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COLLEGE OF COMMUNITY DENTISTRY OF SRI LANKA
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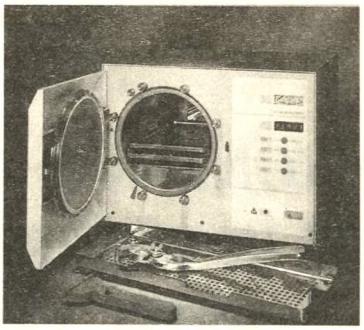

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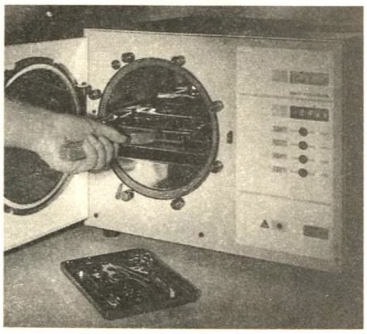

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SRI LANKA DENTAL JOURNAL

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EDITORIAL

Oral health in the next century in Sri Lanka

Oral diseases are the most widespread of all diseases prevalent in the world. No population is free from periodontal disease or dental caries. Such diseases impair the quality of life and impose financial burdens on society.

Most countries in the world do not have the resources to meet the complete oral health needs of its population. Therefore there is an urgent need to develop a new strategy to achieve oral health for all. Associated with this is the need for education and training of the providers of primary oral health care.

Significant progress has been achieved in oral health in most developed countries as a result of sustained preventive programmes that stress oral hygiene , adoption of healthy eating habits and widespread use of fluorides. In these countries, while the prevention has advanced dental care techniques have also changed beyond recognition.

However, this is not so in most developing countries where a more varied picture is seen. The situation in some of these countries is causing concern as oral diseases are showing an increase in incidence; these increases may be related to the rapid changes in dietary habits and adoption of new life-styles. In these communities, in addition to the common oral health problems such as dental caries and periodontal disease, there are other serious oral diseases that threaten the lives and welfare of the people.

Although oral diseases are on the increase and treatment costs escalating, these diseases, unlike most other diseases are preventable. The means to prevent this health and economic disaster are available and it should be ensured that these means are implemented in respect of all citizens everywhere.

Action is urgently needed to deal with this situation. Health policies need to be adjusted and oral health personnel need to be trained to deal with these new developments.

The education and training of oral health personnel should match the primary health care needs of a population, the patterns of oral disease and conditions, and the cultural, social and economic factors that

influence the standard of oral health. This means that the system of training required by one country may not be the same as that required by another. Therefore the oral health science educational programmes of a developing country will be different from those adopted in a developed country. An emphasis should be placed on the relevance to real community needs , if not, it could lead to lack of job satisfaction among the trained personnel.

In the past the traditional courses for dentists and dental auxiliaries have been largely directed at the dissemination of knowledge and skill that are required to meet the demands of individual patients. However recently the educationists have placed emphasis on the need for community health-oriented rather than disease-oriented training programmes. The responsibilities of dental educationists should not be restricted to training and education for oral health, they also have a social responsibility in taking the leadership in developing suitable oral health care delivery systems.

At the dawn of the 21st century the Government and people of Sri Lanka have been gifted a fully fledged Dental Faculty and Hospital Complex by the Government and people of Japan. This decision had been taken after recognising the absolute need to improve the facilities at the Faculty of Dental Science of the University of Peradeniya. The new complex includes one four-storied building complex for pre-clinical studies, another four-storied complex to accommodate clinical departments and a two storied complex for various student activities. This new complex with all modern equipment and technologies will improve the quality of teaching and research and is expected to be a centre of excellence in dental man power training in the South Asian region. The young and aspiring dental graduates leaving this Institution, fully conversant with the modern technologies available in the field of dentistry, have a role to fulfil : to serve the community at large. They need to meet the oral health needs of the entire population of our country, the rich and the poor, the literate and the illiterate, the urban and the rural masses.

Thank you for a task well done

Dr J A P Jayasinghe ,who served as the Editor of the Sri Lanka Dental Journal, relinquished office after over four years. During this period six issues of this journal were published.

He and the Assistant Editors Prof. M.T.M. Jiffry, Drs. J.N. Chinniah, Ranjith Weerasinghe and Adly Mohammed were largely responsible for the many improvements that took place in the journal and will be remembered for introducing the present format of the journal.

I am sure that members of the present editorial board, and all readers of the journal will join me in saying 'Thank you' to the former Editor and the Editorial Committee for a task well done.

Deepthi Nanayakkara
Editor

LEADING ARTICLE

Sri Lanka Dental Journal 27(1) 1998 5 - 6

Curriculum Options for Dental Education

N.A.de S. Amaratunge
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Introduction

Dental curricula in western countries are currently being reviewed and several radical changes are being considered. The dental disease patterns have changed in these countries to a great extent, which have necessitated curriculum reforms. It may be useful to look at these reforms albeit with a critical eye for our curriculum is also being revised in order to conform to the modern educational concepts and the modern training facilities the Japanese Grant Aid project will provide.

Integrating Basic and Clinical Sciences

Sri Lankan undergraduates as they begin their university education are fresh with the experience of fact oriented learning. They have very little experience if at all of problem oriented learning. Dental students may continue this type of learning in basic science courses too which creates student disinterest and non-retention of information. The traditional curriculum, which places basic and para-clinical sciences in the first two years and the clinical sciences in the last two years, is inadequate to satisfy the objectives of a scientifically based curriculum. A basic science curriculum taught in a vacuum does little to educate students in its relevance to clinical practice. Curriculum reforms must take this into careful consideration and design ways and means of demonstrating the important link between science and practice in both the classroom and the clinic. As the Dental Faculty now has its own Basic Science Department, it has a very good opportunity to remedy the above concerns. Further, as the majority of basic science teachers are dentists, there should be better chance to correlate basic and clinical science teaching. One option is to move towards " Early introduction to clinicals " which the new BDS curriculum attempts to do. Specific clinical problems which have an obvious and easy to understand link with basic science aspects are identified and introduced into the basic science course with participation of clinicians. For example, when development of the face is learnt its relevance is strengthened by a demonstration of the clinical appearance of cleft lip and palate.

Problem based learning is a more advanced method of integrating basic and clinical sciences, where the whole dental curriculum would be an integrated course. However, there is very little evidence of favourable outcome of problem based learning in dental education because only a very few dental schools in the world have employed this method, although several medical schools have used this approach for more than twenty years and they report greater student satisfaction and better clinical performance (Howell and Matlin, 1995).

Horizontal Integration

A departmental based curriculum would attempt to teach the different aspects of diseases in isolation. For instance, treatment of caries may be taught by one department while its diagnosis may be taught by some other department at some other time and its prevention at yet another occasion. Such fragmentation makes comprehension difficult and retention poor. A disease based curriculum, on the other hand would integrate the teaching of all these aspects in a scientific sequence. It would also attempt to draw from basic science in order to strengthen scientific learning. Theory learning and practical skills should also be integrated as far as possible. All lectures on clinical subjects have a practical aspect, which must be taught, in the clinic. Teaching of these two aspects should not be done in isolation but in an integrated form.

Integration of Medical and Dental Education

The question is often asked whether there should be integration of medical and dental education and how close it should be. There have been views expressed for and

against this idea. In the UK several universities have a common basic science course for dental and medical students and also integrated teaching in several areas of para clinical subjects. The report of the Institute of Medicine on dental education in the USA appears to recommend a similar approach for the universities in that country (Bradley 1995). However, those who oppose this point of view say that the basic science course must be relevant to oral disease and if they are jointly taught to medical and dental students by medically qualified teachers priority may be slanted to medicine and dental students may not receive relevant information.

There are other areas where there can be closer integration between medical and dental education. As both professions are concerned with the health of people their training should not be in totally separate compartments. There can be opportunities for dental and medical students to learn together during clinical work, e.g. physical examination, emergency medicine, geriatrics etc., which would benefit dental students. Similarly joint learning could be designed for the benefit of the medical students in areas such as stomatology, oral surgery, oral medicine, oral pathology etc. The present "isolation" observed in relation to these two professions could be lessened to some extent by this means.

More medicine ?

How much medicine should be taught to dental students? Could too much of it be included in the dental curriculum? It may be argued and in fact proved that nothing in medicine is irrelevant to dentistry. Yet there is a limit to the amount of medicine that could be included in the already heavy dental curriculum. The report of the Institute of Medicine on dental education in the USA observes that dentists will have to use more medical knowledge in the future. Subjects like Oral Medicine, Oral and Maxillofacial Surgery, Oral Pathology, Maxillofacial Radiology, Forensic Odontology etc. have grown in scope and importance, and these subjects need a strong base in medicine. In the USA double degree programmes leading to MD-DDS degrees have been started mainly as a requirement for specialisation in oral surgery. Expansion of this scheme could be expected in the future and dentistry becoming a medical speciality has been already considered! While the latter consideration could be viewed as an extreme point of view a balance may have to be formed in order to ensure that dentists have an adequate knowledge of medicine to cope with the demands in the future.

Non-medical subjects ?

" It really is of importance, not only what men do, but also what manner of men they are that do it ", said J.S.Mill in his essay " On Liberty " (Mill 1859). The practice of dentistry just as much as medicine, requires not only knowledge and skills but also a sympathetic approach to people. This aspect unfortunately has not received the attention it deserves. The present, heavily loaded, highly competitive curricula may brutalize and dehumanize the student (Weatherall 1994). Subjects like art, literature, history and other humanities would help students to understand the human condition and develop as caring people. Modules on these subjects could be introduced into medical and dental curricula and relevant faculties could undertake the teaching of these modules. The question may be asked how would it be possible to introduce additional subjects into a curriculum that is already heavily burdened. In the first instance a good curriculum should not be over burdened. There must be time for students to engage in the extra curricular activities. Secondly time must be found at any cost for learning subjects that would help health personnel acquire attitudes like sympathy and kindness.

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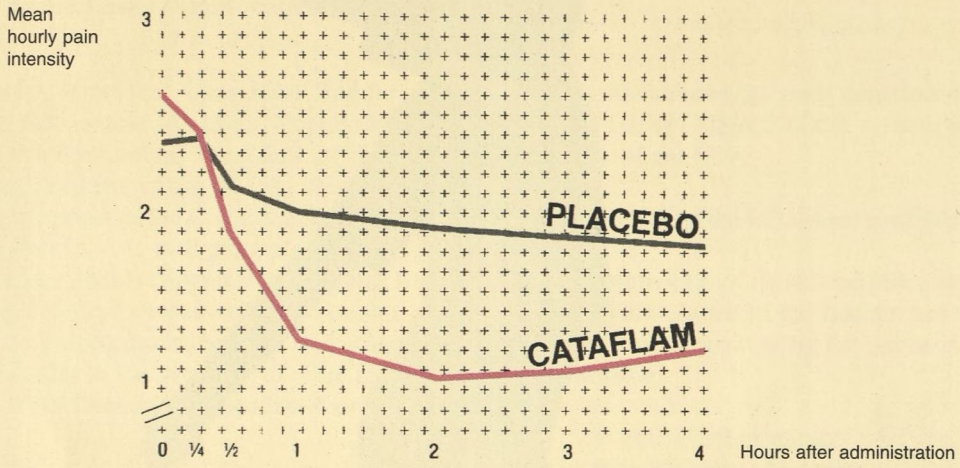

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Presidential Address

The Dental Profession and the Public

M.T.M. Jiffry
President of the Sri Lanka Dental Association (1997- 1998)

Your Excellency President Chandrika Bandaranaike Kumaratunge, Honourable Ministers, Deputy Ministers, Members of the Parliament, President of the APDF, Immediate Past President of the SLDA, Past Presidents of the SLDA, Members of the Council and distinguished ladies and gentlemen, it is with great pleasure and pride and with a purpose, that I commit myself to this highest office amongst dental surgeons in Sri Lanka. I am fortunate to be inducted amidst such a distinguished audience especially in the presence of Her Excellency the President of the Democratic Socialist Republic of Sri Lanka.

Dr Gamini de Silva, although you have listed out the contributions I have made in various fields, I still feel that I should do much more towards the development of oral health in Sri Lanka especially towards the rural community. Therefore, it is my obvious choice today to talk about the Dental Profession and the Public.

My presidential address will be divided into four sections.

1. The SLDA Past and Present
2. The current situation of dental care in Sri Lanka
3. Our plans for the future
4. How the state can help us

1. The SLDA Past and Present

History of the SLDA

The Sri Lanka Dental Association (SLDA) is the only single body which represents the entire dental profession in Sri Lanka. It was founded in 1932 as the Ceylon Dental Association (CDA), by 12 dental surgeons. At its infancy, the CDA was affiliated to the British Dental Association until it formulated its own constitution. Dr Sydney William Garne LDSRCS (1875 – 1946) was the founder President of the CDA.

The objectives of the CDA were twofold;

1. The promotion of dental and allied sciences and
2. The maintenance of the honour and the interests of the dental profession by the aid of all or any of the following:

   - periodical meetings
   - publication of journals
   - allocation of funds for the promotion of dental sciences
   - maintenance of rights and privileges according to dental ordinance.

In 1933, the CDA having been just formed, officially proposed the establishment of a dental school. The outcome of that effort was the birth of the only Dental School in 1938, which was initially housed at the Dental Institute in Colombo. Subsequently with the establishment of the University of Ceylon the Dental School was made a Department of the Faculty of Medicine in 1942.

The journal of the Association, namely the Ceylon Dental Journal commenced its publication in 1970. In 1978, the Ceylon Dental Association was renamed as the Sri Lanka Dental Association and accordingly the journal was also named as the Sri Lanka Dental Journal. The SLDA officially started its library in 1978 and the office of the SLDA was physically located at the premises of the Organisation of Professional Associations (OPA) in 1982. The first induction of a President was performed in 1978 whereas the first inaugural annual oration was held in 1985. In keeping with the policy of decentralisation the

Galle and Kandy branches of the SLDA were formed in 1986 and the North Western branch was formed later.

The Present Status

The SLDA having gradually strengthened its professional standards and international recognition, is in a mature position to focus its attention to public service at its 65th year at present. The strength of its membership now exceeds 300.

The SLDA and the International Dental Community

The first international Dental Conference was held in Sri Lanka in 1982 under the Presidentship of Dr Lional Dassanayake.

The Federation Dentaire Internationale (FDI) was founded in Paris in the year 1900. In 1983 the 71st Annual World Dental Congress was held in Tokyo, Japan for the first time outside a European Country. The SLDA was also fortunate to send an official representative to this event. The Asia Pacific Dental Federation (APDF) is the regional organisation of the FDI. The SLDA is a member of the APDF. It is with great pride I mention here that the 19th Asia Pacific Dental Congress (APDC) was held in Sri Lanka in April this year. This event was efficiently organised by the immediate past president Dr. Gamini de Silva. Currently the APDF is presided by Dr Reggie Gunatilleke, one of our own past presidents.

Under the concept of South Asian Association for Regional Cooperation (SAARC) the national dental associations of SAARC countries except the Maldives where there is no national organisation, formed a South Asian Dental Associations Federation (SADAF) in 1992. The 2nd SADAF conference was held in Colombo in 1993, and Dr Mrs Ira Ratnaike functioned as the second President of SADAF. During the period of her presidentship a Dental Data Bank was compiled. This document was found to be very useful in obtaining information pertaining to dentistry within the SAARC countries.

Let us look at some of the policy statements of a few national dental associations such as the ADA, BDA, CDA. or MDA.

The vision statement of the ADA highlights that, leading the profession, guarding the public's oral health and commitment to high quality oral health care, as their main concern. The BDA states while its principal duty is to look after the interests of its members, this is best done through policies which also lead to improvement of public health. The CDA expresses its dedication to meet the needs of its members and promotion and provision of optimal oral health for the Canadians. One of the objectives of the MDA is to enlighten and direct public opinion on dentistry and on problems of dental health.

Furthermore, in the recent mission statements issued by the FDI (World Dental Federation) which has a membership of 133 National and International Dental Associations, the following is included; to support the principle that all people should have access to the best possible care to achieve optimal oral health care.

Thus it is appropriate that as a National Body devoted and committed to the promotion of oral health status of the nation, the SLDA should officially recognise the importance of serving the public.

Thus it is time that this leading dental professional body review its policies and reframe its vision, especially emphasising the need for serving the community. A broadbased theme will be 'optimal oral health care for all'. However, although this function is not included in the list of objectives of the SLDA, we have already initiated programs for the benefit of the public. I will be failing in my duties if I do not recognise the initial steps taken by Dr Mrs Ira Ratnaike in this respect, especially the role she played in organising the 'outreach' programs. Thereafter, Dr Ranjith Weearsinghe took a keen interest in promoting and continuing this program.

2. *The current situation of dental care in Sri Lanka*

Indicators for Oral Health Status

There are two common major dental diseases which are prevalent in Sri Lanka. They are dental caries (decay) and periodontal (gum) disease. In addition to the above two diseases, there are other related and commonly observed conditions which have a significant impact on oral health, such as oral cancer and fluorosis.

The WHO sponsored National Oral Health Survey carried out in 1984-85 revealed the following.

Dental Caries

Age	Prevalence
6 years	78% of primary teeth
12 years	67% of permanent teeth
35-44 years	92% of permanent teeth

Periodontal disease

12 yrs	88% had some degree of the disease
35-44 years	95% had the disease

According to the results of the second National Oral Health Survey conducted in 1994-95, there is an increase in dental caries and edentulousness amongst the adults. However, fortunately there is a reduction in the prevalence of caries amongst children. Similarly the recent survey revealed that the periodontal health of the adults was deteriorating whereas an improvement was seen in children.

