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Role of oral medicine specialist in disclosing systemic lupus erythematosus: A diagnostic dilemma

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ABSTRACT
Systemic lupus erythematosus (SLE) is a connective tissue disease in which organs such as liver, kidney and heart in addition to skin and mucosa are involved. Oral findings are one of the diagnostic criteria which can be presented with ulcer or red and white lesions. In this article we report a case of SLE that is diagnosed by oral medicine specialist on the basis of oral ulcers. A 16-year-old female was referred to oral medicine department with 3 months lasting oral ulcers. There was a history of transient artheralgia in review of systems. In extra oral examination a butterfly diffuse erythema was observed on nasal bridge and malar prominences. Oral ulcers had different forms and involved different parts of oral mucosa. Due to chronic oral ulcers, malar rash and history of artheralgia, a presumably diagnosis of SLE was affirmed. She was referred and hospitalized to rheumatology department. Oral and skin lesions were improved significantly in follow up examination. Oral findings may be the first diagnostic presentation of SLE. It is important for dentists to pay attention to medical history and different systemic symptoms to achieve accurate clinical diagnosis.

Key words: Systemic lupus erythematosus, Oral ulceration, Case report, Oral Medicine, Iran

INTRODUCTION
Systemic lupus Erythematosus (SLE) is one of the most important immunity related diseases with unknown etiology, although several factors such as autoantibodies, immune complex, tissue damage, genetic factors (e.g. specific HLA types and gene loci), environmental factors (e.g. exposure to sunlight and infections), endocrine agents and drugs can predispose an individual to this disease (1,2). There are four main clinic-pathological forms: systemic, discoid (chronic cutaneous), acute cutaneous and subacute cutaneous (3). Organ damage occurs as a result of direct attachment of autoantibodies to host antigens or precipitation of immune complex in small vessels and tissues (vasculitis) (1,2,4). There is a female predominance (10:1) and blacks are involved more frequently.

SLE typically arises in adults aged 15 to 45. (1,2,5) Only 15% of individuals with SLE are younger than 18 year at the time of diagnosis (6).
Clinical manifestations of this disease vary upon specific organ involvement. Fever, fatigue and weight loss are of clinical components. (7) Arthritis is the most common clinical manifestation of this disease (in 90% of patients) (1,7) and usually appears symmetrically. Interphalanges, knees, wrist and metacarpal joints are affected more frequently.(1) Malar rash, dry pruritic skin, gastrointestinal disorders and muscle spasms are of other clinical signs.(1) Diagnosis of this disease can be made via clinical and paraclinical findings.. If four of 11 criteria become evident simultaneously or consecutively in the course of this disease diagnosis can be made with a 75% sensitivity and 95% specificity. (1)

Oral manifestations can be the first presentation of disease, and may lead to diagnosis. Incidence of oral manifestations, was first reported by Monach (1931)as 50%, (8) and Vasculitis is considered as the main etiology of oral lesions (1,7,8,9).

These manifestations include: nonspecific chronic ulcers, erosion, inflammation, erythema and keratotic white lesions (papule, plaque …) or even granulomatous lesions and malignant transformation of oral ulcers. (1,3,7,8)Candidosis, periodontal disease and temporomandibular disorders and desquamative or marginal gingivitis are other oral findings of SLE. (1,8,9,10,11) In advanced SLE , xerostomia may appear (1).Sometimes delayed primary and permanent tooth eruption and twisted root formation can be encountered as a result of corticosteroids treatment (10).

The affected sites are the buccal mucosa, gingiva, vermilion border of the lips, palate and tongue (1, 8) . Usually diagnosis of SLE is performed by physicians but at least one case report exists about diagnosis of SLE by dentist (11).

This article, presents a case of SLE, in which the diagnosis was made based on oral manifestations. Despite a history of skin lesions and articular pain, the patient had received improper treatments and Oral Medicine Specialist could reveal the disease.

CASE REPORT

A 16-year-old female was referred to Oral Medicine Department of Mashhad Dental Faculty in OCT 2008. She complained of oral ulcers with three months duration. In review of systems, there was a history of transient artheralgia in knees, elbows and wrists in 6 months before initiation of oral manifestations. Ibopruphen, calcium and vitamin D was prescribed for her by an internist, and partial relief was obtained after this therapy. There was also a history of hair loss. In extra oral examination, generalized erythema was seen on nasal bridge and malar region (Butterfly rash) with exfoliation of skin in some areas (Fig 1) accompanied by a thick crust on the lower vermilion border.

The patient noted exacerbation and exfoliation of Malar rash after sun exposure. She was advised to use sunscreen by a dermatologist and a few resolution was acquired.

Fig 1: Butterfly rash and exfoliation of cheeks and nasal bridge skin and lip crust.
In intraoral examination multiple ulcers with different patterns were seen in several areas of oral mucosa such as palate, buccal region, gingiva and tongue.

Diffuse map like ulcers were present bilaterally on buccal aspects of mandibular attached gingiva (canine, premolar region) and palatal aspects of maxillary gingiva (premolar and molar region) (Fig 2).

Multiple small, clustered ulcers were observed in right lateral side of hard palate adjacent to first premolar and molar, involving an area of $1.5 \times 1.5$ cm diameter. There was no keratotic lesion with reticular pattern (lichenoid reaction). SLE was considered as a possible clinical diagnosis by an oral medicine specialist due to chronic oral ulcers, butterfly rash and history of articular involvement. So, because all of these signs represent a systemic disease, there was no need for biopsy of oral lesions (especially when there was no evidence of lichenoid pathology). The patient was referred to Rheumatology clinic for further diagnostic tests and appropriate therapy.

