The limitations in clinical teaching, learning and practice of conservative amalgam cavity preparations in developing countries

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abstract

Amalgam is the cheapest and the most widely used intra-coronal posterior restorative material in the world.Therefore, the teaching, learning and practice of conservative amalgam cavity preparations cannot be ignored by any dental school. Since the introduction of the principles and methods of cavity preparation by G.V Black in 1908, there have been a series of modifications in terms of designs and the underlining principles.
The "extension for prevention" dogma by G.V Black had been jettisoned while the modern concept of conservatism or minimal cavity preparation has been well embraced by dental practitioners. However, there are some limitations in clinical teaching of conservative amalgam cavity preparation which include late patient presentation with large carious lesions, lack of appropriate conservative instruments and restorative materials.
This article discusses limitations in teaching, learning and practice of conservative amalgam cavity preparation in the developing countries.

Key Words: Teaching, learning, practice, amalgam, minimal preparation.

Introduction

Amalgam is the cheapest and the most widely used intra-coronal posterior restorative material in the world [1]. Therefore, the teaching, learning and practice of conservative amalgam cavity preparation cannot be ignored by any dental school. The evolution of cavity preparation dated back to 1908 when G.V Black established the principles and methods of cavity preparation. The main thrust of Black's cavity design was "extension for prevention" dogma. In Black's cavity design, both carious and non-carious fissures and pits were removed with a resultant production of an occlusal cavity preparation with a wide facio-lingual dimension and parallel opposing walls (class I amalgam cavity preparation); and an occluso-approximal cavity preparation with a wide proximal box showing parallel opposing walls in addition to the placement of the gingival wall of the box below the gingiva; a wide I sthmus and a wide facio-lingual dimension of the occlusal section[2].
Since the introduction of the principles and methods of cavity preparation by Black, there have been series of modifications in terms of designs and the underlying principles based on advances in science [3,4]. The issue of conservative cavity preparation first came into focus in 1928 when Prime made a plea that cutting of teeth for restoration; and any extension into a fissure must be only wide enough to eradicate the fissure [5,6,7]. In 1951 Markley[8], one of the leaders of minimally invasive dentistry proposed that the goal of dentistry is to preserve healthy natural tooth structure and he further stressed this by saying that the "loss of even a part of a human tooth should be considered a serious injury". His words are more relevant today than when he wrote them half a century ago because we now have the scientific understanding and the means to realize his vision[3].This concept and principles of conservative cavity preparation r eceived a positive boost from other researchers such as Almquist and Cowan (1993)[9], Elderton (1984,1986) [10,11], Osbonne and Gale (1981, 1990)[12,13]. These workers have shown the need for conservatism in cavity preparation by establishing the facts that there is no need for cutting non-carious fissures and pits and that the narrower the cavity preparation the greater the longevity of the tooth-restoration unit.
Therefore, the dogma of "extension for prevention" and sharp internal line angles were jettisoned and t hese changes in design are geared towards conservation of sound tooth structure and protection of the tooth restoration unit from excessive occlusal stresses.
Consequently, c onservative (modern) cavity preparation is characterized by narrow facio-lingual dimension and occlusally convergent opposing walls in the case of class I preparation while occluso-approximal cavity preparation is characterized by a narrow facio-lingual dimension of the occlusal section with oclusally convergent opposing walls; a narrow isthmus; and a narrow proximal box with oclusally convergent embrasure walls as well as the placement of the gingival wall of the box at the level of the crest of interdental papilla. Where there is no extention of caries into the oclussal surface from the approximal side there is no need to extend the cavity preparation into the occlusal surface. In this case, a slot preparation (box preparation) with retention grooves on the lingual and buccal embrasure walls should be done if possible[7].
However, conservative amalgam cavity preparations demand the use of small diameter-based conservative instruments and improved amalgam alloy. Advances In instrumentation and amalgam technologies have taken care of these aspects of perceived limitations . or example, Markley[8] designed pear-shaped burs (No. 330 and No.

329) to create narrow cavity preparations with round internal line angles. The widest diameter of a number 329 bur is 0.6mm and the diameter of the bur at its neck approximates 0.5mm.

In the past few decades, there have been a steady decline in the rate and size of carious lesions in the developed countries owing to the institution of preventive measures such as topical fluoride application, fluoridation of drinking water, salt and milk; and improved dental awareness and oral prophylactic measures on the part of the patients and the general populace[14,15,16,17,18]. Therefore, the growing interest in the concept and principles of conservative cavity preparation in the developed countries in recent years is directly related to these changes in the patterns and rate of caries occurrence coupled with advances in instrumentation and material technologies.