The role of the Dental Profession

The present status of the availability and distribution of oral health personnel in Sri Lanka is shown in Tables 1 and 2.

Table 1: The distribution of Dental Surgeons in Sri Lanka

Govt Hospitals	538
General Dental Practitioners	170 (located) + 100
Armed Forces	20
Universities	60
Other	2
Total	**890**

Table 2: Dental Surgeons with postgraduate qualifications and other dental personnel

Dental Surgeons	
Consultant Maxillofacial surgeons	21
Consultant Orthodontists	2
Consultants in Dental Public Health	4
DSs with MSc in Community Dentistry	20
DSs with DGDP	85
Dental specialists in the Universities	15
Other Dental Personnel	
School Dental Therapists	500
Dental Technicians	18

At present the dental surgeon to population ratio in Sri Lanka is approximately 1:25,000 on the average. However, in certain districts such as in Ampare it is around 1:110,000, suggesting a totally unequal distribution of dental surgeons within Sri Lanka.

3. *Our plans for the future*

Strategies to be adopted

The oral health status of the population is the result of the integrative action of several sectors. Both governmental and non-governmental, professional groups and the public themselves are the stakeholders for this exercise. One of the prime factors is the dynamic interaction between the community based demand and the need for oral health facilities and the availability of resources for oral health services (Fig 1).

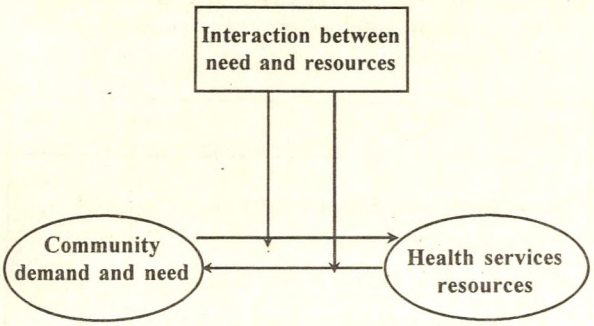

Figure 1

Such interaction between the need and resources should be meaningfully and cost effectively carried out with the continued monitoring by the sectors involved (Fig 2).

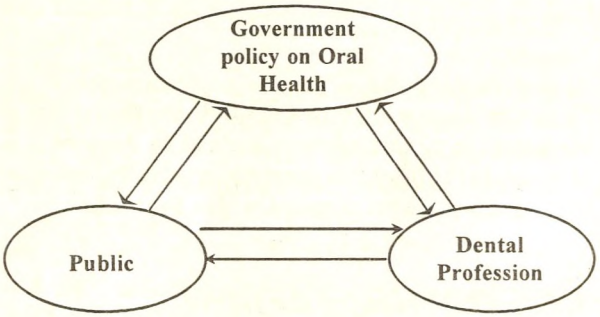

Figure 2

In confirming the concept of interaction at the 13th World Conference on Health Education in 1988 the Director General of WHO stated that the "Society must make it possible for people to live healthy lives. A grand alliance of people, policy makers and health professionals is necessary"

In 1996, which was the Year of Dentistry, the Asia Pacific Dental Federation (APDF) adopted the strategies to utilise the triangle, the Dental Surgeon, the Government and the Public.

Thus it is clear that if the SLDA is interested in promoting oral health of the people, it should be systematically carried out on a well planned format to enable the interaction of the Government, the profession and the public.

Factors to be considered

To implement strategies to achieve the above objectives the following factors should be taken into consideration. They are:

- Goals and objectives
- Identifying target groups
- Implementing agencies / individuals
- Terms of references
- Monitoring bodies
- Resources
- Deadlines and achievement milestones
- Outcome and its impacts
- Utillisation review
- Shortcomings and pitfalls

For example in the case of strategies to be implemented to improve Oral Health Care, it is envisaged that the following should be achieved by the year 2020.
They are:

1. the caries level of adults should be reduced from the present average DMFT of 10.1 to 8.0
2. methods of fluoridation of water should be explored and implemented
3. in areas of fluorosis, cost effective methods of defluoridation should be developed.
4. the level of edentulousness should be reduced from the present level of 70/13 to 70/20.

It is practical to introduce short term and medium term plans to facilitate to achieve the ultimate broad-based long term objectives in the next two decades.

Therefore, one of the immediate tasks of the SLDA should be to mobilise the dental services to the remotest village in the country. This needs cooperation from all sectors. It is also worth noting that there is a batch of newly qualified dental surgeons who are not yet provided with state employment. These graduates should be encouraged to take-up general dental practice in selected areas, of course after providing an initial 'internship' period to gain experience. They could be motivated by offering incentives such as bank loans and duty free facilities to import dental equipment and materials. They should be strictly advised to set-up practice in remote areas for a given period and their performance should be supervised.

The ideal dental surgeon to population ratio to Sri Lanka could not be prescribed neither on the basis of a theoretical

formula nor on a recommendation of a world authority. It should ideally be determined and configured on the basis of the scatter of the population of a given area and the demand and need for treatment. It may be possible to look at a figure of a country with similar health care set up and population characteristics such as Thailand. The dental surgeon to pupulation ratio in Thailand is about 1: 17,000. On the basis of the above example in Sri Lanka we should attempt to stabilise an average Dental Surgeon to population ratio of at least 1: 12,000. This means almost doubling the available dental surgeons from the present strength.

It is also worth exploring the avenues to reduce the cost of dental treatment provided by the general dental practitioners. The same line of action could be taken to reduce the capital expenditure and the cost of maintenace of a surgery. In return they should be committed to reduce their charges so that more people would seek treatment. Such a move may also cause a reduction in the attendance at the government dental clinics so that they could provide a better service to the public. Although the concepts expressed are somewhat theoretical it is worth exploring them. A combined effort of motivating and changing the attitude of the public and the dental professional may produce the desired results in the long run.

The dental professionals as personnel engaged in the frontiers of public service, should display greater care and concern for the public. A dental surgeon very often sees a patient who is very frightened and in pain. Therefore, the dental surgeon should be professionally trained to provide tender loving care for the patient.

Having studied and identified the problems encountered in delivering the optimal oral health care for the public, the SLDA is intending to adopt the following steps;

Summary of immediate tasks of SLDA

1. To re-direct the attention of the dental surgeons and the dental professional associations to explore ways and means of providing better service to the public rather than concentrate on their professional rights and strengthening their own professional interests.
2. To launch a well organised public education programme at school and community level on oral health and patients rights.
3. To conduct outreach dental camps along with health education programmes to alleviate the immediate oral health problems of the public.
4. To mobilise dental surgeons and encourage them to set up practice in remote areas in conjunction with the state.
5. To identify and implement remedies to correct any anomaly that may act as a deterrent for the smooth functioning of dental services at large.
6. To officially appoint a task force to continuously monitor the dental services and provide professional advice on issues related to dentistry to the state and other organisations.

4. How the Government could help us?

- Appoint a separate Deputy Director General of Health Services for Dental Services
- Introduce measures to facilitate the provision of dental materials and machinery to public and private sector dental surgeons to bring down the cost of dental treatment.
- Get the views of the Dental Professional organisations prior to the implementation of any major changes in the delivery of Oral Health Care.

Lastly, I would like to re-emphasise that all the above should be achieved with the close cooperation and healthy interaction between the Dental Surgeon, the State and the Public.

In my presentation I have presented the story of Dentistry in Sri Lanka in a logical and summarised form in the following format;

1. The SLDA Past and Present
2. The current situation of dental care in Sri Lanka
3. Our plans for the future
4. How the state can help us.

I believe that you would have some idea about the present status of Dentistry in Sri Lanka and what the SLDA is planning to achieve this year: especially to take dentistry to the masses.

Therefore, let us get together to make the nation smile.

It is with great respect Your Excellency, I extend my heartfelt gratitude to you on behalf of the Council of the Sri Lanka Dental Association and on behalf of its membership, for having participated at this induction

ceremony. Your Excellency, your presence today with us is an expression of recognition of the contribution of our profession to the development of health care in Sri Lanka as well as the signal of encouragement for us in all our future ventures.

I am also extremely thankful to the Honourable Ministers and Deputy Ministers who graced this occasion today amidst their other official commitments. It is with great pleasure I extend my gratitude to all the Parliamentarians for having accepted my personal invitation to participate at this ceremony.

I would like to appreciate the cooperation extended by Prof Rezvi Sherrif in providing the computer projection facilities and Mr Erantha De Mel for the technical support. A special word of thanks should go to Dr Shyam and Sirimali Fernando for having prepared the slide presentation. I would like to appreciate the services of Swedish Trading Company for providing the special screen. I would also like to thank Drs Hilary Cooray, Siromani Abeyratne and K Krishnarasah for providing the necessary information for this presidential address.

Throughout the preparation of this induction ceremony the council of the Sri Lanka Dental Association assisted me in every respect. I express my gratitude to all the council members as well as Mr Thiel and Miss Thilini Amarasuriya. I appreciate the services rendered by the Staff of the SLFI including its Directress Dr Tara De Mel who provided all the facilities to make this event a success.

It is with pleasure that I mention the encouragement given by my wife Fowzy for this event. Lastly, I wish to express my heartfelt gratitude to all of you who are present today to grace this occasion. My wife joins me in inviting all of you to take part in the reception to be followed immediately after this event.

REVIEW

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Extraction of teeth in Orthodontics.

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The concept of extracting teeth for orthodontic purposes, either to relieve crowding or to correct arch malrelationship was recognized by John Hunter in the eighteenth century. With the development of the concept of occlusion by Edward Angle in the 1900's the extraction of teeth for orthodontic reasons became questionable. Angle (1907) believed that every individual has a potential to bear 32 teeth in a normal occlusion. Therefore his treatment mechanics were directed towards arch expansion in all cases with malocclusion to achieve proper occlusion. Angle (1907) reasoned that if the teeth were placed in proper occlusion, forces transmitted to the teeth would cause the bone to grow around them, thus allowing stabilization in their new position even if a great deal of expansion had occurred. Whether the patient likes the outcome or not, by definition, the best facial appearance would be achieved when the dental arches have been expanded so that all the teeth are in ideal occlusion.

These concepts did not go unchallenged. Angle's great professional rival, Calvin Case argued that although the arches could always be expanded so that teeth could be placed in alignment, neither aesthetics nor stability would be satisfied in the long-term for many patients. The controversy culminated in a widely publicized debate between Angle and his students, Dewy and Case. This was considered as the great extraction controversy in 1920's (Case1964). However, Angle's view remained popular and extraction of teeth for orthodontic reasons essentially disappeared from the orthodontic world and nonextraction expansion treatment continued.

During the 1930's, relapses after nonextraction treatment were frequently observed . Soon after Angle's death , one of his students, Charles Tweed, decided to re-treat some of Angle's relapsed cases with extractions and achieved a stable occlusion. In the same period Raymond Begg in Australia, after his studies on attritional occlusions of Australian Aborigines, concluded that nonextraction treatment is unstable. Like Tweed, Begg also modified the Angle's appliance used for extraction treatment producing what is now called the Begg appliance. After publication of Tweed's and Begg's work in 1940's, extraction of teeth for orthodontic treatment was widely reintroduced. The acceptance of extraction treatment and rejection of Angle's expansion treatment were made easier by the improvement of the knowledge and understanding of genetic influence on development of malocclusion.

The view of malocclusion as primarily a genetic problem was greatly strengthened by breeding experiments with animals carried out in 1930's. By far the most influential individual in this regard was Professor Stockard who methodically crossbred dogs and recorded interesting effects on body structure (Stockard & Johnson 1944). Stockard's experiments proved that different facial characteristics are inherited. Therefore malocclusion may be considered as a problem that is genetically determined. It supported the concept of extractions for correction of malocclusion. Since then, extraction of teeth for orthodontic reasons became widely accepted.

A careful examination of the results of outbreeding in human populations casts doubts on the hypothesis " that independently inherited tooth and jaw characteristics are a major cause of malocclusion". The best data are probably from investigations carried out in Hawaii by Chung et al, (1971). Before its discovery by the European explorers in the Eighteenth century, Hawaii had a homogenous Polynesian population. These people had a long stature, broad and well developed jaws and an unusual and distinctive type of a lower jaw. Large-scale migrations to the islands by European, Chinese, Japanese and other racial groups resulted in the heterogeneous modern population. Tooth size, jaw size and jaw proportions were rather different for the Polynesians,

Orientals and Europeans. Therefore if the tooth size and jaw size were inherited independently a high prevalence of malocclusions would be expected in these populations. However, the prevalence and type of malocclusion in the current Hawaiian population though greater than the prevalence of malocclusion in the original population do not support this concept.

In recent years, the percentage of patients having extractions as a part of orthodontic treatment has decreased considerably from its peak in 1960's. There are several reasons for this. Experience has shown that extraction treatment does not guarantee the stability of the tooth alignment (Little et al,1981). In addition, the development of cephalometric aids for diagnosis and treatment planning has led to more profile oriented treatment planning in order to improve facial aesthetics (William 1969).

At present orthodontic treatment is more profile oriented and some of the cases are treated with extractions and some are treated without extractions. When extraction of teeth is indicated a careful assessment is needed in order to achieve a stable, functionally adequate occlusion with the best possible facial aesthetics.

Choice of teeth for extraction

1. Extraction of Premolars

First premolar

First premolars are the teeth of choice for extraction for orthodontic reasons. Extraction of premolars provides space in the labial segment of the jaws and at the same time does not involve a loss of an obvious anterior tooth, which might be aesthetically unacceptable. The second premolar bears a strong resemblance to the first premolar tooth both aesthetically and functionally and usually provides a good contact point with the canine. The main exception for this general rule of removal of first premolars arises when space requirement is very mild or when crowding is confined to the area behind the molars, or when other teeth are preferred because of caries or other pathological conditions.

The spontaneous alignment, following removal of the first premolar is greatest in the lower labial segment where the loss of the first premolar produces the most marked effect. Mesially inclined canine will almost invariably move distally into fully aligned position following the loss of these teeth, and labio-lingual alignment of the incisors can be expected to resolve. Space closure occurs most rapidly during the first six months and will continue gradually for a number of years provided the occlusion allows this. In a growing child with sufficient crowding an acceptable contact will usually be established between the canine and the second premolar. Often there is some tipping of the canine and the second premolar towards one another but unless food packing occurs there is no evidence that this is detrimental to the periodontal health. The active alignment and space closure will always be required with a fixed appliance, if the lower canines are not mesially inclined, or if the space requirement is minor or in an adult.

Second premolar

Second premolars are traditionally extracted when crowding is comparatively slight. In the past this was probably done to ensure that the residual spaces would be out of sight. When the spaces are allowed to close by natural drifting, this could give rise to a somewhat unsatisfactory contact point between the first premolar and the first molar. This generally takes the form of slack contact with food impaction and pocket formation. It is very often the tooth of choice when the health of the second premolar is unsatisfactory due to caries or hyperplasia. When the second premolar is congenitally missing in the lower arch it is usually balanced by the extraction of the corresponding upper tooth.

Extraction of the second premolar could be considered when they are completely excluded from the arch. This often happens following an early loss of the deciduous second molar with the second premolar usually erupting lingually. When there is more than 2-3 mm of residual space at the second premolar site spontaneous space closure following its extraction is rather unsatisfactory with mesial tipping of the first permanent molar and disruption of the occlusion. When the second premolar is extracted, spontaneous alignment of incisors is less satisfactory than when a first premolar is extracted.

On the other hand, with mild lower incisor crowding which is to be treated with a fixed appliance, the second premolar can be a good choice for extraction as space closure can be completed by controlled forward movement of the lower molar without the danger of unwanted retraction of the labial segment, which can occur in some

cases when the first premolars have been extracted (Mills, 1968). Presence of the first premolar anterior to the extraction site alters the anchorage balance in a way that favours the closure from behind.

2. Extraction of first permanent molar

First permanent molars are seldom the teeth of choice for extraction for orthodontic reasons because even if they are removed at the optimal time, the contact relationship between the second premolar and second permanent molar is rarely ideal and can be poor.

John Hunter first suggested extraction of all four first permanent molars in 1771. Since then this has been a subject of debate. Wilkinson (1940; 1942; 1944) was prominent among those who advocated the extraction of first molars as a therapeutic measure in order to reduce caries, periodontal disease and crowding of the dentition. Wilkinson suggested that all first molars be extracted between the ages of 81/2 -10 years for patients with Class I occlusion and mild incisor crowding, provided that all primary teeth were present. Few children satisfy all of these conditions and Wilkinson's original ideas have been misquoted and often applied to a wide range of patients. Davis (1956) recommended the early extraction of first molars in all cases. This would completely solve the difficulty of conservation and largely relieve crowding of the buccal teeth. However this radical approach may often fail to produce good contact points and occlusion, and thus makes treatment of the existing malocclusion more difficult.

Many investigators have shown that unplanned extractions of first permanent molars can cause serious occlusal irregularities. Effects of extraction on crowding or spacing, occlusion of teeth in buccal segments, alignment of second premolar and second molar teeth and eruption of the third molar have been well documented in papers by Logan (1960), Hallett and Burke (1961), McEwen et al. (1964), Plint (1970), Thunold (1970), and Thilander and Skagius (1970).