She was admitted to Imam Reza hospital with provisional diagnosis of SLE. Laboratory tests such as CBC, Rheumatoid factor, ANA (Antinuclear antibody), Anti ds (double strand) DNA, CRP (C-reactive protein) and ESR (Erythrocyte sedimentation Rate) and kidney function tests were ordered for the patient. The results included: positive ANA, Elevated ESR, Anti ds DNA $>300$, Hgb=9 gr/dl and lymphopenia. CRP, RF and renal function tests were normal.

Our patient’s condition satisfied Six criteria for a diagnosis of SLE: 1) Malar rash 2) Oral ulcers 3) Photosensitivity 4) Lymphopenia 5) Positive anti ds DNA 6) Positive ANA, so the diagnosis of SLE was confirmed.

The treatment was initiated by Prednisolone, Hydroxychloroquine, Calcium D, Cephterixaxon (due to uretral infection). After 2 weeks of flare up control, she was discharged with instructions to continue her prior medications. No topical treatment was needed for oral ulcers, due to rheumatologic clue.

After 48 days, the patient was examined in Oral Medicine Department. Malar rash was relatively faded out and there was no exfoliation. (Fig 3) The lip ulcers were

**Fig 2:** A large deep ulcer of $1 \times 3$ cm diameter was present on marginal gingiva of first right permanent molar extending to hard palate.

**Fig 3:** Significant improvement in Butterfly rash and lip crust.
completely healed and a mild facial edema was evident (possibly due to corticosteroid therapy).

Nine months later (Aug 2009) the patients was admitted once more for ten days, with a complaint of extreme fatigue, arthralgia and myalgia. Oral ulcers were not evident in this visit. There was no lupus nephritis, avascular necrosis and cardiopathy. Appropriate treatment was administered for her by rheumatologist.

In October 2009 she was called and no complication was emerged.

**DISCUSSION**

Although this case represents an unusual diagnostic dilemma, but it seems that in Juvenile SLE (JSLE), this kind of error is not so rare (6). In JSLE the presenting signs are protean and many of them are common complaints among adolescents (e.g. fatigue, arthralgia), so inexperienced physician may fail to considered SLE in differential diagnosis of transient arthralgia and a facial rash in an adolescent female.

Children and adolescents have a more severe disease presentation (6) and develop severe organ damages more quickly. So early diagnosis and intervention is a crucial point to improve overall outcome of treatment. Our case had at least nine months diagnostic delay despite articular and cutaneous symptoms.

Tucker reported a summary of common presenting signs of JSLE with mucocutaneous ulceration as a relatively rare presenting signs in this age group (6). He speculated that every adolescent who appear to have unexplained “un wellness” with vague symptoms of SLE should be further evaluated for diagnosis of this entity. It is more fundamental in a prone ethnic group (e.g. Asian adolescents)

Prevalence of oral manifestations of SLE has been reported as %7 to 87.5% (7,12) in different studies. The difference can be due to lack of diagnosis of SLE at the time of oral presentation or resolution of these findings after appropriate treatment (9). In one research on Venezuelan patients oral lesions were found in first two years after diagnosis (9). Oral ulcer was the main oral manifestation in our case. Rhodous has reported other oral findings such as xerostomia (%100 of cases), mucositis and glossitis (81/3%), glossodynia (87.5%) and angular cheilitis (87.5%), in evaluated patients (7). The severity of these symptoms is compatible with disease flare up (7,13) although no significant changes in titers of c3, ANA or Anti ds DNA has been attributed by some authors (13). Lymphadenopathy and focal parotid necrosis (14) are another occasional findings in head and neck area.

Fernandes et al (10) attempted to address oral health an TMJ dysfunction in JSLE patients. They understood that JSLE patients had poor oral hygiene, higher incidence of gingivitis and TMJ dysfunction especially in those on long corticosteroid and immunosuppression treatments.

In our patient, because histopathologic examination of oral ulcers had no benefit and systemic involvement would lead to diagnosis, biopsy was not performed. There are other differentiated diagnoses for extra oral manifestations of this patient. Similar malar lesions can be seen in acne rosacea, seboreic dermatitis and acne vulgaris and some kinds of viral infections (15,6). Although other systemic signs are not compatible with these diagnoses. Other systemic diseases such as Behçet’s syndrome and dermatomyositis were also mentioned for this case.

Absence of recurring oral and genital ulcers and presence of malar rash excluded Behçet’s syndrome. Absence of muscular and pathognomonic skin involvement ruled out the diagnosis of dermatomyositis.

DLE was also included in differential diagnosis. But in DLE, the lesions are limited to skin and mucosa (with no systemic involvement) and oral involvement appears as lichenoid reactions in combination with skin discoid rash (a finding not observed in our case) (16).

Immunologic findings also are of diagnostic criteria for SLE. Elevated Anti Nuclear Antibody (ANA) titer (1/40 or high) is the most
sensitive diagnostic criterion for SLE in serologic tests, and was positive in this case. Elevated ANA titers can be found in %99 of SLE patients; however, in early stage of disease, it can be negative. ANA is not an specific test for SLE since one study revealed elevated ANA titers in %32 of normal adults (5,16).

ANA is positive in other diseases such as Sjögren’s syndrome (%68), sclerodermy (40-75) and rheumatoid arthritis (25-50%) but lower titers and different immuno fluorescent pattern are observed in these cases.