However, the reverse is the case with the developing countries which have been showing upsurges in size and number of carious lesions in the past few decades [19]. The question is what would be the position of dental teachers and practitioners on the concepts and principles of conservative cavity preparation in the face of large-sized carious lesions being observed in patients in the developing countries? Many papers have been published on the concepts and principles of conservative cavity preparations with a great emphasis on the advantages of conservative cavity preparations. However, most of these papers paid little or no emphasis on the limitations in teaching, learning and practice of conservative (modern) amalgam cavity preparations in the developing countries. Therefore, the purpose of this article is to highlight the limitations in teaching, learning and practice of modern amalgam cavity preparations in the developing countries such as Nigeria.

Laboratory teaching/learning and practice of modern amalgam cavity preparation

The method of teaching /learning and practice of conservative cavity preparation in most dental schools' laboratories in developing or third world countries involves the use of plastic teeth and low speed hand-pieces for cutting during demonstration and practice [20,21,22].

The use of low-speed hand-pieces and plastic teeth provides a good opportunity to adhere strictly to the principles of conservatism because the plastic teeth are intact, less resistant to cutting and the speeds of the low-speed hand-pieces can easily be controlled by the beginners. But it should be noted that this method is not without its own demerits which include lack of feeling of the resistance of natural tooth substance during cutting and delayed experience in the handling of turbine hand-pieces which are the most frequently used rotary instruments in clinical operative dentistry [20].

Clinical teaching/learning and practice of modern amalgam cavity preparations

The beginners are usually introduced into clinical practice through a gradual process consisting of four phases namely:

a) clerking of patients and diagnosis of carious lesions;
b) clinical demonstrations of the various forms of cavity preparation by consultants;
c) observational period through attachment to consultants, senior registrars and registrars as well as
d) treatment of selected cases, starting with simple cases and progressing into more complex ones.

The first three phases will enable the beginners to internalize the various procedures which are involved in the restoration of carious lesions using direct filling materials.

At the initial stage of carrying out restorative procedures, low speed hand-pieces are used by the beginners and this is later followed with a gradual introduction of the turbine hand-pieces. The advantage of this approach is to allow the beginner to get used to treating live patients using a low-speed hand-piece which cuts at a moderate speed and therefore, with less tendency for excessive tooth destruction. However, this process consumes more time as compared with the laboratory experience in which plastic teeth, with less resistance compared with natural teeth, were used for practice.

The major limitations in adhering strictly to the principles of conservative cavity preparation, in a clinical setting in developing countries are:

i. Abundance of large carious lesions:- most patients present with large carious lesions which cannot be treated based on the principles of conservatism, due to late presentation. The causes of which can be attributed to:

(a) lack of dental awareness and education; hence they are not well informed;
(b) poverty:- most patients first visit the traditional healers and if there are no solutions, they finally report to the dentist for help;
(c) even when they report early to the dentist there is dearth of advanced diagnostic tools such as digital imaging optic trans-illumination, electric conductivity methods and laser and light fluorescence techniques to detect incipient caries because it is an established fact that the accuracy of dental radiographs and visual inspection of caries detection is insufficient. Therefore, caries in developing countries are diagnosed at a more advanced stage[4,5,6].

ii. Inappropriate and inadequate instruments thereby limiting the choices of instruments for use in relation to caries presentation. For example, a patient may present with a small carious lesion that demands the application of conservative principles but because the available burs, condensers, carvers and amalgam carrier have large-ended diameters; the cavity preparation cannot be made as conservative as it should be taking into consideration the principle of convenience form; and

iii. Lack of appropriate filling materials:- for example, a patient may present with a small carious lesion that requires conservative resin restoration, but owing to non-availability of composite resin or glass ionomer cements, this may result in the use of amalgam alloy if it is the only available direct filling material. The use of silver -tin amalgam under this condition will surely result into a higher tooth substance removal for retention, resistance and convenience forms.

Discussion and Recommendation

The importance of conservative cavity preparation in the present day operative dental practice cannot be over emphasized. Therefore, teaching, learning and practice both in the laboratory and clinic must be thoroughly assessed in the face of other limiting factors so that the clinician could be made efficient and effective in the performance of his clinical duties.

Clinically, the pattern of caries presentation is a major factor which determines the size of cavity preparation. However, other factors such as materials and the sizes of conservative instruments play an important role in the final assessment of how large or small a cavity preparation should be made. Therefore, the degree of compliance with the principles of conservative cavity preparation is directly related to the established size of the carious lesion, the size of the conservative instruments and the belief of the operator in the concept of conservatism.

In a situation where carious lesions are of small sizes, the principles of conservatism can be applied easily if there are appropriate small-sized conservative instruments; and the operator believes in the concept of conservatism. This situation may apply to the developed countries where carious lesions are becoming smaller in sizes and fewer in numbers owing to the institution of caries preventive measures such as topical fluoride application, fluoridation of drinking water and improved dental awareness and oral prophylactic measures on the part of the patients and the general population[5,16,17,18].

However, in a situation where majority of patients present with large-sized carious lesions, as found in most of the developing countries, the principles of conservatism cannot be strictly applied even in the presence of appropriate small-sized conservative instruments coupled with absolute belief of the operator in the concept of conservatism. The implication of strict adherence to the principles of conservative cavity preparation by beginners in developing countries, in the presence of abundance of large carious lesions, is the high tendency or probability of leaving some residual caries in preparations for fear of not causing excessive tooth tissue destruction.