The frequent observation following extraction of the first molars was cuspal interference caused by the mesial tilting and rolling of the lower second permanent molar and mesial tilting and rotation of the upper second permanent molar. In addition if the extraction of the tooth is done early, developing second premolar can drift distally as described by Hallett & Burke (1961). When the first molar is lost before the age of 8 years, as a result of this tilting, a 50 per cent chance of second premolars becoming impacted against the second molar has been reported. The chances of this happening can be assessed from a lateral oblique radiograph. If the second premolar shows a distal inclination or a tendency to escape from between the distal roots of the second primary molar, every effort must be made to prevent an early loss of the lower first permanent molar. Thilander (1963) in a cross sectional study has shown some favourable results following extraction of first permanent molars.

Since unplanned extraction of first permanent molars can cause many harmful effects, the practitioner should be aware of the possible effects of this on the occlusion and the current guidelines for management of such cases if extraction is unavoidable.

Effects of extraction of first molar on the occlusion

Extraction in the mixed dentition

The lower arch

If the first molar is extracted before the eruption of the second premolar and the second permanent molar, space closure will occur partly as a result of forward eruption of the second molar and partly through the distal drifting of the second premolar. This will relieve crowding in the premolar canine region and the mild incisor crowding will also improve. If the extraction is unilateral the centerline will drift to that side producing an asymmetric malocclusion. The contact between the second premolar and the second permanent molar is rarely ideal because the teeth tip towards one another but it is more reasonable. Sometimes, the second premolar will drift distally to a marked extent leaving a space distal to the first premolar. While this is not an ideal occlusal arrangement, it is functionally acceptable and the space is also large enough to avoid food packing.

The upper arch

The major part of extraction space is closed through the forward drift of the second permanent molar. If the premolars are crowded due to previous forward drift of the first molar following early loss of a deciduous molar this will be relieved. A certain amount of improvement

of incisor crowding may follow but this is variable and is less than in the lower arch. Frequently, the second molar will be slightly mesiopalatally rotated but the contact relationship with the second premolar will be fair.

Extraction in the permanent dentition

The lower arch

The effects of extraction of the first molar after the second molar has erupted are often disastrous. The second molar will tip forward, roll lingually and a very poor contact may be established with the second premolar usually producing a stagnation area. Secondary changes of the upper arch often follow; producing occlusal disharmonies. There will be little spontaneous improvement in incisor crowding. These effects are particularly marked if the extraction is been performed during the growth period of the person. In an adult, the drift of the second molar is less marked and the result is often less harmful although unopposed upper teeth may overerupt

The upper arch

Space closure is better than in the lower arch and it occurs largely through mesial tipping and mesiopalatal rotation of the upper second molar around its palatal root.

One of the most difficult decisions in orthodontic treatment planning is whether or not the enforced extraction of one or more first molars should be followed by extraction of molars in other quadrants.

The decision is influenced by three factors:

1. the condition of the first molar
2. the dental age of the patient
3. the type of occlusion and the degree of crowding present.

Tully and Campbell (1970) referred to extraction in contra lateral quadrants as balancing extractions, and extractions in opposing arches as compensatory extractions.

The therapeutic extraction of first molars suggested by Wilkinson (1940) and balancing and compensatory extractions described by Tully and Campbell (1970) are not widely practiced in modern orthodontics.

However if the condition of the first molars is poor they may have to be removed, and the space is utilized for orthodontic treatment. The timing of extractions is very important. If they are removed in the mixed dentition period the effects are much less harmful than when they are extracted later. It is therefore essential to assess the life expectancy of the first molar that requires extensive restorations as far as possible and if the prognosis is poor serious consideration should be given to extract at the right time rather than leaving it to be extracted later.

The best time for extraction of first molar is just after the root formation of the second molar has begun. This is usually before the age of 8 1/2 -10 1/2 years. The timing of extraction is more critical in the lower arch than in the upper. The following guidelines are used in deciding on extraction of the first permanent molars. Before the extraction, the developmental stage, especially of the second permanent molar, the direction and the position of the developing second premolar should be assessed. The severity of crowding of both arches and the type of malocclusion should also be carefully assessed.

Extraction of first molars in Class I malocclusion

In the lower arch if one first molar is in a poor condition both should be removed at an optimal time. This will allow maximal relief of crowding, and the development of a fair contact relation between second premolar and second permanent molar. The balancing extraction of the other first molar preserves the symmetry of the arch, relieves the crowding of the other side and removes a tooth which may also be cariously involved. If the upper arch is mildly crowded, particularly where there has been a forward drift of the permanent molar, extraction of both upper first permanent molars at the same time as the lower is indicated. However if the upper arch is very crowded or if the upper first molars are sound it is preferable not to extract them but to remove teeth near the site of crowding at a later stage (e.g. premolars).

If the upper first molar has to be extracted the other should be removed at the same time to preserve symmetry but compensating extractions should not be undertaken in the lower arch. If the upper arch crowding does not resolve spontaneously retraction of the upper buccal segments become necessary. If crowding is very severe it is necessary to extract two teeth from each quadrant. In this case the first molars should be extracted early following the

guidelines indicated above, and then, when the permanent canines have erupted, the first premolars are extracted to gain space. However these extremely severe cases are rare.

Extraction of first molars in Class II malocclusion

If the lower first molar is grossly carious at an early age, both lower first molars should be extracted at the optimal time. But compensating extractions of first molars from the upper arch are not indicated unless these also have a poor prognosis. The upper arch can be treated on its own merit, preferably with the extraction of first premolars at the appropriate time. If the upper first permanent molars are of doubtful prognosis it is usually best to extract them early and then treat the upper arch on its merits. Occlusion should be accepted if space requirement is mild and the first premolars should be extracted if space requirement is considerable for overjet reduction.

Extraction of first molars in Class III malocclusion

In general if one first molar is carious it should be extracted early and if the arch is crowded, balancing extraction of the first molar from the opposite side should be undertaken. Thus if one of the lower first permanent molar is of poor life expectancy, both lower first molars should be extracted and the upper is treated on its own merit. Similarly, if an upper first molar has to be extracted early, the other should be removed at the same time and the lower arch treatment planned accordingly.

3. Extraction of second permanent molar

Extraction of the second permanent molar was introduced by Cryer (1967) to relieve the third molar impaction and to relieve the second premolar and incisor crowding. The stage of development of the third molar, angulation of the developing third molar and the relationship of it to the root of the permanent second molar were used as guidelines for extraction. Cryer (1967) used the following criteria for selection of cases:

1. the best time for extraction of the second molar is at the stage when the whole of the crown of the third molar is calcified but the root has not yet begun calcification.
2. the long axis of the third molar should have an angle of about 30 degrees to the long axis of the first molar.
3. the third molar should be well forward in contact with the second molar or better still, overlapping it to a reasonable extent.

Many investigators have put forward different views regarding the extraction of second permanent molars. Its critics claim that the procedure is associated with many uncertainties, in particular, the successful eruption of the third molar. Proponents of the technique claim that it has the benefits of the nonextraction treatment and offers many of the advantages of extraction treatment.

Timing of treatment

Ideal timing for the second molar extraction has been based on the chronological age and the stage of development of the third molar root. Some studies have suggested that the optimal time for the second molar extraction is when the third molar crown is fully formed and before the beginning of root formation. Dacre (1987) agrees that this is the optimal stage of the third molar development, but found that even earlier stages of development give good results. However, Lawlor (1978) has reported that there is no association between the stage of development of the root and the results obtained. Richardson & Richardson (1994) suggested the extraction of second molar tooth as soon as they erupt regardless of the stage of development of the third molar.

The importance of timing of extraction on successful third molar eruption is unknown. However, early removal just after eruption may be favourable. Many of the investigators favour the timing of extraction at the stage when the crown of the third molar is fully formed.

Angulation of the developing third molar

There is no consensus as to the angulation necessary for the developing third molar to erupt successfully after the second molar extraction. Cryer (1967) has suggested that lower third molars erupt into a good position when their initial angulation to the long axis of the first molar is less than 30 degrees at the time of extraction of second molars. Huggins and McBride (1978) in their study using the angle between the occlusal surface of the developing third molar and the occlusal plane, found that a wide range of angulations between 20-60 degrees were likely to result in satisfactory eruption. Dacre (1987) found that both successful and unsuccessful third molar eruption occurs over a wide range of angulations. It is therefore clear that

the assessment of angulations of developing third molar does not help in the prediction of third molar eruption. Lawlor (1978) also found in his studies that the inclination of the developing third molar was not of use in predicting the outcome. Overall results seen in the literature suggest that the initial angulation of the third molar is of little value in predicting whether or not the molar will erupt successfully.

Space between the third molar germ and the second molar root

Cryer (1967) has suggested that when the tooth germ of the third molar is found close to the root of the second molar, the final eruption of the third molar is satisfactory. However, Lawlor (1978) has shown that a gap (Lawlor space) between the third molar germ and the second molar root too gives favourable eruption of the third molar tooth. But Dacre in his sample found that the Lawlor space is of little predictive value.

It appears that the angulation of the developing third molar and the gap between the developing third molar and second permanent root are of no use in planning extraction time of the second permanent molar.

Extraction of maxillary second permanent molar

The eruption of maxillary third molar after extraction of the second molar is far more predictable than that in the lower arch (Quinn, 1985). But extraction of the second molar should be carried out if the maxillary third molars are of good size , shape and in good position. Some authors have suggested the extraction of maxillary second molar to facilitate the distal movement of the first molar.

Even though, extraction of the second molars has been practiced in the past, it is widely accepted that it has very little benefit to orthodontic treatment. Therefore in current orthodontic practice extraction is indicated if crowding is confined to the arch distal to the first permanent molar and when crowding anterior to the region is very mild in the lower arch. Extraction of upper second molar can be carried out to facilitate the distal movement of the first permanent molar if there is postmolar crowding.

4. Extraction of Incisors

Upper central incisor

From an orthodontic viewpoint, an upper central incisor is never the tooth of choice for extraction. However, the upper incisor may be lost accidentally as a result of trauma. A central incisor may remain unerupted due to the presence of a supernumerary tooth, a cyst , or a dilacerated root and it may not be possible to bring it to the position. In such situations the upper incisor may be extracted and the space could be maintained for a bridge or a prosthesis. Space may be closed with controlled tooth movement and the crown of the lateral incisor is disguised to resemble the central incisor.

Upper lateral incisor

An upper lateral incisor may be extracted as part of orthodontic treatment in certain circumstances. Indications noted in the literature are,

1. a palatally placed lateral incisor with displacement of the apex from the line of the arch.
2. to make room for a canine which is buccally displaced and distally inclined.
3. pathological conditions of the lateral incisor. e.g. dens in dente., extensive root resorption.
4. a traumatized lateral incisor.
5. the absence of one lateral incisor and peg shaped lateral incisor on the other side.

Lower incisors

The temptation to relieve lower labial segment crowding by extraction of an incisor should be resisted except in well defined circumstances. Loss of a lower incisor is often followed by a gradual decrease in intercanine width, with development of crowding in the remaining lower incisors. To some extent, the lower arch buttresses the upper intercanine width, and secondary reduction of upper intercanine width may result in upper incisor crowding, particularly in a growing child. For these reasons the lower incisors have a bad reputation for extraction.

Extraction of lower incisors can be successfully employed in selected cases.

1. When one incisor is completely out of the arch with the other three incisors in fairly good alignment.

2. When there is a narrow apical base in the incisor region. Clinically this presents as a fanned arrangement of incisors with distal inclination of canines.

3. Where a decrease in intercanine width is favourable. e.g. occlusal tendency to Class III where a decrease in intercanine width helps to stabilize the positive overbite.

4. To match upper and lower incisor segments.
   a. when there is disharmony in size of the upper and lower teeth.
   b. to compensate for upper incisor extraction.
   c. when there is upper incisor spacing which is to be closed.

5. When a lower incisor is damaged and beyond satisfactory repair.

6. In elderly patients who present with gross irregularities of lower incisors and for whom long appliance therapy is contra indicated either due to lack of cooperation or due to poor oral hygiene.

5. Extraction of canines

The permanent canine is an important tooth and it should be retained whenever possible. However, the alignment of upper permanent canines which are not uncommonly ectopically positioned can be difficult or even impossible with orthodontic appliances. Extraction of permanent canine can give satisfactory results if premolars can be moved adjacent to the lateral incisor with mesio palatal rotation so that the palatal cusp of the premolar is hidden to improve aesthetics. Lower canine again would seldom be extracted unless grossly displaced since it is very difficult to achieve a good contact between the lower lateral incisor and lower first premolar.

Conclusions

Orthodontists have held quite different views at various times about the etiology of malocclusion . To a great extent, these views affect the type of treatment offered to patients. In the early part of the twentieth century it was believed that environment had a considerable effect on dental and facial development. It was assumed that orthodontic treatment was also another environmental influence, which could have a major impact on the development. Therefore dental arch crowding was dealt routinely with arch expansion. By the mid-century, a combination of failure with the earlier expansion treatment and increased knowledge of genetics had led to a nearly universal adoption of the view , that the malocclusion was largely a result of genetically determined dental and facial proportions. Since then extraction of teeth for orthodontic treatment was universally accepted. At present, both these views have been rejected. The relative importance of environmental versus inherited factors in the etiology of malocclusion remain highly controversial. In current orthodontic practice, treatment is more profile oriented and cases are treated either with extractions or without extractions. The concept of adopting extractions at different sites for different malocclusions in some patients and nonexrtraction technique in others, is adopted. When extraction is indicated a careful assessment is needed in order to achieve a stable and a functionally adequate occlusion with the best possible facial aesthetics.

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HEALTH ISSUES

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Infection control in dentistry
A review of recent literature

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Summary

The need for awareness and practice of infection control measures adopted by dental surgeons in Sri Lanka was highlighted by a recent study. It is timely for the professional organizations in dentistry in Sri Lanka to take up this issue and formulate guidelines for infection control in dentistry. Emphasis should be placed on consistent adherence to recommended infection-control strategies, including the use of protective barriers and appropriate methods of sterilizing or disinfecting instruments and environmental surfaces, maintenance of 'chain of sterility' and proper disposal of waste and sharps. The need to vaccinate against Hepatitis B should be emphasized. Each dental facility should develop a written protocol for instrument reprocessing, operatory cleanup, and management of injuries. Training of all DHCWs in proper infection-control practices should begin at educational institutions of dentistry and be updated regularly with continuing education perhaps, through professional organizations.

Key words: *Diseases, Infection, Sterility, Contamination, Precautions*

Introduction

Dental Health Care Workers (DHCW), have been carrying out their work for centuries regardless of the inherent infectious hazards associated with it (Samaranayake et al, 1991). The potential risk of transmission of infectious diseases in dental practice was not established until 1970's when an outbreak of Hepatitis B was traced to a dental surgeon. Since that time till 1987 nine clusters in which patients were infected with HBV associated with treatment by an infected DHCW have been reported (CDC 1985). Transmission of HBV from dentists to patients has not been reported since 1987, possibly reflecting such factors as incomplete ascertainment and reporting, increased adherence to universal precautions and protection due to use of hepatitis B vaccine. In addition, transmission of HIV to six patients of a dentist with acquired immunodeficiency syndrome has been reported (CDC 1993). Similarly, the possibilities of transmission of Hepatitis C virus, another blood-borne virus, also exist, although no conclusive evidence is available (Piazza et al, 1995). However, isolated sporadic cases of infections are more difficult to link with a health-care worker than are outbreaks involving multiple patients. For both HBV and HIV, the precise event or events resulting in transmission of infection in the dental surgery setting have not been determined; epidemiological and laboratory data indicate that these infections probably were transmitted from the DHCWs to patients, rather than from one patient to another (CDC 1993; Canter et al, 1990). Patient-to-patient transmission of blood-borne pathogens has been reported, however, in several medical settings (Kent et al, 1988; Polish et al, 1992). DHCWs are also at risk of contracting these infections from infected patients.

In 1980's many industrialized countries began to introduce a number of regulatory policies aimed at reducing the risk of occupational exposure to infectious diseases and transmission of infection to patients through dental manipulation (CDC 1986; CDIE 1988).

However, it appears that, not much attention has been paid to infection control in dentistry in this country. A recent study on the infection control practices adopted by the dental surgeons in Sri Lanka highlights the need for awareness and practice of infection control measures in

this country (Fernando et al, 1998). This study which looked at the use of protective wear, sterilization of instruments and waste disposal and cleanliness in the clinics found these to be grossly inadequate both in the government and the private sector.

Dental patients and DHCWs may be exposed to a variety of microorganisms through blood (Hepatitis B, HIV), oral (Herpes simplex, Candida etc) or respiratory secretions (respiratory viruses, staphylococci, Mycobacterium tuberculosis) (CDC 1990; Roderick-Smith 1982). Although the possibility of transmission of blood-borne infections from DHCWs to patients is considered to be small (CDC 1992; Chamberland et al, 1992), precise risks are yet to be quantified in the dental setting by carefully designed epidemiological studies. Infection may be transmitted in the dental operatory by direct contact with blood, oral and other secretions, or indirectly through contact with contaminated instruments, operatory equipment, (Roderick-Smith et al, 1982) or environmental surfaces.

Cleanliness and proper sterilization techniques have been a part of dental practices for many years, but recently a number of pathogens such as HIV/AIDS, hepatitis B and C, and herpes viruses have made these techniques even more important.

In this review it is intended to broadly describe (1) the infection control measures, and (2) the considerations for infection control in special situations mostly based on the recommendations of the Center for Disease Control (CDC) in Atlanta, USA.

1. Infection control measures

1.1 Protective-wear and barrier techniques

Medical gloves (latex or vinyl) should always be worn by DHCWs for protection of personnel and patients in dental-care settings, when there is potential for contact with blood, blood-contaminated saliva, or mucous membranes (CDC 1986; 1988; 1989). Non-sterile gloves are appropriate for examinations and other non-surgical procedures; sterile gloves should be used for surgical procedures.