Anti ds DNA survey has high specificity and low sensitivity for SLE and in JSLE is a prominent laboratory profile. In this patient it was increased. Although complement levels (C3, C4, C5) are normal in variable kinds of vasculitis, they are decreased in SLE, as a result of consumption. In inflammatory process in second administration (flare up) of this patient, C3 and C4 levels were low. SLE owns episodes of flare up and remission (2,7) and decreased levels of complement is the sign of disease flare up. (17)

The aim of treatment for SLE in acute phase is management of acute attacks. And because of multiple organ involvement, treatment plan is based on clinical presentation. (1)

Management regimen in these patients include NSAIDS, corticosteroids, Anti malaria drugs and Immunosuppressants.(1) Prognosis depends on severity and extent of organ involvement and complications of treatment. poor prognostic factors are young age at onset, male gender, poor socioeconomic status and positive titers of antiphospholipid antibodies. (1) Since oral lesions respond well to systemic therapy, no additional treatment is necessary.

**CONCLUSION**

SLE is a systemic disease with multiple organ involvement and variable diagnostic features. So one may be referred to a dentist with chronic oral ulcers, with an undiagnosed SLE. Importance of achieving a complete “review of systems” and accompanying signs must be kept in mind by general dentists to reveal an undetermined systemic condition.

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Oral Health Care of Elderly in India: Present Scenario and Future Concerns

Pankaj Datta*
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ABSTRACT

India has a rapidly growing elderly (60+) population of 77 million which is likely to rise up to 300 million by 2050. For the most of this rapidly growing geriatric population there are no specialized oral health services. The elderly suffer from multiple oral health problems. The Indian population in the 21st century requires an in-depth understanding of the co-relation between oral health and general well being. Viewing these issues through the lens of oral health care provider allows an analysis of current oral health care status of the elderly in India; understand the cause of their poor oral health, their attitudes and treatment needs. The unique combination of growing age, physical disability, personal habits, socio-economic status and our oral healthcare system presents challenges for appropriate oral health care.

The present article highlights on the need to understand the shortfalls in its current oral health status in elderly and formulate strategies to improve its oral healthcare structure as well as education policy in geriatric dentistry to help resolve problems of oral health care for the elderly in India.

Key words: elderly, oral healthcare, dental treatment needs, geriatric dentistry

INTRODUCTION

Demographic ageing is a global phenomenon. India’s booming population of above one billion people and improved life expectancy (63 for males and 65 for females) has led to rapidly increasing number of elderly people (>60 years age group). This includes both healthy adults and adults who are cognitively and physically challenged and/or medically compromised.

The 20.2 million population of elderly was 5.60% (4) 5.6%) in 1951 which climbed to 7.63% in 2001 and is likely to climb to 14% in 2025. In absolute numbers there are 77 million and 177 million elderly in the year 2001 and 2025 respectively, which will rise to 300 million in 2050. Special features of the elderly in India are: 52% of elderly in the country are women. 71% of the elderly reside in rural areas. Nearly 75% of the elderly are economically dependent. 30% of the elderly are below the poverty line. 73% of the elderly are illiterate. It is estimated that 90% of the old people belong to unorganized sector (i.e. without gratuity, pension etc.) 4. With such large population estimates of the elderly, out of which most of them are underserved, considerable efforts are required to support the geriatric oral health.

EXTENT OF POOR ORAL HEALTH

As per the National Oral Health Survey (2004), poor oral health among elderly has resulted in a high level of tooth loss (29.3%), dental caries status (84.7%), periodontal...
disease (79.4%), mucosal lesions (10%) and oral cancer (0.5%) 5.

A LINK TO SYSTEMIC HEALTH

The ill effects of poor oral conditions are particularly significant among older people in the form of caries, periodontitis and edentulousness. Direct ill effects cause a state of partial or complete edentulousness. Extensive tooth loss/ill-fitting prostheses reduces chewing performance and affects food choice; edentulous people tend to avoid dietary fiber and prefer refined foods leading to poor nutrition, weight loss and problems in communication besides low esteem.

Poor oral health is a common risk factor for many systemic diseases; severe periodontal disease is associated with diabetes mellitus, ischemic heart disease, chronic respiratory disease and osteoporosis. The challenge of maintaining oral health for the nursing elderly holds additional danger of aspiration pneumonia 6, 14, 15.

As more epidemiological evidence links dental infections and systemic complications, it should be clear that dental and health benefits should not be compartmentalized rather it should be replaced with a new paradigm—that of including dental care in comprehensive medical care improve our geriatric patients’ quality of life and outlook. 16

CHALLENGES OF ORAL HEALTH CARE IN ELDERLY

As they age, older people are more likely to live alone, may be socially isolated and some are unable to manage walking without assistance, have failing eyesight and other physical infirmities.

The maintenance of oral health becomes more difficult if the elderly person is also suffering from other systemic illness e.g. arthritis, diabetes, cardiovascular disease, osteoporosis, neurological diseases associated with age such as stroke, Alzheimer’s disease and Parkinson’s disease. 17. Many systemic drugs prescribed for these chronic diseases can cause adverse effects to the oral mucosa, lichenoid reactions, hypersensitivity and xerostomia 18, 19.

Elderly are especially at risk for caries and periodontal diseases if they suffer from xerostomia. It may be caused by illness, radiation therapy and chemotherapy apart from medication.

Dental professionals must understand that the elderly must be considered under the category of “special needs and care” for treatment due to their social, psychological, physical and medical conditions 20. Thus, at times it may necessitate alterations in the treatment objectives, deviating from the standard norms with the prime objective to “compress morbidity and chewing disability” and keeping oro-dental apparatus in a state of reasonable function.

CURRENT SHORTFALLS IN ORAL HEALTH CARE OF THE ELDERLY

To have and maintain oral health, there are three basics tenets that must be in place. For older adults, one or more of these tenets may be absent. As a result, the prevalence and severity of oral diseases and conditions in older adults are a significant public health concern.

1. Knowledge of the importance of oral health and its value to overall health.

There are compounding factors such as deficiencies in knowledge, attitudes, practices and socioeconomic status which predispose the elderly to oral health problems. Fear of surgical nature of work may make them apprehensive of dental care, and may deter them from seeking it. Many may not realize the benefits of good oral health as the effects at times may not be evident instantly.