The concept and principles of conservative cavity preparation must be accepted by the operators if the objectives and advantages of modern cavity preparation are to be realized. The old dentists who had imbibed the doctrine of Black's cavity preparation may not be prepared to change easily because old traditions or habits are usually difficult to give up. With respect to the beginners, the concept and principles of modern cavity preparation will be well appreciated if natural teeth or resin ceramic teeth are used for teaching/learning and practice of cavity preparation in the phantom laboratory. The use of ceramic-composite teeth has been found to be favourably comparable with the use of natural teeth in terms of quality or practice time; and that the ceramic-coated teeth present an acceptable alternative for use as a simulator in pre-clinical teaching [20].

The use of turbine hand-pieces by beginners in the laboratory will also eliminate the need to make the students to pass through the use of low-speed hand-pieces in the clinics before graduating into the use of turbine hand-pieces because their laboratory experience will have a positive effect on their manual dexterity during cavity preparation in vivo.

It is appropriate to note that some authorities may argue that it is still possible to be conservative in cavity preparation in the presence of large carious lesions. Yes, bu t to what extent and at what cost? For example, a large carious lesion in a tooth may result In a situation where sound enamel tissue may be severely undermined. In this situation, the only way to be conservative of the sound enamel tissue is by using glass ionomer cement or a composite resin to reinforce or support the severely undermined enamel. However, these resins are scarce restorative materials in the developing countries because of their expensive nature. Therefore, in the absence of the resins, the undermined but sound enamel tissue will have to be sacrificed because it will not be able to withstand occlusal forces.

Furthermore, some authorities may also argue that the problem of obtaining appropriate instruments of smaller diameters, which are very essential in the practice of conservative cavity preparations could be resolved at the departmental or institutional level. Yes, but to what extent and at what cost to the dental students and the institutions? It may be possible for some dental schools in the developing countries to provide some appropriate restorative instruments (both in phantom laboratories and the clinics) for use by the students. However, these instruments are not usually adequate for the students in most cases; and it is an open secret that dental students in some developing countries with financial constraints owing to the dwindling economic fortunes, are responsible for the purchase of their instruments as well as paying for patients' treatment costs in order to meet their clinical requirements. Therefore, under these financial constraints, the choices of appropriate conservative instruments are very limited.

The authors are of the opinion that the teaching/learning and practice of modern cavity preparation are influenced by instruments, materials, caries presentation and the belief of the operator in the concept and principles of conservatism. In the developed countries where there are appropriate conservative instruments and materials coupled with reduced sizes of carious lesions; strict adherence to the principles of modern cavity preparation can easily be achieved. But in the developing countries where there are no appropriate conservative instruments and materials coupled with abundance of large-sized carious lesions, strict adherence to the principles of conservative cavity preparation cannot easily be achieved.

Consequently, in the d eveloping countries, emphasis on teaching/learning and practice of modern cavity preparation in the presence of large carious lesions should be directed to:

i. total removal of caries, establishment of convenience and retention forms without jeopardizing the resistance form of the tooth;

ii. use of appropriate conservative instruments that are compatible with the concept and principles of conservatism;

iii. reinforcement of unsupported enamel with composite resin instead of cutting back technique; and conservation of every sound tooth tissue taking into consideration the extent of caries which determines the size of the cavity preparation.

In a s ituation where carious lesions are small in sizes, strict adherence to the principles of conservatism must be observed. Emphasis must also be placed on d ental health education, involvement and engagement of patients in preventive measures so as to reduce both the size and number of carious lesions in the population.

Conclusion

Clinical and laboratory teachings of amalgam cavity preparation still constitute a significant portion of

undergraduate operative dentistry curriculum in the dental schools in developing countries, despite the increasing usage of composite resin for restoration of carious posterior teeth.

The concept and principles of conservative amalgam cavity preparation (engendered by decrease in caries sizes particularly in advanced countries as well as technological advances in diagnostic procedures, equipment, instrumentation, and dental materials) cannot be absolutely applied in clinical teaching of amalgam cavity preparation in the developing countries owing to some limitations such as abundance of large-sized carious lesions, lack of appropriate instruments, lack of appropriate diagnostic devices and the belief of the dental operator in the concept and principles of conservatism.

Clinical and laboratory teachings of conservative amalgam cavity preparation must be carried out with a serious consideration of the aforementioned limitations vis-ŕ-vis the concept and principles of conservatism for the purpose of establishing a balance between limitation realities and the principles of conservatism in certain clinical situations.

Finally, undergraduate dental students should be made to understand that the goal of operative dentistry, with respect to amalgam cavity preparation, is removal of caries without causing unnecessary damage to sound tooth structure while keeping I n mind the basic principles of cavity design.

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