The need for hand washing between patients and whenever hands are contaminated cannot be overemphasized. Before treatment of each patient, DHCWs should wash their hands and put on new gloves; after treatment of each patient or before leaving the dental operatory, DHCWs should remove and discard gloves, then wash their hands. DHCWs should always wash their hands and re-glove between patients. Surgical or examination gloves should not be reused.

Surgical masks and also preferably protective eyewear should be worn when splashing or spattering of blood or other body fluids is likely, which is common in dentistry (Bond 1982; CDC 1990). When a mask is used, it should be changed when it becomes wet or moist. Protective eyewear should be washed with an appropriate cleaning agent and, when visibly soiled, disinfected between patients.

Protective clothing such as reusable or disposable gowns or coats, or uniforms should be worn when clothing is likely to be soiled with blood or other body fluids (CDC 1988). Protective clothing should be changed at least daily or as soon as it becomes visibly soiled (Garner et al, 1985). Protective garments and devices (including gloves, masks, and eye and face protection) should be removed before DHCWs leaves the dental surgery.

Impervious-backed paper, aluminum foil, or plastic covers should be used to protect items and surfaces (e.g. light handles or x-ray unit heads) that may become contaminated by blood or saliva during use and that are difficult or impossible to clean and disinfect. Between patients, the coverings should be removed (while DHCWs are gloved), discarded, and replaced (after ungloving and washing of hands) with clean material.

Appropriate use of rubber dams, high-velocity air evacuation, and proper patient positioning would minimize the formation of droplets, spatter, and aerosols during patient treatment.

Hand washing

DHCWs should wash their hands before and after treating each patient (i.e. before glove placement and after glove removal) and after barehanded touching of inanimate objects likely to be contaminated by blood, saliva, or respiratory secretions (CDC 1988; 1990). Hands should be washed after removal of gloves because gloves may become perforated during use, and DHCWs' hands may become contaminated through contact with patient

material. Soap and water will remove transient microorganisms acquired directly or indirectly from patient contact (CDC 1990) therefore, for many routine dental procedures, such as examinations and non-surgical techniques, hand washing with plain soap is adequate. For surgical procedures, an antimicrobial surgical handscrub is recommended (Garner 1985).

When gloves are torn or punctured, they should be removed as soon as the situation permits. DHCWs then should wash their hands thoroughly and reglove to complete the dental procedure.

DHCWs who have exudative lesions, particularly on the hands, should refrain from all direct patient care and from handling dental patient-care equipment until the condition resolves (Garner et al, 1985). Guidelines addressing management of occupational exposures to blood and other fluids to which universal precautions apply have been published (CDC 1988; 1990; Miller & Palenik 1991) in other countries.

1.2 Vaccines for dental health-care workers

Although HBV infection is uncommon among adults in the United States (1%-2%), serologic surveys have indicated that 10%-30% of health-care or dental workers show evidence of past or present HBV infection (CDC 1988; 1989). Ideally employers should make hepatitis B vaccinations available without cost to their employees who may be exposed to blood or other infectious materials (CDC 1986). In addition, CDC recommends that all workers, including DHCWs, who might be exposed to blood or blood-contaminated substances in an occupational setting be vaccinated for HBV (CDC 1988; Garner 1985). DHCWs also are at risk of exposure to and possible transmission of other vaccine-preventable diseases (Petersen et al, 1979); accordingly, vaccination against influenza, measles, mumps, rubella, tetanus and tuberculosis may be appropriate for DHCWs.

1.3 Use and disposal of sharp instruments and needles

Sharp items contaminated with patient blood and saliva should be considered as potentially infective and handled with care to prevent injuries (CDC 1988).

Used needles should never be recapped or manipulated in a way that the point of a needle is directing toward any part of the body (CDC 1988). Used disposable syringes and needles, scalpel blades, and other sharp items should be placed in appropriate puncture-resistant containers located as close as is practical to the area in which the items are used (CDC 1988). Bending or breaking of needles before disposal requires unnecessary manipulation and thus is not recommended.

For procedures involving multiple injections with a single needle, the unsheathed needle should be placed in a location where it will not become contaminated or contribute to unintentional needlesticks between injections. If the decision is made to recap a needle between injections, a one-handed "scoop" technique or a mechanical device designed to hold the needle sheath is recommended.

1.4 Sterilization or disinfection of instruments

1.4.1 Indications for Sterilization or Disinfection of Dental Instruments

As with other medical and surgical instruments, dental instruments are classified into three categories - critical, semi-critical, or non-critical - depending on their risk of transmitting infection and the need to sterilize them between use (CDC 1990; Rutala 1990). Each dental practice should classify all instruments as follows:

Critical. Surgical and other instruments used to penetrate soft tissue or bone are classified as critical. These should be sterilized after each use. These devices include forceps, scalpels, bone chisels, scalers, and burs.

Semi-critical. Instruments such as mirrors and amalgam condensers that do not penetrate soft tissues or bone but contact oral tissues are classified as semi-critical. These devices should be sterilized after each use. If, however, sterilization is not feasible because the instrument will be damaged by heat, the instrument should receive, at a minimum, high-level disinfection.

Non-critical. Instruments or medical devices such as external components of x-ray heads that come into contact only with intact skin are classified as non-critical. These non-critical surfaces have a relatively low risk of transmitting infection. They may be reprocessed between patients with intermediate-level or low-level disinfection (see Cleaning and Disinfection of Dental Unit and Environmental Surfaces) or cleaning with detergent and water, depending on the nature of the surface and the degree and nature of the contamination (CDC 1990).

1.4.2 Sterilization or Disinfection of Dental Instruments

Before sterilization or high-level disinfection, instruments should be cleaned thoroughly to remove debris. Persons involved in cleaning and reprocessing instruments should wear heavy-duty (reusable utility) gloves to lessen the risk of hand injuries. Placing instruments into a container of water or disinfectant/detergent as soon as possible after use will prevent drying of patient material and make cleaning easier and more efficient. Cleaning may be accomplished by thorough scrubbing with soap and water or a detergent solution, or with a mechanical device (e.g. an ultrasonic cleaner). The use of covered ultrasonic cleaners, when possible, is recommended to increase efficiency of cleaning and to reduce handling of sharp instruments.

All critical and semi-critical dental instruments that are heat stable should be sterilized routinely between uses by steam under pressure (autoclaving), dry heat, or chemical vapor, following the instructions of the manufacturers of the instruments and the sterilizers. Critical and semi-critical instruments that will not be used immediately should be packaged before sterilization.

Proper functioning of sterilization cycles should be verified by the periodic use (at least weekly) of biologic indicators (i.e. spore tests) (CDC 1990). Heat-sensitive chemical indicators (e.g. those that change color after exposure to heat) alone do not ensure adequacy of a sterilization cycle but may be used on the outside of each pack to identify packs that have been processed through the heating cycle. A simple and inexpensive method to confirm heat penetration to all instruments during each cycle is the use of a chemical indicator inside and in the center of either a load of unwrapped instruments or in each multiple instrument pack (CDC 1985), this procedure is recommended for use in all dental practices. Instructions provided by the manufacturers of medical/dental instruments and sterilization devices should be followed closely.

In all dental and other health-care settings, indications for the use of liquid chemical germicides to sterilize instruments (i.e. "cold sterilization") are limited. For heat-sensitive instruments, this procedure may require up to 10 hours of exposure to a liquid "sterilant/ disinfectant." Aseptic rinsing with sterile water, drying should follow this sterilization process, and, if the instrument is not used immediately, it should be placed in a sterile container.

"Sterilant" chemicals (e.g. 2% gluteraldehyde) are used to attain high-level disinfection of heat-sensitive semi-critical medical and dental instruments. The product manufacturers' directions regarding appropriate concentration and exposure time should be followed closely. Liquid chemical agents that are less potent than the "sterilant/disinfectant" category are not appropriate for reprocessing critical or semi-critical dental instruments.

It is equally important to maintain the 'chain of sterility' of the instrument or the item once it is sterilized. Sterile instruments should be left in the sterile pack until it is used. These should ideally be stored in an identified area in the surgery that would not come into contact with contaminated material (such as used instruments or waste).

1.4.3 Cleaning and disinfection of intra-oral dental devices attached to air and water lines of dental unit

Sterilization either by autoclaving (steam under pressure) or dry heat, is recommended for all high-speed dental handpieces, low-speed handpiece components used intra-orally, and reusable prophylaxis angles. Manufacturers' instructions for cleaning, and sterilization procedures should be followed closely to ensure both the effectiveness of the sterilization process and the longevity of these instruments. According to manufacturers, virtually all high-speed and low-speed handpieces in production today are heat tolerant, and most heat-sensitive models manufactured earlier can be retrofitted with heat-stable components.

Internal surfaces of high-speed handpieces, low-speed handpiece components, and prophylaxis angles may become contaminated with patient material during use. This retained patient material may then be expelled into the mouth during subsequent uses (Lewis et al, 1992). Restricted physical access - particularly to internal surfaces of these instruments - limits cleaning and disinfection or sterilization with liquid chemical germicides. Surface disinfection by wiping or soaking in liquid chemical germicides is not an acceptable method for reprocessing high-speed handpieces, low-speed handpiece components used intra-orally, or reusable prophylaxis angles.

Because retraction valves in dental unit water lines may cause aspiration of patient material back into the handpiece and water lines, antiretraction valves (one-way flow check valves) should be installed to prevent fluid aspiration and to reduce the risk of transfer of potentially infective material (Scheid et al, 1982). Routine maintenance of antiretraction valves is necessary to ensure effectiveness; the dental unit manufacturer should be consulted to establish an appropriate maintenance routine.

High-speed handpieces should be run to discharge water and air for a minimum of 20-30 seconds after use on each patient. This procedure would help in physically flushing out patient material that may have entered the turbine and air or water lines (Scheid et al, 1982). Use of an enclosed container or high-velocity evacuation should be considered to minimize the spread of spray, spatter, and aerosols generated during discharge procedures. Additionally, there is evidence that overnight or weekend microbial accumulation in water lines can be reduced substantially by removing the handpiece and allowing water lines to run and to discharge water for several minutes at the beginning of each clinic day (Garner et al, 1983). Sterile saline or sterile water should be used as a coolant/irrigator when surgical procedures involving the cutting of bone are performed.

Other reusable intra-oral instruments attached to, but removable from, the dental unit air or water lines - such as ultrasonic scaler tips and component parts and air/water syringe tips - should be cleaned and sterilized after treatment of each patient in the same manner as handpieces, which was described previously. Manufacturers' directions for reprocessing should be followed to ensure effectiveness of the process as well as longevity of the instruments.

Some dental instruments have components that are heat sensitive or are permanently attached to dental unit water lines. Some items may not enter the patient's oral cavity, but are likely to become contaminated with oral fluids during treatment procedures, including, for example, handles or dental unit attachments of saliva ejectors, high-speed air evacuators, and air/water syringes. These components should be covered with impervious barriers that are changed after each use or, if the surface permits, carefully cleaned and then treated with a chemical germicide having at least an intermediate level of activity. As with high-speed dental handpieces, water lines to all instruments should be flushed thoroughly after the treatment of each patient; flushing at the beginning of each clinic day also is recommended.

1.4.4 Single-use disposable instruments

Single-use disposable instruments (e.g. prophylaxis angles; prophylaxis cups and brushes; tips for high-speed air evacuators, saliva ejectors, and air/water syringes) should be used for one patient only and discarded appropriately. These items are neither designed nor intended to be cleaned, disinfected, or sterilized for reuse.

1.5 Enviornmental cleanliness

After treatment of each patient and at the completion of daily work activities, countertops and dental unit surfaces should be wiped with detergent and water. Surfaces that may have become contaminated with patient material should be disinfected with a suitable chemical disinfectant.

A chemical germicide labelled as "tuberculocidal" (i.e. mycobactericidal) activity is recommended for disinfecting surfaces that have been soiled with patient material. These intermediate-level disinfectants include phenolics, iodophors, and chlorine-containing compounds. Because mycobacteria are among the most resistant groups of microorganisms, germicides effective against mycobacteria should be effective against many other bacterial and viral pathogens (CDMIE 1988; CDC 1990). A fresh solution of sodium hypochlorite (household bleach) prepared daily is an inexpensive and effective intermediate-level germicide. Concentrations ranging from 500 to 800 ppm (parts per million) of chlorine (a 1:100 dilution of bleach and tap water or 1/4 cup of bleach to 1 gallon of water) are effective on environmental surfaces that have been cleaned of visible contamination. Caution should be exercised, since chlorine solutions are corrosive to metals, especially aluminum. In such situations one must use a disinfectant such as 70% alcohol.

Low-level disinfectants - are appropriate for general housekeeping purposes such as cleaning of contaminated floors, walls, and other housekeeping surfaces. Intermediate- and low-level disinfectants are not recommended for reprocessing critical or semi-critical dental instruments.

Proper designing of the dental clinic which would allow physical separation of the surgery, instrument re-circulation area, the laboratory and the patient waiting area would also contribute to effective control of infection. If physical separation is not possible in an already established dental clinic, one should at least take precautions to keep the sterile instruments and other items physically separated from contaminated instruments and waste. Furthermore, porous surfaces and heavy curtaining and carpets that cannot be easily cleaned or disinfected should be avoided in the surgery, instrument re-circulation area and the laboratory.

1.6 Disposal of waste materials

Blood, suctioned fluids, or other liquid waste may be poured carefully into a drain connected to a sanitary sewer system. Disposable needles, scalpels, or other sharp items should be placed intact into puncture-resistant containers before disposal.

Solid waste contaminated with blood or other body fluids should be placed in sealed, sturdy impervious bags to prevent leakage of the contained items. All contained solid waste should then be disposed of according to requirements established by local, state, or federal environmental regulatory agencies and published recommendations (CDC 1990; Lewis 1992).

2. Infection control in special situations

2.1 Infection control in the dental laboratory

Laboratory materials and other items that have been used in the mouth (e.g. impressions, bite registrations, fixed and removable prostheses, orthodontic appliances) should be cleaned and disinfected before being processed in the laboratory, immaterial of being an on-site or at a remote location (Lewis et al, 1992). These items also should be cleaned and disinfected after being manipulated in the dental laboratory and before placement in the patient's mouth. Because of the increasing variety of dental materials used intra-orally, DHCWs are advised to consult with manufacturers regarding the stability of specific materials relative to disinfection procedures. A chemical germicide having at least an intermediate level of activity (i.e. "tuberculocidal hospital disinfectant") is appropriate for such disinfection. Communication between dental office and dental laboratory personnel regarding the handling and decontamination of supplies and materials is important.

2.2 Handling of biopsy specimens

In general, each biopsy specimen should be put in a sturdy container with a secure lid to prevent leaking during transport. Care should be taken when collecting specimens to avoid contamination of the outside of the container. If the outside of the container is visibly contaminated, it should be cleaned and disinfected or placed in an impervious bag (Tate & White 1991).

2.3 Use of extracted teeth for educational purposes

Extracted teeth used for the education of DHCWs should be considered infective and classified as clinical specimens because they contain blood. All persons who collect, transport, or manipulate extracted teeth should handle them with the same precautions as a specimen for biopsy. Universal precautions should be adhered to whenever extracted teeth are handled; because preclinical educational exercises simulate clinical experiences, students enrolled in dental educational programs should adhere to universal precautions in both preclinical and clinical settings. In addition, all persons who handle extracted teeth in dental educational settings should receive hepatitis B vaccine (CDC 1988; 1989; Garner 1985).

Before extracted teeth are manipulated in dental educational exercises, the teeth first should be cleaned of adherent patient material by scrubbing with detergent and water or by using an ultrasonic cleaner. Teeth should then be stored, immersed in a fresh solution of sodium hypochlorite (household bleach diluted 1:10 with tap water) or any liquid chemical germicide suitable for clinical specimen fixation.

Persons handling extracted teeth should wear gloves. Gloves should be disposed of properly and hands washed after completion of procedures. Additional personal protective equipment (e.g. face shield or surgical mask and protective eyewear) should be worn if mucous membrane contact with debris or spatter is anticipated when the specimen is handled, cleaned, or manipulated. Work surfaces and equipment should be cleaned and decontaminated with an appropriate liquid chemical germicide after completion of work activities.

Conclusions

Dental professionals should be aware and concerned about the possibility of disease transmission through dental treatment and thus make visible changes in the provision of dental services. For example,

1. Motivating the DHCWs in using the proper infection control techniques for all procedures on all patients.
2. Providing continuing education programs and creating awareness on infection control techniques including, the maintenance of the 'chain of sterility' where necessary.
3. Encouraging vaccination against diseases especially, hepatitis B.
4. Formulating a set of guidelines to be practiced by all DHCWs.
5. Creating an awareness among the public on consequences of infections acquired through dental treatment and the standards of infection control procedures expected from DHCWs. This would no doubt serve as a positive factor in implementing the guidelines for infection control in dentistry.

Most of these infection control techniques are not costly and are of great value, considering the amount of protection that is provided. Many of these techniques have been practiced in the dental clinics for years but it is time for us to be more aware of the suitable techniques and concsiously evaluate ones own infection control procedures.

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RESEARCH ARTICLES

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Postextubation airway complications in cleft lip and palate surgery

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Summary

The incidence of airway related complications following tracheal extubation was studied in 400 paediatric patients undergoing cleft lip and cleft palate repair under general anaesthesia. Thirty nine patients (9.8%) developed complications. Upper airway obstruction was the most frequent problem occurring in 12 of 110 patients in cleft palate group, 7 of 170 in cleft lip with alveolus and 2 of 120 in cleft lip only category. Patients after cleft palate surgery were at a significant risk for upper airway obstruction (P<0.05). Following awake tracheal extubation, patients were at risk of adverse airway events, which could be partly related to the surgical procedure.