The high prevalence of oral cancer in India is related to behavioral risk factors such as poor oral hygiene, improper diet, alcohol and tobacco abuse.

2. Physical ability to maintain oral health through oral hygiene practices.
Most elderly due to poor manual dexterity have difficulty in performing routine oral hygiene procedures, which increases the prevalence of dental decay, periodontal disease and edentulism in this population.  

3. Ability to access professional oral health services.  

In India, primary health centres do not have the provision for dental care. This has left oral health far behind other health services. It appears that oral health is not a priority in our health care system. Except those in organized sectors like in government jobs, railways, defense services and public sector, majority of the elderly have no oral health security. 

Most services for geriatric patients are on a "fee-for-service" basis in the private clinics which is expensive and not within the reach of most of the elderly with reduced retirement income. With the paucity of government dental colleges/ dental departments of government hospitals in the country; most of the elderly patients do not get comprehensive treatment either due to lack of facilities or long waiting period. There are no health insurance plans which cover dental treatment except in an emergency (trauma).  

Improper distribution of dental manpower in India has created a void in the desired healthcare status in the elderly. Older adults are often at risk of limited access to oral health care because of transportation, economics, medical illness, social and personal reasons.  

RESPONDING TO GERIATRIC ORAL HEALTH NEEDS  

INCREASING THE AWARENESS AND KNOWLEDGE AT COMMUNITY LEVEL  

About 70% of the rural population does not have access to dental facilities. Currently, only 2% of the specialists are being trained in public health dentistry, whereas in a country like India, there is a greater need for these specialists to emphasize on the importance of oral health among elderly. Primary prevention, imparting dental health education and promotion of oral healthcare of elderly in underserved communities needs to be implemented by outreach activities of public health professionals.  

There is need of setting up of mobile oral health care services involving multidisciplinary teams to provide domiciliary services to the elderly in the rural areas. Regular preventive dental care with portable dental equipment can be used to serve the functionally dependent elderly at home/nursing homes to reduce the development of harmful oral health conditions.  

Use mass media (particularly TV) to raise the public awareness and understand the importance and benefits of good oral hygiene.  

Educate the public about the harmful effects of tobacco and alcohol abuse on the oral health as it predisposes them to a high risk of periodontal disease and precancerous oral lesions. Oral cancer is more common after age sixty and early detection is among a major approach to prevention of the disease.  

TRAINING IN GERIATRIC DENTISTRY  

With an increasing awareness in the society about oral health and treatment needs, there has been a greater demand for geriatric specialists in dentistry. To serve them better, it is important to understand the physical, mental and socioeconomic background of the elderly, their illnesses, medication and age-related disabilities. Thus, special training in geriatric dentistry is required. However, there is no institute to provide it in India. Till the time we have geriatric dentists there will remain an urgent need of specialists in endodontics, periodontics, prosthodontics and public health to club together as a part of rehabilitative team to minimize the oral disability and restore the oral health of elderly.  

In the current scenario, the dental education needs to be reframed with the rising need of preparing students to care for the increasing numbers of medically complex, dentate elderly. It is time for a new model of dental education to be implemented at undergraduate level so that it is more
integrative with a variety of elderly patients, health care providers and individuals who are involved in health care management of older population.

Apart from people involved in dentistry other health professionals must be provided oral health training and information on the specific needs of older adults.

Lastly, there is an urgent need to educate caregivers in families, assisted living, supportive housing and nursing homes on how they can effectively assist older adults for oral hygiene practices.

NEED TO IMPROVE ORAL HEALTH SERVICES

To fill up the desired level of oral health amongst elderly in India, National Oral Health Policy needs to be implemented. The negative impact of poor oral health on the quality of life of elderly is an important public health issue which must be addressed by policymakers. The need of dentists and dental auxiliaries in National Health Program was suggested for providing oral health care at primary health care (PHC) and community health care (CHC) as per the Bajaj Committee Report. This was further recommended by National Oral Health Care Program, but unfortunately still the implementation part is missing at PHC and CHC level. Till the time any positive step is taken by the government it is incumbent on us, as oral health professionals, to deal with this need and provide access to care for elderly patients.

The major cause of poor oral health due to the absence of primary health care approach in dentistry is the prime area of focus where oral health professionals (dentists and dental auxiliaries) should be increased. In 1990 there were 3,000 registered hygienists and 5,000 laboratory technicians in India. There are no registered dental nurses, chair side assistants and denturists.

To improve the shortage of dental professionals, permission to open new dental colleges was granted. Despite increased number of dental colleges (291) in the country there is acute shortage of dental manpower in the rural areas due to significant geographic imbalance in the distribution of dental colleges. This has resulted in two unfavorable outcomes.

(1) Though it improved the overall dentist to population ratio, there has been a great variation in the dentist to population ratio in rural and urban areas. The dentist: population ratio is 1:13,000 in the urban areas and 1:250,000 in rural areas.

(2) It left a big void in the geriatric oral health care services in rural areas. Since, most of the dental colleges provide free dental treatment to people in nearby periurban and rural areas.

To cover up the shortage of dentists to serve the underserved populations in rural area there is an urgent need of expanding the use of dental auxiliaries in the provision of dental services. Dental auxiliaries can provide services to rural patients without much financial impact on the health agencies. When hygienists are utilized to the full scope of preventive practice, they can free time for restorative procedures by dentists. Denturists can be utilized for directly providing removable prostheses to the elderly.

Lastly, we need support other than dentists' to help us to lobby government for geriatric dental care. It is time for us to look after the generation which brought us to this level and let them feel proud of themselves for raising us.

