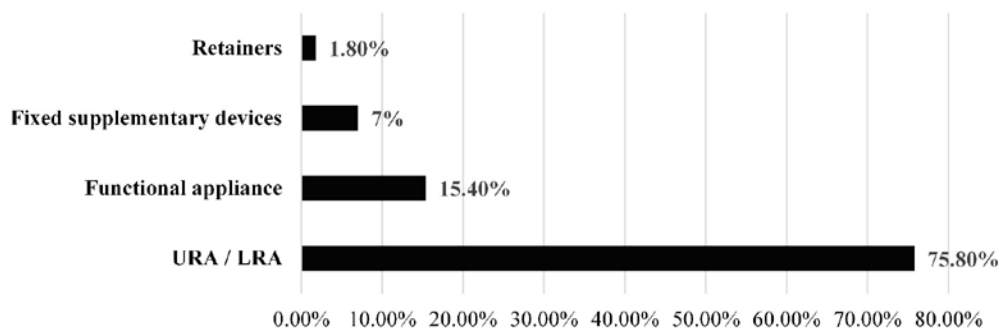


Figure 4. Type of appliance requiring repair or replacement

Discussion

An audit is a quality improvement process that can be done as a cycle in various fields in dentistry and promotes 'good clinical practice' leading to clinical effectiveness^{3,4}. An audit could be performed comparative to a gold standard or as an assessment of a currently existing situation or base line information. If audit is done to determine the current situation for the first time, those data can be utilized in future occasions to compare the incidence in an audit cycle. This is part of clinical governance, which considers successes, difficulties and determines the quality of everyday delivery of care.

The information on the number of repairs and replacements that were done in the laboratory during the 09 months period would enlighten

the stakeholders on many aspects. Firstly, it would give an insight into the extra workload, time, materials and the money that had been allocated to this process. Secondly, it would reveal the causative factors, if the relevant information is extracted. In our setting, it would be appropriate to investigate the existing situation and determine the baseline information, since a gold standard is not yet available.

In the present study, it was revealed that the volume of repairs and replacements accounted to 26% of the total workload. It demanded an additional cost of LKR 56725 to the University and a burden of 872 hours of technical time for the staff. It has become an additional burden to the institution as the hospital is maintained by public funds in a country where the dental education is totally free

of charge for the citizens. Therefore, the burden is not only for the hospital, but for the whole country for many generations. In an audit⁵ on cost of repairs and replacements at the Department of Orthodontics in the Southend University Hospital, UK in 2011, it was revealed that an additional 1112 £ was incurred by the NHS Foundation Trust within a period of 3 months. Ours, being for 9 months costs a huge amount considering the financial burden involved in maintenance.

In the present study, the highest rate of breakages was 50.6% and it was among 13-15-year-old adolescents. The causative factors for the repairs and replacements could be factors related to the patient, construction or deficiencies in the information delivery on appliance care^{6,7,8}. Therefore, these findings direct the orthodontic setting of the Faculty of Dental Sciences, University of Peradeniya for pertinent information delivery at the time of appliance fitting and reinforcement during the subsequent visits especially to the 13-15yr group of patients.

The most frequently damaged component was the Adam's clasp and it was 44%. It is the part of the appliance used as the retentive component and frequently handled by the patient in the insertion and removal of the appliance. As a result, chances are higher for this component to become damaged even with proper care. Meanwhile, less or lack of attention to proper appliance care could also be a reason for frequent breakages of the Adam's clasps.

In literature, only a few audits on orthodontic laboratory work have been found and none could be found in the Sri Lankan orthodontic settings. The present audit revealed a significantly higher percentage of additional workload as repairs and replacements to the orthodontic laboratory in spite of the massive routine workload. Orthodontic care is a highly demanding service in the country and the region and hence the orthodontic technician's time is an invaluable commodity. It is an additional financial burden

and a waste of time when the amount of repairs accounts for 26 % of the total workload.

Conclusions

The clinical audit in the orthodontic laboratory has revealed the weaknesses that have been overlooked over the years. In an audit procedure, local quality assurance can be done by monitoring the existing system, peer review and self-regulation. Therefore, it can be concluded that the internal auditing process is mandatory in order to maintain good clinical practice of the institution.

Recommendations

Considering the burden of repairs and replacements of orthodontic appliances detected in the audit, we strived to strengthen the instructions on appliance care to the patients, especially to the 13–15-year-olds by presenting a video clip on appliance care. The information delivered will be reinforced by the clinicians and additionally a leaflet would be given to them for future reference. It is also vital for the technical officers to take additional care in the construction of Adam's clasps. Therefore, orthodontic technical staff should be educated on the findings of this audit and their constructions would be randomly evaluated after implementation of the recommendations for 06 months by the stakeholders in orthodontic care.

As a 'Gold-standard' is not yet available locally to compare the findings of the future audits, a gold standard would be formulated in consultation with the stakeholders of the orthodontic unit. Finally, a re-audit would be carried out in order to assess the effectiveness of the remedial actions and be on par with the good clinical practices.

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Errata

The following two articles in Vol 50 /Issue 02, which should have been published under "Clinical Update" category were published under "Case Report" category, by error.

1. Occlusal considerations in partially dentate patients - I.P. Thilakumara, R.M. Jayasinghe
2. Early Childhood caries: An overview - L.K. Nadeesha Premathilaka, E.M.U.C.K. Herath

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