Key words: *Anaesthesia, paediatric, tracheal extubation Surgery, plastic*

Introduction

Airway obstruction and aspiration are potential causes of morbidity and mortality in the immediate postextubation period. A 4%-9% incidence of serious adverse respiratory events has been reported in the immediate postextubation period (Ruth et al, 1947). The paediatric upper airway is more easily compromised than that of adults. Thus, children are more prone to airway related complications than adults (Patel et al, 1991). Even though anaesthesia related factors are responsible for serious adverse respiratory events in the immediate postextubation period (Mathew et al, 1990), patients following cleft lip (CL) and cleft palate (CP) repair may be at a greater risk of airway compromise due to the surgical procedure.

Timing of extubation can influence the incidence and nature of airway related adverse events (Koka et al, 1977). Awake tracheal extubation has been associated with a higher incidence of arterial desaturation than was tracheal extubation with the patient in a deep plane of anaesthesia (Patel et al, 1991). Furthermore, the incidence of coughing and breath-holding is less with deep extubation (Pounder et al, 1991). However, tracheal extubation in a deep plane of anaesthesia may result in difficulty in the management of the upper airway. Also, airway problems in paediatric CL and CP surgery can be compounded by aspiration when extubated in a deep plane of anaesthesia.

In the light of these concerns the purpose of this study was to determine the incidence of adverse airway events following tracheal extubation and also to identify patients at risk for such events.

Materials and methods

During a 10 year period, 400 consecutive healthy children aged 2 months to 5 years presenting for CL and CP repair were prospectively studied after obtaining parental consent. Forty percent were females. The closure of a CL and a CP was carried out at two operations, the lip and/or the alveolus at the first operation and the palate at the second, at or after 1 year of age.

Premedication was not given. Anaesthesia was induced with halothane and nitrous oxide in oxygen. The trachea was intubated with uncuffed portex endotracheal tube. The tracheal tube size was selected so that a small air leak was present on manual ventilation. Pharyngeal packs were used to prevent aspiration of blood. All patients had intraoperative analgesia provided by pethidine 1 mg kg^{-1}

intravenously during operation. Halothane was used to maintain anaesthesia and respiration was assisted manually during surgery. The same team of anaesthetists and surgeons attended on all patients.

On completion of surgery, 100% oxygen was administered for at least 5 minutes and the trachea was extubated in the lateral position once the patient was fully awake and the tubes were no longer tolerated. All patients had eye opening and purposeful movements prior to extubation. They breathed 100% oxygen via face mask after extubation. Heart rate and arterial oxygen saturation (SpO_2) were monitored and the results recorded throughout the anaesthetic and immediate recovery period. Patients were observed carefully for complications. The lowest measured SpO_2 values, the airway-related complications and their management were recorded. End tidal halothane concentration was not measured prior to extubation. Hypoxaemia was defined as a SpO_2 less than 95%.

Statistical analysis was performed using chi-square test.

Results

Surgery and anaesthesia were uncomplicated; all patients were breathing adequately and had a SpO_2 of 100% prior to extubation. Adverse airway related events occurred in 9.8% (39/400) of patients following tracheal extubation (Table 1), the commonest being the obstruction of the upper airway occurring in 21 patients. Of the 21 patients, 57% were in cleft palate group, 33% in cleft lip with alveolus and 10% in cleft lip only category.

Table 1: Distribution of patients who experienced complications according to site of surgery

Complication	Cleft lip n=120	Cleft lip & alveolus n=170	Cleft palate n=110	Total n=400
Upper airway obstruction	2	7	12*	21
Breath-holding	5	2	1	8
Coughing	-	2	5	7
Laryngospasm	1	-	2	3
Lowest SpO_2 recorded (mean ± SD)	94±1.2	92±1.8	89±1.3	

* $p < 0.05$

Patients following CP repair were at a significant risk for upper airway obstruction ($P < 0.05$). The 12 children in the CP group had associated retrognathia. Hypoxaemia occurred in all of them, the mean lowest SpO_2 was 89% (SD ± 1.83) irrespective of administration of 100% oxygen. Hypoxaemia was not accompanied by a significant change in heart rate.

Airway obstruction persisted despite forward displacement of the mandible (chin lift or jaw thrust), lateral position and neck extension. Obstruction was completely reversed and the saturation rapidly returned to 100 per cent only with the placement of the oral airway. The decreases in SpO_2 lasted only for 1-2 minutes. Noisy breathing without apparent disturbance in respiration was observed in 3 per cent of patients following CP repair.

In the 9 patients with postextubation upper airway obstruction following repair of cleft lip and alveolus (7) and the isolated cleft lip (2), forward displacement of the mandible was ineffective and the airway was established only with the insertion of oral airway.

Postextubation complications by the age of the child are shown in Table 2. Children over 2 years of age had the fewest complications when compared with all groups. There was no difference in the incidence of complications between males and females.

Table 2: Distribution of patients who experienced complications according to age

Complication	Age			
	2-6 (mo) n=185	6-12 (mo) n=95	1-2 (yr) n=80	2-5 (yr) n=40
Upper airway obstruction	4	5	12	-
Breath-holding	5	2	1	-
Coughing	-	2	3	2
Laryngospasm	-	2	1	-
Total	9	11	17	2

Apnoea occurred in 2% (8/400) of patients due to breath-holding, necessitating mask ventilation. Coughing did not produce hypoxaemia but was associated with oozing from palatal edges. Mild degree of laryngospasm was observed in 3 patients who responded to mask ventilation and oropharyngeal suction.

Laryngeal oedema, pulmonary aspiration or lingual swelling did not occur. All patients were managed without reintubation of the trachea and were discharged to the ward subsequently.

Discussion

In our study, 9.8% of patients developed airway related complications, the reported incidence of which is 4-9% mainly due to anaesthesia related aetiologies. Comparison with other studies is difficult due to differences in patient population, anaesthetic technique and surgical procedure. Oral surgery is known to increase the likelihood of the development of airway complications and cleft palate patients represent a high risk group in the present study.

The causes of upper airway obstruction in the postextubation period are many and varied, but in patients following CP repair, the obstruction was completely reversed by placement of the oral airway, suggesting that tongue may have predisposed to this complication. A likely cause in this situation was loss of space for the tongue due to the occlusion of the posterior oropharyngeal space following CP repair.

Retrognathia, a characteristic associated with difficult intubation (Gunawardana 1996) was also a contributory factor for difficult extubation. The possible risk of respiratory problems in the immediate postoperative period due to retrognathia or other congenital anomaly involving the upper airway was re-iterated in a recent editorial (Hatch 1996). When the mandible is small and retrognathic, the tongue is placed posteriorly and impinges in the oro- and hypopharynx (Arystas and Shprintzen 1991).

A second possible cause of upper airway obstruction is a reduction in the nasal dimensions due to elevation of the floor of the nostril and nasopharyngeal oedema. Since the infants are obligatory nasal breathers, following the closure of a wide cleft there can be difficulty in breathing as the baby adjusts to a new airway configuration.

The relaxation of the airway soft tissue due to residual effects of halothane could contribute to postextubation airway obstruction even though the patients were awake at the time of extubation. However, airway obstruction occurred more frequently in the CP group, which could be attributed to the surgical procedure.

Prophylactic airway placement (Donnelly and Thirlwell 1992) or anterior glossopexy (Oeconomopoulos 1960) prior to extubation may prevent upper airway obstruction, but the insertion of artificial airways carries the risk of damaging the suture line with possible haemorrhage. The tongue sutures are uncomfortable, particularly in paediatric patients.

The differences in airway anatomy make the potential for airway difficulties greater in infants than adults. However, the higher incidence of upper airway obstruction in the age group 1-2 years could be due to the higher incidence of CP surgery in that age group.

Lingual oedema after oral surgery can compromise postoperative airway function (Chan et al, 1995). Laryngeal spasm, a common cause of upper airway obstruction following extubation was rare despite oozing from lateral palatal edges. It may be due to the fact that the patients were awake. It is precipitated by irritation of the vocal cords by blood and is most likely to occur following extubation under light anaesthesia, neither awake nor deep. The reported incidence of laryngeal spasm after adenotonsillectomy is 20% (Baraka 1978).

Complications such as breath-holding and coughing are common in children and are usually seen following awake tracheal extubation. Postextubation coughing was associated with oozing in CP children. It may be advantageous to extubate patients at risk of developing bleeding at deep levels of anaesthesia as the patients are less likely to strain and cough during deep extubation. The disadvantage of such a technique is the increased risk of aspiration owing to the presence of blood in the airway.

Previous studies comparing awake versus deep extubation have shown variable results in the paediatric population. Even though the awake patient is expected to maintain the airway, in the present study, awake tracheal extubation did not assure that a patient would not develop airway complications.

Conclusion

Children following CP surgery were at high risk for postextubation airway obstruction. Patients must be closely observed in the immediate postextubation period though they have regained consciousness at the time of extubation.

Acknowledgements

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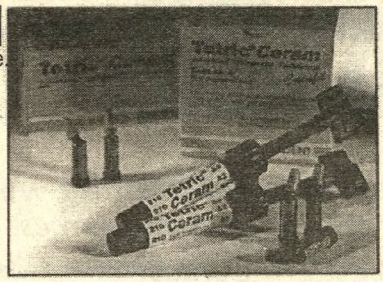

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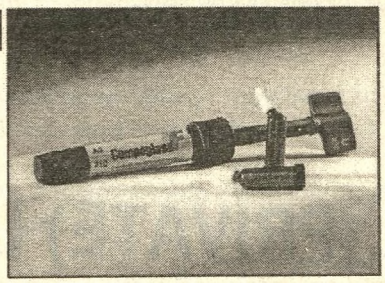

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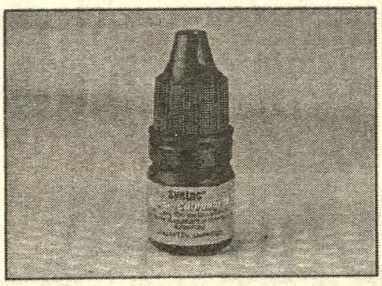

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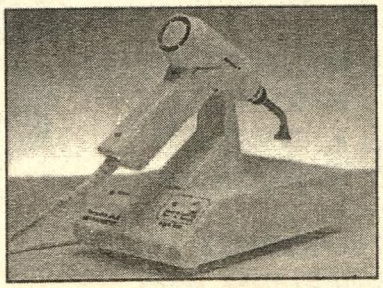

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Effects of occlusal stress on posterior composite restorations: an experimental study

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Summary

A study was designed to find out the effects of occlusal stress on posterior composite restorations. Four different types of cavities were prepared in one hundred and thirty five human upper pre molar teeth extracted for orthodontic purposes.Cavity type A was prepared using the Black's method. Type B preparation comprised of an interproximal box preparation similar to that of Black's technique with the exception of the occlusal dovetail prepared within enamel. Type C cavity was prepared according to the Elderton's method, while, Type D, a new cavity preparation, was designed to a cylindrical shape without an occlusal preparation. Tooth samples from each cavity type were filled with either TPH or Tetric composite restorative materials, while amalgam restorations were prepared only for Black's cavities, for comparison purposes. All the restorations were subjected to an occlusal force of 70 Newton at a frequency of 75/120 per minute, up to a maximum of 250,000 cycles. Better overall performances were observed from the restorations of cavity types prepared without an occlusal dovetail than those prepared with an occlusal dovetail. Restorations of cavity types C and D (cylindrical type) have shown better performance than those of cavity types A and B. The restorations with larger surface area were more susceptible to the failures of loss of material, crevice formation and crack initiation. Crevice formation had been a common failure in amalgam restorations. There was no significant difference of the performances between Tetric and TPH composite materials.

Key words: *Restorations, posterior composites, occlusal force.*

Introduction

Posterior teeth in contrast to anterior teeth are used for chewing and grinding of food during mastication. As such they are subjected to occlusal stresses more than the anterior teeth. Therefore restorations in posterior teeth should have the capacity to withstand high occlusal compression. Failure of posterior class II restorations due to the biting force is a major concern in the field of restorative dentistry. Faulty cavity preparation, poor physical properties and improper manipulation of restorative materials may have been some common causes for these failures. In a scanning electron microscopic study, Lambrechts et al (1982) reported severe surface and step like losses of the material at the margins of posterior composite restorations. They concluded that the polymerisation shrinkage, one of the undesirable physical properties of the material as the cause of the failures of these restorations. Many other authors (Dickinson 1993; Leinfelder 1996,) have reported that marginal deterioration, localised wear, bulk fracture of these fillings continue even with the present day improved formulations. Although considerable efforts have been made to improve physical properties of composite materials, minimal attempts have been made to modify the cavity preparation design to suit composites enabling to overcome the shortcomings of the restorations. This has led to the continued use of the same cavity preparation designed for amalgam, when carrying out restorations with composite materials too (Leinfelder 1996). On the other hand some other workers (Bronner 1930; Markley 1951; Gilmore 1964; Rodda 1972; Elderton 1986) have made considerable effort to modify the original Black's method and have come up with modified methods of cavity preparation designs for amalgam restorations. Leinfelder (1996) states some important factors in making cavities

for posterior composites, as there has not been a prescribed form of cavity preparation designed for composite restorations, which could overcome most of the failures of the restorations. An attempt has been made in this study to find out a new cavity design which would take into consideration most of the problems of composites.

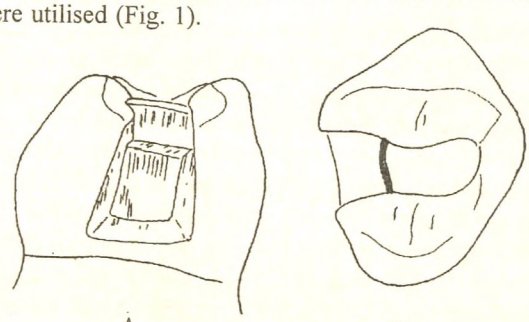
Materials and methods

The sample comprised of 135 sound maxillary premolar teeth, which had been extracted for orthodontic purposes. Each tooth was mounted onto a separate aluminium cubicle measuring 1 x 1 x 1 inch, using hard plaster as the mounting medium. The sample of teeth was divided into nine groups so that there were 15 teeth in each group.

Four different types of cavities were prepared.

1) **Type A** (Black's cavity preparation method)
   (Used for restoration types 1, 2 and 3)

The cavity preparation design essentially followed Black's principles. The buccal and lingual walls of the box were made converging towards the occlusal surface. The axial wall was prepared parallel to the long axis of the tooth. Axial wall, pulpal and gingival floors were made to meet each other at right angles. The pulpal and gingival floors were made flat and parallel to the occlusal plane, so that they were at right angles to the biting forces of mastication. The cavo-surface angle was made at right angle to the enamel at the gingival margin. The width of the narrowest part of the occlusal dovetail was made approximately 1/5th of the intercuspal distance. The pulpal floor was made flat, while the axio pulpal line angle was bevelled. The floor of the cavity was made in dentine and no undercuts were utilised (Fig. 1).



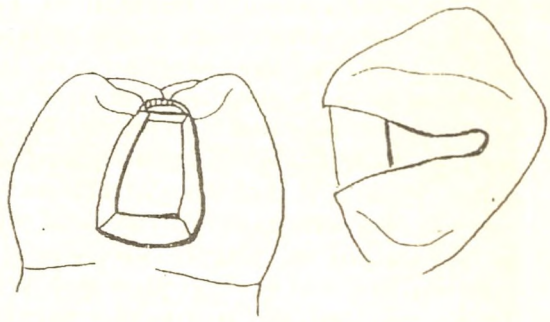
A
Interproximal view

B
Occlusal view

Figure 1: Cavity type A (Black's method)

2) **Type B** (Class 11 cavity preparation with occlusal dovetail confined to enamel)
   (Used for restoration types 4 and 5)

In this type, a proximal box preparation was carried out similar to the preparation of cavity type A described above. However, in contrast to the cavity type A, the occlusal dovetail was modified to a more conservative preparation. It was prepared totally in the enamel in order to gain more retention by acid etching thus making use of the increased enamel surface. The width of the isthmus was made approximately 1/5th of the intercuspal distance like in the cavity type A. This type of cavity preparation is shown in Fig. 2.



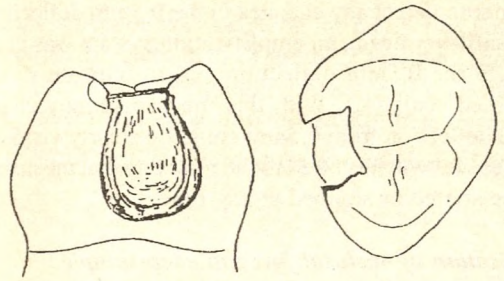
A
Interproximal view

B
Occlusal view

Figure 2: Cavity type B (Occlusal extension is in enamel)

3) **Type C** (Elderton's method)
   (Used for restoration type 6 and 7).

Cavities were prepared comprising only the proximal box with no occlusal dovetail, following the Elderton's method. (Elderton 1987). They were prepared to a more conservative type in that the gingival floor was made to a pear shape (Elderton 1987). The axio-bucco-lingual retention grooves were placed in order to achieve additional retention as there was no occlusal dovetail prepared as in cavity types A and B. The gingival floor was made sloping axially (Fig 3).