CONCLUSION

There is a growing demand for oral health care among elderly in India. India needs a comprehensive gerontological oral health care program with the following objectives. First, there is deficient data about the current oral health status and disease trends. Second, we need to learn more about the efficacy of the current treatment modalities. Third, the future dental needs and demands of the elderly needs to be explored. Fourth, the organization of the dental health care delivery system to catch and address the changing and probably new oral health problems of the elderly needs to be expanded. Fifth, to meet these challenges,
geriatric dentistry needs to be developed to create a trained and dedicated workforce which can effectively plan and administer geriatric oral healthcare delivery, education and research in India. Finally, the relationship between oral health and general health must be understood, if oral health care is to have a reasonable chance of success.

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A review on repair of fracture porcelain

Roseline Meshramkar

ABSTRACT

Because of their high esthetic qualities and mechanical stability in the oral environment, ceramic restorations are commonly used in daily dental practice. Due to the inherently brittle nature of porcelain restorative materials, failure of metal ceramic restorations under intraoral conditions is not uncommon. The majority (65%) of failures are observed in the anterior region (60% in labial, 27% in buccal, 50% in incisal and 80% in occlusal regions). Clinical studies show failure rates upto 90% for ceramic veneers. Because it is arduous to remove the ceramic restorations from the mouth, they are repaired intraorally, using a bonding system and composite resins. It is necessary to know the possible causes of fracture of porcelain, the various bonding systems and the composites resins used for repairing. The current review takes into account the majority of papers published in the last few decades concerning the issue of bonding composite resins to porcelains.

Key Words: Porcelain fracture, bonding agent, ceramic repair, composite.

INTRODUCTION

Since 1728, when Fauchard [1] first suggested the use of porcelain, the art and science of ceramics in restorative dentistry has evolved into a revolutionary method for aesthetically treating dental needs of a wide variety. Porcelain inlays and crowns as well as the use of porcelain facial veneers are reported several decades ago.[2-4] Although aesthetically satisfactory, the brittle nature of the early porcelain restorations limited their wider application.[5]

In the 1960's gold was used as a reinforcing under structure, [6], followed by MacLean's application of high aluminous ceramic substructure for fixed partial dentures. Because of their high aesthetic qualities and mechanical stability in the oral environment porcelain fused to metal restorations are commonly used in daily dental practice.[7] It is to be expected that with increased application of this technique the number of failures also will increase.[8] Clinically failures often begin as porcelain fractures that may be caused by inappropriate coping design, poor abutment preparation, technical errors, contamination, physical trauma or premature occlusion.[9] These fractures are mainly in the maxilla [75%] and predominantly at the labial surface.[10] It is necessary to assess the possible cause of fracture so that the most suitable treatment can be recommended. Depending on the extent of the area to be restored, cost and time available treatment may range from making a new prosthesis, faceting or overcasting to resin composite repairs.[11] Replacement of a failed restoration is not necessarily the most practical solution for obvious economic reasons and because of the complex nature of the restoration.[12] Because it is arduous to remove these restorations from the mouth ceramic restorations are repaired intra-orally.[10]

With development of the composite restorative materials and the introduction of organosilanes by Bowen [13] in 1962; solutions
to the repair problem were possible. Two types of bond, metal-resin and porcelain-resin are involved in the repair process of ceramo-metal restorations. Surface configuration, reactivity of the bonding surface and the use of adhesive resins are important for metal-resin and porcelain-resin bond.\textsuperscript{[14]} To achieve a satisfactory bond between porcelain and composite resin several mechanical and chemical retention systems were developed. Mechanical roughening of porcelain surfaces with a coarse diamond, Air-abrasion (sandblasting) and acid etching with hydrofluoric acid\textsuperscript{[15]}, acidulated phosphate fluoride\textsuperscript{[16]}, Ammonium biflouride\textsuperscript{[17]} or phosphoric acid\textsuperscript{[18]} are some of the commonly used methods to achieve retentive porcelain surface texture. The organosilane repair materials enhance the adhesions of the repair resin to the porcelain surface.\textsuperscript{[19,20]} Within the last few years, several types of porcelain repair systems have been developed for use by the dental profession. The purpose of this article is to review the treatment pertaining to the various porcelain repair systems.

THE EVOLUTION OF PORCELAIN REPAIR SYSTEMS

Historically, intraoral repair of fractured porcelain restorations has required roughening of the porcelain surface with a rotary abrasive, application of silane followed by composite to replace the contour of the restoration.\textsuperscript{[21,22]} Early in the 1960s manufacturers’ reinforced plastics with particles of glass treated with silane bonding agents, Bowen (1962)\textsuperscript{[13]} used these materials in the development of composite resins that were reported to the dental profession in 1963.\textsuperscript{[23]}

Paffenbarger et al 1967\textsuperscript{[24]} bonded porcelain teeth to acrylic resin using silane solution as the coupling agent. In 1968, Semmelman and Kulp\textsuperscript{[25]} reported results of bonding porcelain denture teeth to acrylic resin with a silane coupling agent. The study indicated that failure occurred not at the tooth resin interface, but within the body of the porcelain indicating a true bonding. In 1969 Myerson\textsuperscript{[26]} concluded from his experiments that cold-cured resins produced a stronger bond than mechanically retained porcelain teeth, but that thermal cycling was detrimental to the bond. A study of porcelain teeth in cold-cured dentures by Duhaney HN\textsuperscript{[27]} in 1970 indicated that retention by bonding with silane solution was as satisfactory as mechanical retention.