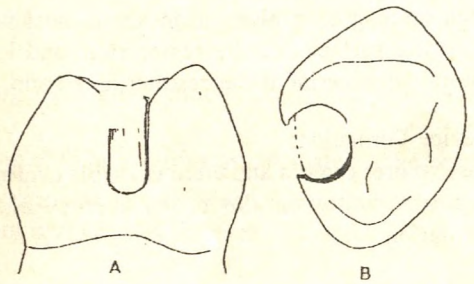
A
Interproximal view

B
Occlusal view

Figure 3: Cavity type C (Elderton's method)

4) **Type D** (The new cylindrical cavity preparation design suggested in the present study)
(Used for restoration types 8 and 9)

This group included the cavities prepared according to a modified new design that is suggested in the present study. The Elderton's method was modified from a pear shape to a cylindrical shape cavity. The axial, buccal and lingual walls were made to a round shape to form a cylindrical shape, so that they were not diverging or converging towards the occlusal surface. The gingival floor was made to be in level with the free gingival margin. Retentive grooves were not used (Fig. 4).



A
Interproximal view

B
Occlusal view

Figure 4: Cavity type D (The new design - Cylindrical)

The materials used for restoration of the cavities described above are shown in Table I.

Table 1: Types of cavities prepared and the filling materials used

Cavity preparation method	Sample Type	Material used
A (Black's method)	1	Amalgam
- do -	2	Tetric
- do -	3	TPH (Total Performance Hybrid)
B (occlusal dovetail in enamel)	4	Tetric
- do -	5	TPH
C (Elderton's method)	6	Tetric
- do -	7	TPH
D (Suggested cylindrical)	8	Tetric
- do -	9	TPH

Sequence of the Experimental procedure of testing the prepared restorations

Designing the device

Techniques to test the behaviour of posterior composite restorations during occlusal stresses in vitro are not available. However, Stafford et al, in 1982 described a device to test the fatigue of denture base polymers. In this study a machine was developed using the principles of Stafford, Lewis and Hugget's device to subject composite restorations to stress. The schematic diagram of the device is shown in Fig 5. The machine was constructed in mild steel in order to eliminate the inertia factor that is developed in dynamic machines during function.

The machine basically comprised of a vertically moving stroke cylinder (D), and a horizontal deflecting cantilever beam (J). A horizontal adjustable tooth holding unit (G) is fitted to the stroke cylinder with the tooth, adjusting the nuts (F). A horizontally placed deflecting cantilever beam is bolted to the frame. The required load of 70 N at

0.5 mm deflection is obtained by designing the beam length, 100 mm, width, 7.19 mm and the depth to 7.19 mm. The tooth sample is fixed to the horizontally placed platform which is fitted to the cantilever beam. The power was provided by a motor (IS 11 TS 2, China) bolted to the end of the unit. This motor (L) is a single-phase induction machine providing a speed of 1500 revolutions per minute. The motor drives a short input shaft (worm) to which gear wheels are locked, enabling an out put speed of 30 rpm. The cam follower with ball bearings lifts the stroke cylinder in which the load resisting spring controls the degree of movement to the required rate. The needle, which is attached to the horizontal beam, presses onto a pulse counter (M) which records the ultimate number of revolutions.

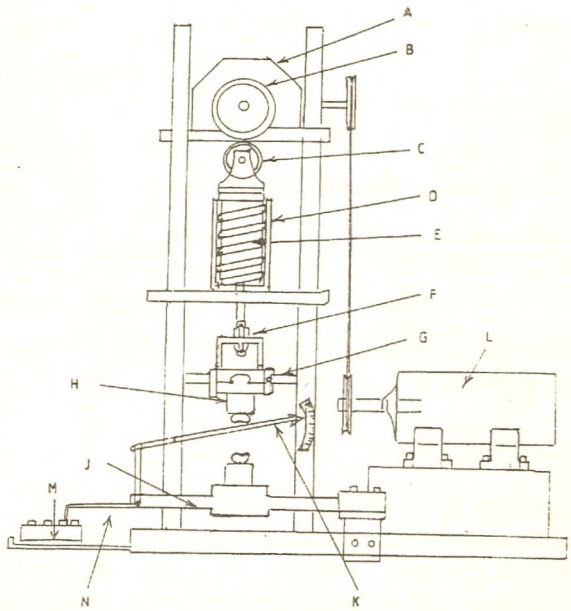


Figure 5

Schematic diagram of the device used for appication of occlusal forces.

A - gear box,
B - 0.5 mm eccentric cam,
C - cam follower with ball bearing,
D - stroke cylinder,
E - overload resisting spring,
F - tooth adjusting nuts,
G - adjustable tooth holding unit (horizontal),
H - tooth holding block,
J - deflecting cantilever beam,
K - deflection indicator,
L - motor,
M - pulse counter.

In order to detect any changes in the 0.5mm deflection of the cantilever beam, an amplification system was used to amplify the 0.5mm deflection and to indicate it on an amplified scale (K). With this mechanism any changes of the deflection from 0.5mm could be clearly visualised. An electric switch is fitted to the motor so that the machine can be started or stopped at any time.

Application of occlusal force to each sample

Once the tooth sample was secured in place and the point of application of force was determined, the application of cyclic loading was initiated by starting the motor. After 25,000 stress cycles, the machine was stopped to observe the failures due to the force.

The same tooth was fixed to the machine and subjected to a further 25,000 stress cycles and the failures were observed. This procedure was carried out until the tooth sample was subjected to 250,000 stress cycles.

Results

Four common failures (Fig 6) were identified and detected by using a hand lens and a stereo microscope with the aid of an explorer.

1. Loss of Material:
   Surface pitting is sufficiently coarse to inhibit the continuous movement of an explorer across the surface.

2. Surface Failure:
   Presence of a catch at the tooth/restoration margin when running an explorer from the enamel surface on to the surface of the restoration, and loss of restorative material at the restoration margin.

3. Crevice Formation:
   The explorer catches and there is visible evidence of a crevice between the tooth surface and the restoration.

4. Crack Initiation:
   Appearance of a visible crack. Cracks spreading from one edge of the filling to another were considered as fractures and excluded from this group.

Scanning electron microscopic pictures were taken from selected samples for confirmation.

The data collection was based on the number of failures observed in all teeth in each group. These data showed a binary (binomial) distribution (Finney 1971). The linear logistic model was fitted for these data to estimate the proportion of failure $\hat{p}$ at different number of stress cycles.

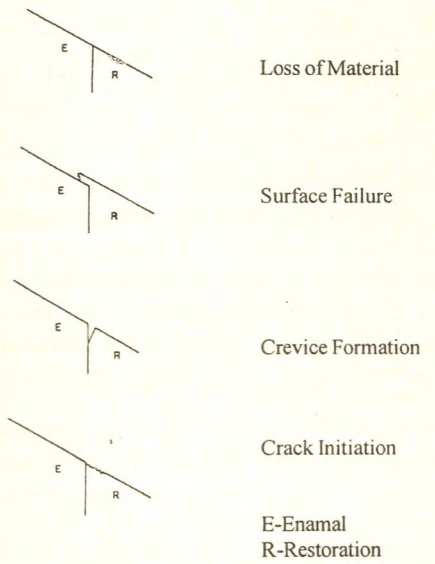


Figure 6
Four types of failures observed after application of occlusal force

The linear logistic model is given by :

$$\text{Log}\left(\frac{\hat{p}}{1-\hat{p}}\right) = Y \quad \text{(Finney1971)}$$

Based on the assumption that the total number of teeth in which failures occurred after each 25000 cycles was 15, and using the logistic model $\text{Log}\left(\frac{\hat{p}}{1-\hat{p}}\right) = a + bX$ proportion of failure, ($\hat{p}$) was calculated. The best type of cavity preparation was selected, based on the required number of stress cycles for each failure (Fig.7, 8, 9,and 10).

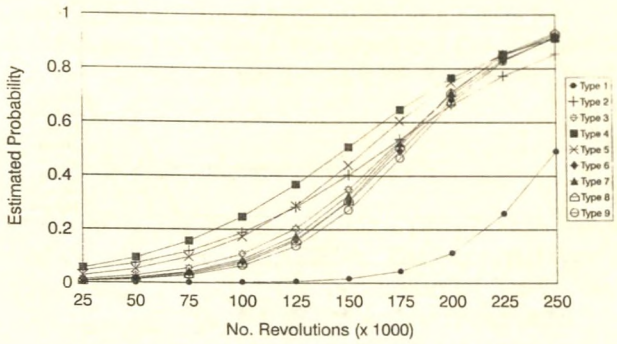


Figure 7 Estimated probability for loss of material at different stress cycles

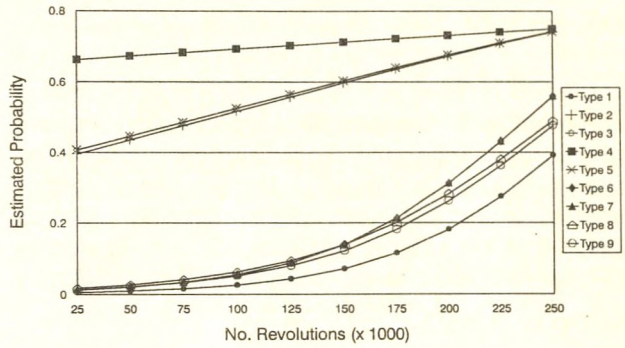


Figure 8 Estimated probability for surface failure at different stress cycles

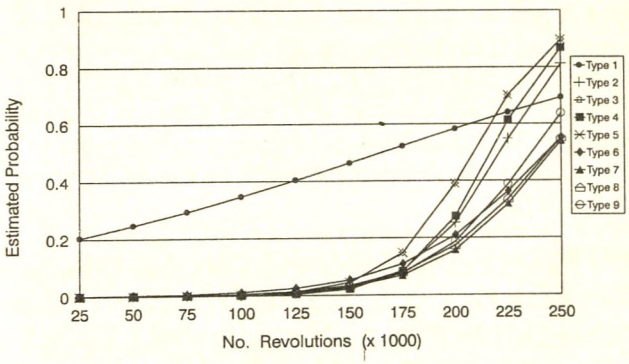


Figure 9 Estimated probability for crevice formation at different stress cycles

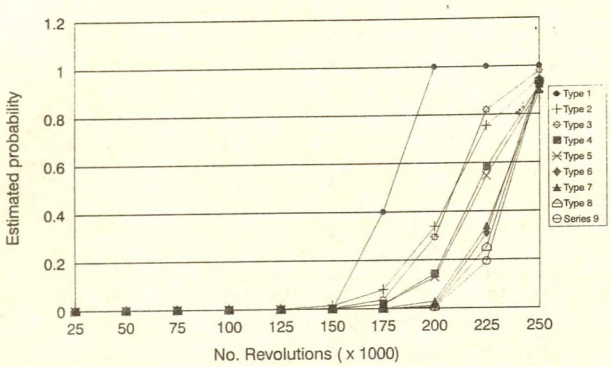


Figure 10 Estimated probability for crack initiation at different stress cycles

Discussion

The results obtained for the failure of loss of material is shown in Fig. 7. Amalgam filled type 1 restorations are very clearly separated from the composite filled restorations (type 2 to type 9). The required number of stress cycles for loss of material to occur is as high as 250,000 in the case of amalgam when compared to 144,000 - 180,000 cycles for composite (TPH and Tetric) cavities at $\hat{p} = 0.5$.

When considering the composite restorations, the Elderton's (type C) and the suggested cylindrical (type D) cavity designs have shown better performance than type A and B. The shorter bucco-lingual dimension of type C and D cavities may have helped them to wear at a slower rate than A and B. These results support the findings of Leinfelder et al (1996) done on clinical material. They concluded that the narrow bucco-lingual dimension of the restoration lowers the rate of wearing of the surface.

The Surface Failure shown by various cavity types are illustrated in Fig. 8. According to these results, two major groups of restorations could be identified (Fig. 8). Composite restoration types 6, 7, 8 and 9 and amalgam restoration type 1 required more than 237,000 cycles to show a 50% failure rate of Surface Failure ($\hat{p} = 0.5$). In fact amalgam filled type 1 restorations and restoration types 8 and 9 (the new, cylindrical preparation filled with composite) did not show Surface Failure ($\hat{p} = 0.5$) even after 250,000 stress cycles. Composite cavity types 2, 3, 4 and 5 however showed Surface Failure fairly early, around 95,000 cycles with a 50% failure rate ($\hat{p} = 0.5$). Types 3, 4 and 5 restorations showed a greater failure rate, even at 25,000 cycles. Therefore, it is evident that even among composite restorations, the Surface Failure mainly depends on the cavity preparation design. The cavities without an occlusal extension have performed much better than the larger cavities with occlusal dovetails.

The results obtained for Crevice Formation are shown in Fig. 9. It is apparent that the Crevice Formation is very much material dependant. Amalgam restorations have shown Crevice Formation ($\hat{p} = 0.2$) as early as at 25,000 stress cycles. In fact, Crevice Formation seems to be a very early occurrence in amalgam and rises steadily with the increase in number of stress cycles (Fig 9). All composite restorations seem stable up to 180,000 compared to the very low 25,000 cycles of amalgam ($\hat{p} = 0.2$). Therefore, composites seem to have exerted high resistance for Crevice Formation. Crevice Formation probably occurs due to the properties of the material.

Duke (1991) reported that all composite resin formulations undergo polymerisation shrinkage upon setting, and the pulling away effect of the material leads to poor adaptation of the material to the cavity walls. Further, the stress due to polymerisation shrinkage would disrupt the adhesive bond between the tooth and the material resulting in crevice formation. Furthermore, Leinfelder (1985) has stated that the difference of the thermal expansion and contraction between the restoration and the tooth is also a possible cause of disruption of the bond between the tooth-restoration interface.

The results obtained for Crack Initiation are shown in Fig. 10. Cracks are important in determining the longevity of a restoration and therefore, a 20% failure rate ($\hat{p} = 0.2$) was considered as the critical value in analysing the results obtained for Crack Initiation.

Amalgam began to show cracks at 150,000 cycles and reached a 20% failure rate ($\hat{p} = 0.2$) at 162,000 cycles. Composite restorations showed cracks later than amalgam, at 185,000 stress cycles (restoration type 2). However, the suggested cylindrical preparation (type D) was the best of all and remained stable throughout the study and reached a 20% failure rate only after 219,000 cycles.

When comparing the required number of stress cycles for Crack Initiation at $\hat{p} = 0.2$, a significant difference was observed between each type of cavity preparation design. Basically, larger the cavity preparation design, higher was the tendency for Crack Initiation.

According to the results of the present study, composite restorations carried out in cavity types C (Elderton's) and D (cylindrical) prepared without an occusal preparation have shown better overall performances than cavity types A and B, prepared with occusal dovetails. It is therefore evident that the occlusal extension prepared in order to achieve better retention has done in fact more harm than good in the case of posterior composite restorations.

Black's cavity preparation in which a fair amount of the tooth substance is removed from both proximal and occlusal surfaces of the tooth, results in a larger restoration with an extensive surface area, onto which occlusal forces are readily exerted. Therefore, a grater part of the occlusal forces are transferred to the roots and the basal bone via the restoration. This would increase the risk of failures. In contrast, if the surface area of the restoration is smaller, a fair part of the occlusal forces will be transferred via the remaining part of the natural tooth crown. This is probably why the composite restorations of cavity type C and D were better performers than A and B. In addition, the longer periphery of the out line in Black's cavities and the greater bulk of the restoration perhaps enhance the adverse properties of composite restorations such as polymerisation shrinkage. In the case of amalgam however, no polymerisation shrinkage is involved and also a certain amount of bulk, as in Black's cavities, is required for the amalgam alloy to have sufficient tensile and compressive strengths to withstand the occlusal forces.

Conclusions

The present study shows no significant difference between the performance of the two composite materials tested (Tetric and TPH composite material). However there was a definite difference of performance between amalgam and composite restorations. It also shows that the amalgam filled cavities to be the best performers out of all the restorations with regard to the Loss of Material and Surface Failure. When considering the other two types of failures, i.e. Crevice Formation and Crack Initiation, in fact, composites performed better than amalgam.

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National Oral Health Survey (1994-95)
Present status and changing scene in dental caries in Sri Lanka

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Summary

The second national oral health survey was undertaken in 1994-1995 after a lapse of 11 years in order to describe the oral health situation in Sri Lanka. The WHO oral health assessment form and WHO criteria (1986) were used and representative samples were taken from the following age groups: 6 years (n=2021); 12 years (n=2003); 15 years (n=1995); 35 - 44 years (n=2013); 65 - 74 years (n=1894). Differences in dental caries were found according to sex, urbanisation, region and ethnic group. Dental caries status in Sri Lanka shows a reduction in the prevalence and severity in children and a minor reduction in the prevalence but an increase in severity in adults. Large regional differences were observed. This paper deals only with dental caries.

Key words: Dental caries, prevalence surveys, Sri Lanka

Information on the changing prevalence and severity of oral diseases is a fundamental requirement in advancing our understanding of health, the ways in which we may prevent onset of disease, and limit its progression and consequences. While there is a constant stream of research findings, there is less opportunity to reflect on the information available. As a result valuable information may be under - utilised. Outside special interest circles there is lack of awareness on the information that might be used to improve health; information available is frequently not made accessible to potential users in a timely manner; and, the skills necessary to interpret information are not always available among the wider dental profession. The aim of this paper is to describe and interpret the data obtained in the second national oral health survey on dental caries.

Dental caries could be stated as the major determinant of tooth longevity. This is the key and highly significant predictor of needs and demands for traditional dental care, which in Sri Lanka is provided by the state free of charge for almost a century now.

1. Prevalence of caries - present status

Dental caries is scored throughout at the "caries into dentine level" and the prevalence is determined as the percentage of subjects with one or more teeth affected by dental caries.

Dental caries prevalence in Sri Lanka ranges from 53.17% at 12 years to 91.16% at 35-44 years. The children aged 6-15 years had a prevalence of 66.45%. Regionally there is a wide variation ranging from 18.18% at 12 years in Trincomalee to 97.2% at 35-44 years in Gampaha. Males had a higher prevalence of caries up to the age of 15 years and beyond 15 years of age the females had a higher prevalence. The children in the age range of 6-15 years in rural areas had a higher prevalence of caries than those in urban areas while it was the other way about in the adults (35 - 44 years) and elderly (65-74 years). Ethnically the Moors had a higher prevalence of caries when compared to the Sinhalese. The Tamils had the least prevalence in all age groups except at 12 years and 6 years (permanent teeth) where the Sinhalese had the least. Regionally, Kegalle, Gampaha, Batticaloa, Puttlam and Kandy could be identified as areas of high caries prevalence and Jaffna, Vavuniya, Trincomalee, Hambantota and Matara as areas of low caries prevalence. The children living in low fluoride areas had a higher prevalence of caries compared to those in high fluoride areas and the prevalence decreased with the increase in

concentration of fluoride in drinking water. However, this trend was not observed clearly in the case of adults and elderly. The children who used tooth powder for cleaning their teeth showed a higher prevalence of caries compared to those who used tooth paste while in adults and elderly the tooth paste users showed a higher prevalence. No clear association could be made between the prevalence of caries and the income of adults and elderly.

In children, even though caries were prevalent in 66.45%, it is a major problem for a minor percentage of them. 45.19% of the caries affected teeth were found in only 9.53% of the children and 60.39% of the caries was found in 14.82% of them in Sri Lanka. This is comparable to that found in the USA where 75% of the caries was found in 25% of the children.

Trends in caries prevalence

The prevalence of dental caries in 1994-95 when compared with that in 1983-84 shows a reduction at 6 years, 12 years, and 35-44 years (1983-84 data is available only for the above mentioned age groups).

Table 1: Prevalence of Caries

Age (years)	NOHS 1994-95 % Affected	NOHS 1983-84 % Affected	Reduction in % Affected (83-95)
6 - Deciduous	76.42	78.2	1.78
6 - Permanent	9.61	14.3	4.69
12	53.17	67	13.83
35 - 44	91.16	91.8	0.64

(NOHS = National Oral Health Survey)

6 years - deciduous teeth

A reduction of 1.78% in the prevalence was observed in this age group in 1994-95 when compared with that in 1983-84. However, an increase in the prevalence at 6 years for the deciduous teeth was noted in the Tamil and Moor ethnic groups in the regions of Colombo, Kegalle, Kandy, Nuwara Eliya and Kurunegala. The maximum decrease of 40.34% in the prevalence was noted in Matara, and the maximum increase of 13.61% was in Nuwara Eliya.

6 years - permanent teeth

In this age group, a reduction of 4.69% in the prevalence was observed in 1994-95 when compared with that in 1983-84. An increase in the prevalence was observed in the Moors in the regions of Kegalle, Hambantota, Nuwara Eliya, Batticaloa and Trincomalee. The maximum increase of 10.26% was in Kegalle and the maximum decrease of 19.28% was in Jaffna.

12 years

In this age group, a reduction of 13.69% in the prevalence was observed in 94-95 when compared to 83-84. An increase was observed only in Nuwara Eliya, which was 34.9%. The maximum decrease of 33.49% was observed in Jaffna.

35-44 years

A reduction of only 0.64% was observed in 94-95 when compared to 83-84. An increase in the prevalence was observed in the Moors, urban areas and in the regions of Colombo, Kalutara, Badulla, Hambantota, Kandy, Trincomalee, Anuradhapura, Puttlam and Gampaha. The maximum increase of 7.36% was in Trincomalee and the maximum decrease of 18.86% was in Galle.

2. Severity of caries - present status

Severity of caries is determined by the mean number of caries affected teeth in the total sample. It is expressed as the mean total number of decayed, missing and filled teeth (dmft, DMFT).

Severity of dental caries in Sri Lanka ranges from 0.17 in the permanent teeth at 6 years to 22.58 at 65-74 years. Regionally there was a wide variation ranging from a minimum of 0.03 in Anuradhapura to 0.46 in Gampaha in the permanent teeth at 6 years, 1.08 in Matara to 5.36 in Kegalle in the deciduous teeth at 6 years, 4.92 in Vavuniya to 12.74 in Kandy in the adults, and 16.16 in Batticaloa to 26.3 in Matara in the elderly. Males have a higher severity up to the age of 12 years and beyond this age the severity is more in females. At 15 years of age the prevalence of caries is more in males but the severity is less. The severity of dental caries is more in rural areas when compared to urban areas except in the age group of 35-44 years. In children the prevalence and severity of caries are more in rural areas. In adults the prevalence and severity of caries are more in urban areas. In the

elderly the prevalence is more in urban areas but the severity is less. Ethnically the severity remains the same as the prevalence except in the elderly where the Sinhalese have a greater severity than the Moors, and the Tamils the least as in the prevalence. The positive relationship observed between caries prevalence and fluoride concentration was found in the case of caries severity too.

Trends in severity of caries

The severity of caries in Sri Lanka in 1994-95 when compared to 1983-84 shows a reduction in children and an increase in the adults.

Table 2: Severity of Caries

Age (years)	DMFT 1983-84	DMFT 1994-95	DMFT Change 1983-95
6-Deciduous	4.4	4.1	-0.30
6-Permanent	0.2	0.17	-0.03
12	1.9	1.44	-0.46
35-44	9.2	10.08	+0.88

- Indicates a reduction + indicates an increase

6 years - deciduous teeth

There is a reduction of 0.3 in the dmft in this age group in 1994-95 when compared to 1983-84. However an increase was noted in the Moors in the regions of Gampaha, Hambantota, Nuwara Eliya, Badulla, Kegalle, Kandy and Kurunegala. The maximum increase of 1.06 was observed in Nuwara Eliya and the maximum decrease of 3.72 was in Matara.

6 years - permanent teeth

In this age group a reduction of 0.03 in the DMFT was observed in 1994-95 when compared to 1983-84. However, an increase was noted in the Muslims in the regions of Gampaha, Hambantota, Nuwara Eliya, Kegalle, Batticaloa and Trincomalee. The maximum increase of 0.15 was noted in Batticaloa and the maximum decrease of 0.31 was in Jaffna.

12 years

There is a reduction of 0.46 in the DMFT in this age group in 1994-95 when compared to 1983-84. However, an increase was noted in the Muslims in the Nuwara Eliya district. An increase of 1.18 in the DMFT was noted in Nuwara Eliya and the maximum decrease of 1.31 was in Jaffna.

35-44 years

There is an increase of 0.88 in the DMFT in this age group in 1994-95 when compared with the values of 1983-84. However, a decrease was noted in the regions of Galle, Ratnapura, Nuwara Eliya, Kegalle, Batticaloa and Jaffna. The maximum increase of 3.96 was noted in Puttlam and the maximum decrease of 4.17 was in Batticaloa.

3. Comprehensively treated caries - present status

Comprehensively treated caries is expressed as the percentage of subjects who had obtained treatment for all their carious teeth in the total sample. The oral health survey in 1994-95 showed that the comprehensively treated caries in Sri Lanka to be 4.75% in children, 11.33% in adults, 17.96% in the elderly and only 8.6% in the total sample. It ranges from 0.4% in the permanent teeth at 6 years to a maximum of 17.96% in the elderly. Comprehensively treated caries are more in females when compared to males except in the adults where the males have a higher percentage of caries treated. Urban areas show a higher percentage treated comprehensively when compared to rural areas, which may be due to the higher dental manpower and dental clinics available in these areas.

Regionally, Kegalle, Kalutara and Galle could be identified as districts showing a high percentage of comprehensively treated caries while Kurunegala and the districts in the North East showed the lowest percentage. The subjects using toothpaste to clean their teeth showed a higher percentage of treated caries.

4. Missing teeth - present status

Missing teeth is expressed as the mean number of teeth found missing in the mouth due to caries or periodontal disease and also as the percentage of teeth missing out of the decayed, filled or extracted teeth. The oral health survey of 1994-95 shows that the mean number of teeth missing ranges from 0.11 at 12 years to 20.35 at 65-74 years. Percentage wise missing teeth ranges from 5.3%

in the deciduous teeth affected with caries at the age of 6 years to as much as 90% of the teeth affected with caries or periodontal disease at the age of 65-74 years. In children 0.22 tooth or 7.96% of the teeth affected with caries is missing. In the adults 5.83 teeth or 57.8 % of the teeth affected with caries are missing. Missing teeth were more in females except at the age of 6 years. Missing teeth were more in the Moors when compared to the Sinhalese, and the Tamils had the least number of missing teeth. The subjects living in urban areas have a greater number of missing teeth when compared to those living in rural areas, except at the age of 65-74 years. Extraction as a treatment for caries was practised more in the regions of Kalutara, Galle, Matara and Kegalle and less in the regions of Vavuniya, Batticaloa and Trincomalee.

5. Edentulousness - present status

Edentulousness is expressed as the percentage of subjects who have lost all their teeth. 1.64% of adults (35-44 years) and 36.93% of the elderly (65-74 years) had lost all their teeth. Edentulousness was more in females. The Sinhalese had a greater percentage of edentulousness when compared with the Moors and Tamils. The Moor adults had a greater percentage of edentulousness when compared with the Tamil adults while this was the other way about in the elderly. Edentulousness was more in rural areas when compared with the urban areas. Galle and Matara showed a high percentage of edentulousness, while the North East except Ampara, Hambantota, Anuradhapura, and Kegalle had the least. The maximum increase in edentulousness, 62.9%, from the age of 35 years to 65 years was noted in Matara. An increase of 0.54% in edentulousness in the adults was shown when the values of 1983-84 and 1994-95 oral health surveys were compared.

6. Filled teeth and restorative index - present status

Filled teeth is expressed as the mean number of teeth found with permanent fillings and the restorative index as the percentage of teeth restored out of the decayed, missing and filled teeth. The traditional restorative approach, which has a strong influence on dental practice and dental education in many parts of the developed world, still has not caught up here in Sri Lanka at least in dental practice. Untreated dental caries constitutes most (81.8%) of the total caries experience in children and there is a continued domination of the DMFT index score by the decay component. There is an increasing proportion of one surface lesions (mainly pits and fissure lesions) at the expense of two or more surface lesions and diminishing caries in anterior teeth.

The mean filled teeth ranged from 0.4 in adults to 0.06 in the elderly and the restorative index ranged from 2.9% in the deciduous teeth at 6 years to a maximum of 12% at 12 years. The mean number of restorations found in children in the 6-15 year age group was only 0.2 and the restorative index was 7.3% . The females had more restorations and a higher restorative index up to the age of 12 years and beyond this age the males had more. Ethnically more restorations were found in the Sinhalese when compared to the Moors, and the Tamils had the least. Those living in urban areas had more restorations than the ones in rural areas except in the 65-74 year age group.The subjects living in Kegalle, Kalutara, Matara and Colombo had more restorations, and those living in the North-East had the least. Surprisingly all subjects examined in four of the five age groups in 1994-95 survey in Ampara, Batticaloa, Trincomalee and Vavuniya did not have a single restoration. The next was Jaffna where the children did not have any restorations.

References

1. World Health Organization (1987). Oral Health Surveys, Basic Methods. 3rd edn. Geneva, WHO.

2. National Oral Health Survey Data published and unpublished 1994 to 1995.

3. National Oral Health Survey Data 1983 to 1984.

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Activities of the Sri Lanka Dental Association - 1997/98

The activities of the current year commenced with the Annual General Meeting 1996/97 held at Hotel Club Palm Bay, Marawilla. This event was preceded by the Sri Lanka Dental Association Oration delivered by Professor Malkanthi Chandrasekera, the Annual Scientific Sessions and the the Inaugural Cricket Tournament for Dr W.G. Wimaladharma Trophy, which was won by the Southern Branch. At the Annual General Meeting the following were elected to the SLDA.

President	Prof M.T.M.Jiffry
Vice President	Dr Mano Fernando
President Elect	Dr Adly Mohammed
Immediate Past President	Dr Gamini de Silva
Hon. Gen. Secretary	Dr Sarath Senaratne
Asst. Secretary/Librarian	Dr K. Krishnarasa
Editor	Dr Nalin Jayatilleke
Council	Dr. M.Stanislaus
	Dr.R.Weerasinghe
	Dr.L.T.J.Fernando
	Prof.M.Chandrasekera
	Dr.T.J.Liyanarchchi
	Dr.K.Paranthamalingam
	Dr.K.S.N.Ariyasinghe

Induction of the SLDA President

Induction of the SLDA President 1997/98 was held on 14 October 1997, at the Sri Lanka Foundation Institute, amongst a large gathering including Her Excellency Chandrika Bandaranaike Kamaranatunge, as the chief guest.

APDF Workshop

The workshop on "Improving Oral Health of Children in the Asia Pacific Region" was held in Manilla, Philippine, from 11- 13 November, 1997. This was organised by the APDF. Dr Reggie Goonetilleke (APDF President) and Dr K.D.G. Saparamadu (Chairman, Dental Public Health Commission, APDF) were responsible for the organisation of this workshop.

The SLDA was represented by

Prof. M.T.M.Jiffry	SLDA representative
Dr.J.U.Weerasinghe	University representative
Dr.M.Marasinghe	Health Department representative

Post of Editor, Sri Lanka Dental Journal

Dr. J.A.P.Jayasinghe resigned from the post of Editor, SLDJ, after serving for over four 4 years. Dr Deepthi Nanayakkara was appointed as the Editor of the journal.

New Office Project

The SLDA has been allocated a 1000 sq ft office space at the new OPA building that is being constructed. This project is being organised by Dr Gamini de Silva.

Amendments to the Constitution

At a special General Meeting held on 8 February 1998, the amended version of the constitution pertaining to "Criteria for sponsorship of members by the Sri Lanka Dental Association" was approved. A committee headed by Dr Ranjith Weerasinghe ratified these amendments. The other members of the committee were Drs N.Chinniah, S.Senaratne, N.Jayatilleke, K.Krishnarasa, Gamini de Silva, Ira Ratnayake, Shelton de Mel and A.Amunugama.

Out Reach Programmes

Three Out Reach Programmes were organised by Dr Ranjith Weerasinghe at Molkawa in the Kalutara District, Nikaweratiya and Hendela.

The North Western Branch of the SLDA held Out Reach camps at Narammala and Negombo prisons.

President Chandrika Bandaranaike Kumaranatunga with Prof. M.T.M. Jiffry, President, SLDA at the induction ceremony.

Educational Programmes

The following Lectures/Workshops were organised by the SLDA.

1. **9 August 1997**
   "Modern uses of Modern Materials"
   A lecture based seminar with table clinics were conducted by Dr Trevor Burke, Professor of Primary Dental Care and Consultant in Dental Surgery, University of Glasgow Dental Hospital, and Dr Raj Malik , Prosthodontist, at Hotel Renuka.

2. **4 September 1997**
   "Structural studies on the periodontal ligament"
   A lecture was delivered by Dr Barry Berkovitz , the Visiting Examiner from the King' College, London, for MS Part I Examination.

3. **10-14 September**
   The SLDA participated in the "National Convention on Professionals on Career Education and Career Guidance Exhibition" held at Sri Lanka Exhibition and Convention Centre. The SLDA organised a booth to present Dentistry as a career in the future for GCE A/L students. The SLDA Council and the office staff managed this stall.

4. **31 October 1997**
"Some Facets of Tooth Wear"
A Guest Lecture on the above topic was delivered by Prof B G N Smith of United Medical and Dental School of Guy's and St. Thomas's Hospital and visiting examiner for MS Part II (Restorative Dentistry) Examination.

5. **5 April 1998**
"Hands on sessions in the use of computers"
The SLDA organised the above workshop at the University of Moratuwa.

6. "Workshop on Infection Control in Dental Surgery"
A workshop on the above title is being organised by the SLDA with the participation of Prof Lakshman Samaranayake. The purpose of this workshop would be to produce a document on "Infection control in Dental Surgery". Participants would be the nominees of the Colleges, Associations, Ministry of Health and the Faculty of Dental Sciences.

Committee on Out-Reach Programmes

Chairman: Dr Ranjith Weerasinhe
Secretary: Dr K. Krisknarasa

Three Out-Reach Programmes were held during the period from 1997-98 and three further programmes have been scheduled. The programmes held were :

1. **21 October 1998** – Molkawa in the Kalutara District. Participants – Drs Ranjith Weeeasinghe, Sunil Fernando, K Shanmuganathan, J N Chinniah, Mrs Padmini Jayasinghe, Sunil Gunaratne and Brig. Thilak Jayaweera.

2. **1 February 1998** – Nikaweratiya. Participants – Drs Ranjith Weerasinghe, Sarath Senaratne, T J Liyanarachchi, J N Chinniah, K Shanmuganathan, Mrs Sita Rajakaruna, Brig Tilak Jayaweera, Asoka Amunugama, B M G H Marasinghe, N S Manoratne (Consultant Dental Surgeon, General Hospital, Kurunegala).

3. **15 March1998** – Palliyawatte, Hendala, oragnised by the Lions Club and co-ordinated by Dr Malcolm Stanislaus. Participants – Drs Adly Mohammed, Sunil Gunaratne, Asoka Amunugama, Nalin Jayatilleke, Malcolm Stanislaus, J N Chinniah, Brig Tilak Jayaweera, and Dental Surgery Assistants working at Dr Ranjith Weerasinghe's Surgery.