Jochen and Caputo\textsuperscript{[28]} reported that the abrasion of the surface of porcelain with a diamond rotary instrument increased the retention of the repair material. In 1978, Eames et al\textsuperscript{[29]} evaluated the composite resins utilizing silane coupling agents for repair of porcelain. Porcelain denture teeth were used in this study and acceptable bond strength for temporary repairs was reported. In 1978, Newburg and Pameijer\textsuperscript{[8]} also studied the bond strength of composite resin to porcelain denture teeth utilizing a silane coupling agent, and reported that the samples produced a reliable bond. Highton et al\textsuperscript{[30]} 1979 also studied the effects of silane coupling agents on the composite resin/porcelain bond. The study indicated that the repair system using a bonding agent with acrylic resin was significantly stronger than the repair system using a composite resin.

Nowlin et al\textsuperscript{[31]} reported that fusion plus concise (3M Co. Dent products Div., st. Paul Minn) was superior to Dent-mat and 18% of the original porcelain strength was regained.

In 1983, Ferrando et al\textsuperscript{[32]} concluded that Enamalite (Lee pharmaceuticals, South El Monte, Calif.) was superior to Fusion plus Adaptic (Johnson and Johnson Dental products co., East Windsor, N.J.), Adaptic, Dent-mat porcelain repair kit and cyano-veneer (Ellman International Manufacturing Inc., Hewlet., N.Y) in tensile strength and had the least leakage at the resin-porcelain interface.

The adhesion of resin to dental porcelain was enhanced by etching the porcelain surface with hydrofluoric acid (Horn 1983\textsuperscript{[33]}; Calamia 1983\textsuperscript{[34]}) and using silane coupling agents (Calamia and Simonsen, 1984).\textsuperscript{[35]} Combination of hydrofluoric acid etching and the application of silane coupling agent was shown to be an effective method for improving
the adhesion of resin. (Stangel et al 1987; Shetch et al 1988[5]; Aida et al 1990)

As an alternative to hydrofluoric acid, acidulated phosphate fluoride (Lacy et al[25] 1988) or phosphoric acid (Newburg and Pameijer[6] 1987; Okamoto et al[34] 1989; Matsumara et al[37] 1989) were investigated. However, neither etching with hydrofluoric acid nor adding silane resulted in an adequate resin bond to some new high-strength ceramics.[38] High-alumina[49] or Zirconia-reinforced ceramics[40] cannot be roughened by hydrofluoric acid etching since such ceramics do not contain a silicon dioxide (silica) phase.

For this reason, special conditioning systems are indicated for these newer types of ceramics. Modern surface conditioning methods utilize air-particle abrasion for achieving sufficient bond strength between the resins and high strength ceramics that are reinforced either with alumina or Zirconia.[40] In this technique the surfaces are air abraded with aluminium oxide particles modified with silicic acid with different particle sizes ranging from 30 to 250µm.[40] The blasting pressure results in the embedding of silica particles on the ceramic surface, rendering the silica-modified surface chemically more reactive to the resin through silane coupling agents.[41]

THE BOND BETWEEN PORCELAIN AND THE RESIN COMPOSITE

Bonding of resin to a ceramic surface is based on the combined effect of micromechanical interlocking and chemical bonding. The bond strength of composite to porcelain is affected by the surface preparation and the type of bonding agent.[42]

Mechanical roughening of porcelain surfaces with coarse diamond has demonstrated improved repair strength.[26,32] Sandblasting with aluminium oxide \( \text{Al}_2\text{O}_3 \) is another method of surface roughening[15] and porcelain can also be etched with hydrofluoric acid, ammonium biflouride, phosphoric acid or acidulated phosphate fluoride gel to facilitate micromechanical retention of resin composite.[42] The mechanical bonding always poses an inherent disadvantage of microleakage.[43]

Chemical bonding to ceramic surface is achieved by silanization with a bifunctional coupling agent.[44] Silane coupling agents can improve the bonding of composite resin to porcelain by approximately 25%.[5] Silane coupling agents possess the general chemical structure \( \text{X-}-(\text{CH}_2)_3-\text{Si-(OR)}_3 \) and have ability to bond chemically to both organic and inorganic surfaces.[45] The coupling agent at one end chemically bonds to the hydrolyzed silicon dioxide of the ceramic surface and a methacrylate group at the other end polymerizes with the adhesive resin.[44] The type of resin composite also effects of bond strength to porcelain. It is assumed that larger particle size resin composites or hybrid[16]

THE MATERIALS AND THE TESTING METHODS USED FOR THE BOND TEST

Material selection and clinical recommendation of resin bonding to ceramics are based on mechanical laboratory tests that show great variability in materials and methods.[7,46] Many methods of measuring the in-vitro bond strength affected by porcelain repair systems have been described. These include torsion, flexural,[19] tensile and shear bond strength tests.[47] The most commonly employed is the shear bond strength test. The crosshead speed used for testing the samples range from 0.5 mm/min to 5 mm/min. But as yet there is no universally accepted bond strength tests for resin composite bonded to ceramic.

The ceramic-composite bond is susceptible to chemical,[48] thermal,[49] and mechanical[50] influences under intraoral conditions. A notable feature of some studies[51] is the observation that, the failure mode is often cohesive within the ceramic bases rather than at the adhesive interface. On the basis of which it has been suggested that the bond strength exceeds the cohesive strength of the ceramic. But this ignores the nature of the stresses generated and their distribution within the
adhesive zone which can have a profound influence on the mode of failure. Finite element stress analysis (FEA) has been used to study the sensitivity of bond strengths to specimen design and changes in testing conditions. These studies show that there is need for a more critical approach on the design of appropriate tests for evaluating the bond strength of resin composite to ceramic if the design for a standardized test procedure is to be achieved.

**RECENT DEVELOPMENTS**

Bonding to traditional silica based ceramics is a predictable procedure yielding durable results when certain guidelines are followed. The physical properties and composition of high strength ceramic materials like aluminium oxide-based and Zirconium oxide-based ceramics differ substantially from silica based ceramics and require alternative bonding techniques to achieve a strong, long term and durable resin bond.

Modern surface conditioning methods require airborne particle abrasion of the surface before bonding in order to achieve high bond strengths. One such system is silica coating. In this technique the surfaces are air abraded with aluminium oxide particles modified with silisic acid. The blasting pressure results in the embedding of silica particles on the ceramic surface, tending the silica modified surface chemically more reactive to the resin through silane coupling agents. Silane molecules after being hydrolyzed to silanol can form polysiloxane network or hydroxyl groups cover the silica surface. Monomeric ends of the silane molecules react with the methacrylate groups of the adhesive resins by free radical polymerization process, when a ceramic exhibits chemical states of silicone and oxygen. The siloxane bond will be achieved as these represent the bonding sites for the coupling agent to the ceramic surface.

The phosphate modified resin cement after airborne particle abrasion provide a long-term durable resin bond to zirconium oxide ceramic. The equipments for airborne particle abrasion are recently simplified and brought to the chairside.

**DISCUSSION**

Intraoral repair of fractured porcelain restorations with resin composite presents a substantial challenge for clinicians. Newer generation multipurpose adhesive systems involve several treatment steps and agents for porcelain repair with resin composite. Several studies focus on mechanical retention, chemical agents and the combination of these two methods. Because of the insufficient bonding characteristics of the chemical agents, physical alteration of the porcelain surface must be used together with these agents to promote adhesion. Wolf et al concluded that sandblasting with Al2O3 or roughening by burs achieve satisfactory bond strength but when more durable and higher bond strength is desired, hydrofluoric acid etching is the most significant step in the surface treatment because of deep acid penetration.

The silane coupling agents achieve a chemical link between the resin composite and porcelain; moreover they promote wetting of the porcelain surface so that it enhances the flow of the low-viscosity resin composites. They improve the bond of resin composite to porcelain by approximately 25%. Aluminium oxide and Zirconium oxide-based ceramics require the use of special resin cement along with airborne particle abrasion. Compared with silica-based ceramics, the number of in vitro studies on the resin bond to high-strength ceramics is small. Further controlled clinical trials are required to test specific treatment modalities and their long-term durability.

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A review on repair of fracture porcelain


The effect of developer age and file thickness on diagnostic accuracy of Kodak insight (F-speed) and Ektaspeed plus (E-speed) films in position assessment of file tip to radiographic apex

A. Dabaghi*
M. Lomee**
S. Saati***

ABSTRACT

Objectives: To determine the effect of developer age and file thickness on diagnostic accuracy of E and F-speed films in position assessment of file tip to radiographic apex.

Study design: Endodontic files size 10 and 15 were placed in mandibular first molar and second premolar up to the root apex or 1.5 mm shorter. Ten series of radiographs were made with two types of film: Kodak insight (F-speed film) and Ektaspeed plus (E-speed film) in different positions of file in apex or 1.5 mm short. The films of each series were processed manually on each day, using Champion chemicals. The films were assessed by four endodontists. They rated the position of file tip to radiographic apex using a 3-point confidence scale in the questionnaires (tip to tip, 1.5 mm under, can not diagnose). The diagnostic performance of observers was compared with true diagnosis.

Results: Mean Az value of E and F-speed films, that shows the diagnostic accuracy is 0.986 and 0.983 for E and F-speed films respectively, that was not significantly different (P = 0.777). Also diagnostic accuracy of films processed during 10 days was not statistically different (P = 0.726). Assessment of files tip size 10 and 15 in lower molar and premolar canals was not significantly different (P = 0.712).

Conclusion: The performance of the F-speed film was not statistically different from E-speed for assessment of file tip to radiographic apex. Because of less required exposure, we suggest to use Kodak insight (F-speed film) in clinical examination.

Key words: Diagnostic accuracy, Intra oral radiographic film, Working length

INTRODUCTION

Radiography is an essential tool in routine dental practice for caries diagnosis and root canal treatment [1]. Assessment of the working length is an initial important stage in root canal therapy. Parallel periapical radiography is the best technique for assessment and measuring the working length [2]. Ektaspeed plus films usually are used to determine the working length because of their excess availability [3,4].

A major objective of diagnostic radiology is to provide images of optimal quality at a radiation dose as low as reasonably achievable [1]. One of the most effective ways to reduce patient radiation exposure is using more sensitive films (Kodak insight F-speed film). These films have larger silver halid grains and thicker emulsion, thus need lower x-ray radiation (20% less x-ray exposure compared with E-speed films) to produce equal diagnostic accuracy [5,6]. According to former studies, the conditions of processing influence
the sensiometric characteristics of F-speed films [7,8].

Today in dental office, developers are used in little volume (about 250 cc) and about one week. If the diagnostic accuracy of E and F-speed films in low volume developer was similar, it would reduce patients and personnel dose and increase x-ray tube life. In addition, the effect of developer age and file thickness on diagnostic accuracy of E and F-speed films to determine the position of file tip to radiographic apex, have been studied.

MATERIALS AND METHODS

In order to simulate clinical examination, a dried human mandibular segment containing premolar and molar teeth was used. The root canal of the left second premolar and the mesiobuccal and distobuccal canals of the first molar were accessed. The radiographic length of the root canals was determined under the supervision of endodontist with a #20 K-file (Dentsply-Maillefer, Ballaigues, Switzerland) and Kodak Ektaspeed dental film (Eastman Kodak Co. NY, USA). Endodontic #10 and 15 K-files (Dentsply-Maillefer, Ballaigues, Switzerland) were placed at the apex or 1.5 mm shorter. A light-cured composite resin stop was placed, so that, the files could be reused in the same position. A series of radiographs with different combinations of correct and short file length was made with Planmeca Prostyle x-ray unit (Planmeca Oy, Helsinki, Finland) operating at 63 kVp, 8 mA and 36 cm SID. The parallel technique with a endodontic film holder (Endoray, Rinn Densply) was used to minimize the magnification and distortion.