Future programmes scheduled:

1. 9 July 1998 – Vevelwatte in the Ratnapura Ditrict
2. 7 August 1998- Agalawatte electorate
3. 6 September 1998- Galle District

When the present Chairman took office only one mobile dental chair, a compressor and a mobile air rotor unit were available for the Out-Reach Programmes. Two new mobile dental chairs, an air-rotor hand piece, some forceps and hand instruments were donated to the SLDA Out-Reach Committee by Unilever (Ceylon) Ltd. for which we are thankful to Mr. Asanga Karunaratne as well. During the 1997/98 period, Mr. S Balaraj of Budget Dental Supply donated a used air rotor hand piece to us. Many forceps and hand instruments were purchased during the 1997/98 period using part of the profits collected from the AGM held in 1996 under the Presidency of Dr. Ranjith Weerasinghe. Most of the equipment and instruments were purchased in India by the Chairman, Out-Reach Programme and some instruments were bought in India by Dr Ravi Gurusinghe and were brought down to Sri Lanka with the help of Dr Sarath Senaratne and Dr Nimal Rajapakse. We are thankful to all of them. The SLDA now possesses most of the equipment to conduct Out-Reach Camps independently. For the other equipment, Unilevers have been courteous enough to allocate Rs 30,000/-. Messrs. Unilevers has been the major sponsor of all Out-Reach Camps held by the SLDA. We thank Mr. Chris Kariyawasam of Unilevers for his assistance.

We are thankful to Dr S Musafer of Kalutara and Mr. Saliya Kaluarachchi, Cabinet Secretary, Lions Club 306C for providing transport for the Makola and Nikaweratiya Camps respectively. They have promised further assistance as well, and their kindness is much appreciated. The State Pharmaceuticals Corporation and Mackwood Winthrops Ltd. provided the antibiotics and analgesics used at these clinics.We are thankful to Mrs Surangani Perera of State Pharmaceuticals Corporation and Mr. Kosala Dissanayake , Managing Director, Mackwood Winthrops Ltd., for their kind assistance.

The SLDA Out-Reach Committee would like to thank: Miss Sumathi, Miss Pushpa Hemanthi, Miss Ayesha

Abeygunawardene, the Surgery Assistants of Dr Ranjith Weerasinghe's Surgery, for participating at all Out-Reach Camps held this year, and the Surgery Assistant from Dr (Mrs) Padmini Jayasinghe's Surgery for participating at the Molkawa camp, and Miss Thilini Amarasuriya and Mr Arnold Thiele for their unreserved assistance.

Committee on Prevention of Malpractice

Dr Ranjith Weerasinghe, Chairman.

Many notable actions were taken during the 1997/98 period to prevent malpractice in the Dental Profession. Wide publicity was given through the SLDA Newsletters and in the newspapers for the dental surgeons and the general public to inform of persons (quacks) practicing Dentistry without qualifications and registration. The response to these appeals was good. We were informed of a large number of unqualified persons practicing Dentistry. We have informed the Registrar, the Sri Lanka Medical Council and the Police to take appropriate action against these persons. Some Police Stations have initiated investigations in response to our appeals. We shall follow it up further and we will do our best to ensure action against all quacks.

While we received information of unauthorised practitioners, the SLDA was informed of some people practicing with bogus dental degree certificates that had apparently been issued by an Institute in Colombo. Some national newspapers carried this news and that caused the Chairman of this committee to receive several threats from persons who were supposed to be from the said Institute. However, these threats did not hinder the action of the committee, and action was taken to get the police to investigate the issue of these certificates. One person has been taken into custody for practicing with such certificates and court action has been taken against him at Polonnaruwa. We are very thankful to Dr S R Amarasinghe and Dr R L Kandewatte, Consultant Dental Surgeon at Polonnaruwa for their interest taken in this issue.

On 21 November, 1997, the following delegation of the SLDA, namely, Drs Ranjith Weerasinghe, Gamini de Silva, Sarath Senaratne, K Krishnarasa and S R Amarasinghe met Hon. Nimal Siripala de Silva, the Minister of Health and Indigenous Medicine to discuss matters related to the Dental Profession at the Ministry of Health. At this meeting we have emphasised that the Medical Act should be amended with the aim of preventing malpractice imposing with larger fines for unqualified practitioners. A memorandum was forwarded to the Hon. Minister at this meeting for action in the interests of the dental profession.

Amendments to the Medical Act: The SLDA is thankful to the Hon. Minister of Health and Indigenous Medicine and the Government for consenting to amend the Medical Act to prevent dental and medical quackery. The draft for these amendments to be forwarded by the SLDA is now being prepared by Professor Asoka Ekanayake, Dr Ajith Ranasinghe, Dean, Faculty of Dental Sciences, Dr Lakshman Wijeyeweera and Dr Athula Pitigalaarachchi and would be available to the SLDA within the month of June 1998.

Dental Products Endorsement Committee

Dr Mano Fernando, Chairman.

Subsequent to the endorsement given to Signal toothpaste, the Endorsement Committee had approved the following submitted by the Messrs. Unilever (Ceylon) Ltd.:

1. Leaflets and posters on Preventive Dental Health Care Methods to be distributed at school programmes and community programmes.
2. The new logo for On Pack Endorsement with words – "SLDA recommended".
3. The TV commercial script and radio spots on Double Action Signal in Sinhala, Tamil and English submitted on 31.3. 98.
4. Testing has been done on 'Clogard' toothpaste with the view of giving endorsement. As the results from the C I S I R and S L S I are conflicting on the fluoride content of Clogard, re-testing is being done at the SLSI and CISIR and we have also sent Clogard toothpaste samples to Messrs Bamber & Bruce for their report too, and the endorsement of Clogard will be taken up again after obtaining the results.

Fluoride Research Committee – Annual Report

Dr Adly Mohammed, Hony Secretary.

1. A workshop for dental surgeons in treatment of dental fluorosis was carried out.
2. A project on treatment of dental fluorosis was implemented in Suwa Udana programme held at Nikaweratiya.
3. The reports of activities done at local level at Polpitigama in Kurunegala by health workers were sent by the Project Manager, Dr BMGH Marasinghe.
4. The committee decided to use future Fluoride Research Funds for :
   (a) Training programmes for prevention and treatment of fluorosis
   (b) To have fluoride research projects in other areas where fluorosis is endemic
   (c) Funds to be made available to SLDA members for fluoride research programmes
5. Study on the impact and the acceptability of the programme for the prevention and treatment of dental fluorosis
   Mid Term Evaluation Report – Research carried out and reports submitted
6. The committee decided to train 3-4 dental surgeons working in highly fluoridated areas.

Sub-Committee on Health Education and Publicity

Dr Adly Mohammed, Chairman

1. Posters on prevention of dental caries and gum diseases were given at Out-Reach programmes. These posters were pasted around the walls of the clinics and explained to the children and adults.
2. Oral Health talks were given by the Dental Surgeons who took part, on how to prevent dental diseases. Demonstrations, advice and referrals were also done.
3. A leaflet on " Teeth for Life-time" was distributed to participants, especially adolescents at Mobile Dental Clinics. The leaflet generally tells about the importance of having good teeth, the cause for caries and gum diseases, the first signs of dental diseases and how to prevent them.

A Report on Sri Lanka Dental Association Library

K. Krishnarasa
Assistant Secretary / Librarian

Sri Lanka Dental Association (SLDA) is committed through its constitution to update the knowledge of its members through continuing education in order to provide a quality care to Sri Lankans. With this in view it has established a library of its own, conducts hands on courses, workshops, seminars and annual scientific sessions. In addition it publishes a journal.

Library

During June 1997 to 15th May 1998 the SLDA got down two journals - the Dental Update and Quintessence, regularly. We received few copies of the International Dental Journal and in addition we also received 281 copies of past journals and books during this period. Thanks to the efforts of Dr. Chris Stock and Dr. Ajith Ranasinghe. At the moment the library has 148 books, 408 copies of 7 dental journals and 114 copies of 29 periodicals. We also have several video cassettes.

Utilisation of Library

Only 112 of the 460 members of the SLDA are enrolled as members of the library.

Books: During the period of June 1997 - 15 May 1998 only 9 Dental Surgeons (DSs) borrowed 31 books from the library. One DS borrowed 10 books, and another borrowed 5 out of this 31 books. Books don't appear to be popular reading material. Only 4 DSs read 3 or more books during this year from the library.

Journals and Periodicals: 13 DSs had borrowed 130 copies of journals and periodicals during June 1997- 15 May 1998. Dental Update is the most popular journal read by the members. 7 DSs had read 58 copies of Update during the above mentioned period. 4 DSs read 28 copies of Quintessence; 4 DSs read 15 copies of the BDJ and 2 DSs read 14 copies of Community Dental Health.

Video cassettes: Only 2 DSs had borrowed 5 video cassettes during the above period.

Books and Journal Overdue from members.

Books: 32 books are overdue and yet to be returned by 18 DSs. These are overdue from as far back as October 1991 to April 1998. One DS has to return 5 books; 2 DSs have to return 3 books each and 2 DSs 2 books each.

Journals: 25 journals are overdue from 7 DSs. One has to return 10 journals and periodicals but he is the one who uses the library most.

It is very sad that only 13 out of the 112 library members used the library to update their knowledge. It is further sad that 18 members are keeping with them 32 books and 25 journals for periods ranging from several months to more than 6 years preventing other members using them. With Dental Science rapidly advancing we trust more and more members of our profession will update their knowledge making use of the library the proper way.

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Study on the Impact and Acceptability of the Programme for the Prevention and Treatment of Dental Fluorosis - Mid Term Evaluation Report

A. Mohammed
Hony. Secretary, Fluoride Research Committee, SLDA

Summary

The village Polpitigama in Kurunegala District is a place where dental fluorosis is a common incidence due to excess fluoride found in the drinking water. The survey was confined to a pocket which contained 97 houses, 32 families using filters to remove excess fluoride from the water and 65 houses without filters.

Almost all families in the community selected perceived dental fluorosis as a major public health problem. In the 97 households surveyed there were 71 families (127 members) who had dental fluorosis.

All families who are using filters knew that dental fluorosis is caused by excess fluoride present in the drinking water. Nearly 82 per cent of those who were not provided with filters knew the correct cause of dental fluorosis.

Nearly 94 per cent of the sample population knew that the primary preventive measure for this problem is to remove excess fluoride from drinking water. However, it was only nearly 62 per cent in the control group who knew the correct preventive measure.

Nearly 89 per cent of the total sample population were aware of the pilot project undertaken by the Dental Association to control dental fluorosis. Nearly 88 per cent of those who used filters perceived the programme as useful whereas only 74 per cent among the respondents who were not being provided flters said that the programme was useful.

Those who do not use filters at present, for their non-use have given the following reasons.

- Not enough filters were available
- Filters were taken back
- Children did not like to drink filtered water
- Filtered water had a yellowish colour
- Take water from wells where there is no excess fluoride
- Bone char is not received on time
- No change could be seen even after using filtered water
- There are no stains in the teeth.

All of the respondents feel that the programme is useful and it should be expanded to cover other houses also.

Most of the people were not aware of the fact that bone char is made of bones of the cattle, yet they approved the use of bone char as the filter medium for defluoridation of water.

An exhaustive list of benefits derived by using defluoridated water could be prepared by analysing responses of respondents. These include:

- the taste of the water becomes palatable
- the food can be kept for long without getting spoilt
- pulses like dhal get boiled well
- the water is cold
- the burning sensation in passing urine disappears
- good for rheumatism
- less chances for dental diseases to occur
- pains in the body disappear
- where defluoridated water is used, the taste of tea is not unpalatable.

Recommendations

1. Regular supply of bone char and repairs to the filters should be assured through closer supervision.

2. More printed material on the benefits of using defluoridated water should be made available.

3. Formation of small groups who would be responsible for maintaining and also motivating others in joining the scheme is recommended.

4. The project should be expanded to cover the villages having excess fluoride in the drinking water.

5. It is important that a carefully designed IEC programme be launched to educate the people with regard to the causes of dental fluorosis, the process of defluoridation and maintenance of filters.

6. Extra benefits of the programme should be highlighted in the IEC programme.

7. In dissemination of information priority should be given to the most popular media i.e. radio. Interpersonal communication by public health field staff and small group members should be encouraged.

8. A school health education programme should be introduced in all schools. The programme should not only educate the school population but should undertake educating the community as well.

9. A community defluoridation programme should be attempted through participatory process, involving community in planning and maintaining the programme.

Examinations

The following have been successful at the examinations held by the PGIM.

MS Part II
Orthodontics
Dr K. Paranthamalingam
Dr J.M.Subasinghe

Restorative Dentistry
Dr W.P. Asanga Goonetilleke
Dr (Mrs) T. Thavavathani
Dr (Mrs) S. Wasantha

Dental and Maxillo Facial Surgery
Dr Suresh Shanmuganathan
Dr S.P.A. Ariyawardene

DGDP
Dr (Mrs) D.M.P.H. Delkandura
Dr (Ms) N. Sriranjan
Dr (Mrs) D.S. Vethavanam
Dr (Mrs) Y.H.R.N.S. Karunaratne
Dr S. Wijesundera
Dr S. Selvaratne

INSTRUCTIONS TO AUTHORS

The SLDJ publishes the following categories of articles which have relevance to Dentistry and allied sciences.

1. Leading Article - One article per issue. It may be solicited by the Editor. Authors are welcome to submit leading articles on current topics of interest, one's expertise or commentaries on general practice etc. They should be approximately 1500 words in length. References should be 20 or less.

2. Reviews - Reviews are detailed surveys of published research pertinent to dentistry and associated sciences. They should be critical in nature and should not normally exceed 3000 words and 30 references.

3. Papers - Articles resulting from research work belong to this group. Results from routine clinical examinations or laboratory investigations will not be considered under this category. Subjects may vary from clinical trials to basic science research, historical analysis to dental economics. They should not exceed 3000 words and 25 references. A reasonable number of tables and illustrations will be accepted.

4. Short-Reports - These include reports on current topics, modified techniques, new materials, practice management etc. Interesting results from routine clinical work or laboratory investigations may also be accepted.

5. Case Reports - Reports such as of rare diseases or conditions, modifications to accepted treatment procedures, new management methods etc. may be included in this category.

6. Letters to Editors - Subjects unlimited, but may include short critique of published papers in the SLDJ.

7. Miscellaneous Topics - Subjects unlimited and the format is free. These may also include details of scientific meetings, conferences, annual sessions, examinations, news and views, visits and obituaries.

8. Proceedings of Annual Sessions - Abstracts from annual sessions of SLDA and other colleges will be published under this category.

The following instructions are mainly applicable to research papers. However, other articles should also conform as far as possible to these instructions.

Submission of Manuscripts

1. General - Manuscripts must be submitted in triplicate. Text must be typed double - spaced with wide margins throughout in A4 (212 x 297 mm) size papers. They should be carefully scrutinised for errors before they are submitted. Correctness of spelling, grammar, and typing is the responsibility of the author. Three sets of figures and tables must be submitted. The number and the size of the illustrations must be consistent with the minimum requirement for clarification of the text. Previously published figures cannot be accepted. Manuscripts should be accompanied by a letter stating that the contents have not been published or submitted elsewhere for publication. Where applicable a copy of the ethical clearance certificate should be attached.

2. Title page - Following information should be furnished in the title page.

Title of paper, names of authors in the order in which they are to appear in the published article, departmental or institutional affiliation and an address for correspondence.

3. Summary- The brief summary should not exceed 250 words and should set out what was done, the main findings and conclusions. Upto five key words should be given for subject indexing. These key words should be taken from the Index Medicus or composed on the same principle.

4. Introduction - The introduction should carry sufficient background information on the subject of study.

5. Materials and Methods - These should be described in sufficient detail and include references.

6. Results - This section should present the findings of the research supported by statistical or illustrative validation of assertion. It should be free from discussion.

7. Discussion - The discussion should be focused on experimental findings and their interpretations. Unsubstantiated speculations and plans for future studies are unacceptable.

8. Tables and Figures - These should be numbered in the order of appearance in Arabic numerals. Tables with brief titles should be typed on separate pages. Legends for figures should provide a brief, self sufficient explanation of the illustration. Magnification should be indicated at the end of the legend if a calibration bar is not included in the figure. Photographs should be glossy prints and the reverse shoud give the figure number, title of paper, principal author's name and have a mark indicating the top. The cost of reproducing photographs and illustrations may be charged to the author.

9. References - References should be cited in the text as follows:

One author	- (Jones 1992)
Two authors	- (Jones and Arnett 1986)
Three or more	- (Jones et al, 1972)

Some common examples for the style of references are given below.

Bartlett J.G., O'Keefe P. (1979) The bacteriology of the perimandibular space infections. J. Oral Surg 37: 407-409.

Stokes E.J., Ridgeway G. (1987) Clinical Bacteriology, 6th ed. London: Edward Arnold, 202-217.

Boyde A. (1976) Amelogenesis and the structure of enamel. In : Cohen B., Kramer K.H. (eds) Scientific Foundations of Dentistry. William Heinemann Medical Books Ltd. London, 335-352.

Barker D.S., Lucas R.B. (1965) Localised fibrous growth of the oral mucosa.
J. Dent Res (In press)

Reoprt of the committee of enquiry into unnecessary dental treatment (1986) HMSO, London, 52-53.

Cumings S. (1992) Personal communication, San Francisco.

Amaratunge N. A. De S. (1991) Epidemiology and treatment needs of maxillofacial fractures in Sri Lanka, PhD thesis, University of Peradeniya