The exposure time was 0.20s for E-speed dental film and 0.16s for F-speed dental film according to the manufacturer’s recommendation (about 20% less exposure for F-speed film compared with E-speed film). 1.7cm selfcure acrylic resin was used as scattering agent to stimulate soft tissue.

Four identical series of radiographs were obtained with each type of films and file sizes. because of different file length (tip to tip or 1.5mm shorter) in three canals, each series consisted of eight different modes and therefore 32 radiographs were obtained. To assessment the effect of developer age on diagnostic accuracy of radiographs, this procedures was done 10 days and finally 320 radiographs were made.

The films were processed manually with Champion chemicals (X-ray Iran Co, Tehran, Iran) in the same condition (1min developing, 15s washing, 2min fixing and 5min final washing) at 25°C ± 1. For similarity to dental office, little volume developer (250cc) was used. Every day, 32 radiographs randomly were divided into eight groups of four. Each group was processed in individual set (eight similar set for developer, fixer and water). To similarity the number of processed radiographs with dental office and helping developer aging, eight radiographs of a step-wedge were processed until day 9th. Four endodontists were asked to rate the position of file tip in relation to the apex of the tooth on a three-piont scales: U:1.5mm under, T: tip to tip and CD: can not diagnose.

Data analysis was performed with ROC, T-test and ANOVA tests.

RESULTS

Mean value (showing diagnostic accuracy) of Kodak insight (F-speed) and Ektaspeed plus (E-speed) films were determined with ROC analysis and were compared with each other (Table 1- Figure1). value of E-speed film was 0.986 and for F-speed film was 0.983. According to the analysis, there was no significant difference between two types of films in determining the position of file tip in relation to the apex (P = 0.777).

Diagnostic accuracy of determining the position of size #10 and 15 K-files, was not statistically different in mandibular second premolar and first molar canals (P=0.712). Also, the comparison of mean Az value from day 1st to day 10th showed that, diagnostic accuracy of processed films in 10 days of
The effect of developer age and file thickness on diagnostic accuracy of Kodak insight (F-speed) and Ektaspeed plus (E-speed) films in position assessment of file tip to radiographic apex

**DISCUSSION**

**Figure 1:** $A_z$ mean values of four observers with E and F-speed films

![Bar chart showing $A_z$ values for E and F films](chart.png)

**Table 1:** $A_z$ values of four observers with E and F-speed films, and comparison them with T-test analysis

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<th>$A_z$ of E film</th>
<th>$A_z$ of F film</th>
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<tr>
<td>No.1 observer</td>
<td>0.994</td>
<td>0.992</td>
</tr>
<tr>
<td>No.2 observer</td>
<td>0.969</td>
<td>0.956</td>
</tr>
<tr>
<td>No.3 observer</td>
<td>0.994</td>
<td>0.992</td>
</tr>
<tr>
<td>No.4 observer</td>
<td>0.990</td>
<td>0.994</td>
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<tr>
<td>Mean value</td>
<td>0.986</td>
<td>0.983</td>
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developer aging, was not significantly different ($P = 0.726$) (Table 2).
The main variable in this study was the film. Syriopulos et al, reported mean value of E and F-speed films, 0.966 and 0.962 respectively and found that this two types of films had no significant difference in determining the position of file tip to radiographic apex [4].

According to the analysis, E and F-speed films are not different in determining the position of file tip in relation to the apex and in clinical examination, Kodak insight (F-speed) films can be used because of its lower x-ray exposure needed.

Another effective parameter in this study was developer aging. Mean of observers was not significant difference in 10 days and were in agreement with Casanova et al findings [3]. They showed that useful developer aging in first 19 days was similar.

Determining the exact useful solution life without volume consideration will not be practical. We concluded that, Kodak insight (F-speed) films do not have any undesired effect on image quality but also reduce the patient and personnel exposure dose. This study continued after day 10th with only E-speed film and size15 file. The results indicated that, image quality was acceptable until day 20th.

In conclusion, we founded that proper exposure and careful processing with little volume developer can be used in dental office at least for ten days. Also, under standard conditions of the exposure and processing, files size #10 and 15 can be used in determining working length in normal root canal anatomy and proper position (e.g. posterior of mandible). It is obvious that, if the position of teeth is improper (e.g. posterior of maxilla) and the root canals are unusual, files size #10 and 15 will help less often, and larger files (at least size20) must be used to determine apex position.

CONCLUSION

Under the condition of this study, we suggest to use Kodak Insight (F-speed) films in clinical examination, because of less required exposure.

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This book has been addressed to young doctors who take care of children, such as postgraduate students, junior doctors working in various capacities in Pediatrics and private practitioners. Standard Pediatric practices as well as diseases have been described in a nutshell. List of causes, differential diagnosis and tips for examination have been given to help examination-going students revise it quickly. Parent guidance techniques, vaccination and food have been included for private practitioners and family physicians that see a large child population in our country. Parents can have some understanding of how the doctors will try to manage a particular condition in a child systematically. A list of commonly used pediatric drugs and dosage is also given. Some views on controversies in Pediatrics have also been included. Few important techniques have been described which include procedures like endotracheal intubations, collecting blood samples and ventilation. I hope this book helps young doctors serve children better.

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Guidelines for presentation of Tables and Figures

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Tables should be typed in double spaced on separate sheets with table number (in Roman Arabic numerals) and title above the table and explanatory notes below the table.

Figures

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