Gold in Therapeutic Dentistry : A Review

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Abstract

The current uses of gold in dental applications are reviewed and the major gold-based dental alloys are described with reference to current International Standards. Newer techniques, such as electroforming, are highlighted with suggestions for potential future areas for research and development. The future role of gold in restorative and conservative dentistry is also discussed in the light of increasing competition from alternative materials. It is clear that if longevity, functionality, aesthetics and biocompatibility, together with ease of manufacture are considered as the most important selection criteria, the optimum material for dental restorations is still an approved gold alloy.

Administration of gold salts (chrysotherapy) has found greatest application in canine medicine in the treatment of autoimmune disorders, particularly autoimmune polyarthritis (e.g. rheumatoid arthritis, idiopathic polyarthritis) and the autoimmune skin diseases (e.g. pemphigus foliaceus, bullous pemphigoid).

Key words : Gold salts , chrysotherapy , autoimmune diseases

Introduction

Gold is the oldest dental restorative material, having been used for dental repairs for more than 4000 years. These early dental applications were based on aesthetics, rather than masticatory ability. The early Phoenicians used gold wire to bind teeth, and subsequently, the Etruscans and then the Romans introduced the art of making fixed bridges from gold strip. During the Middle Ages these techniques were lost, and only rediscovered in a modified form in the middle of the nineteenth century.

The use of gold in dentistry remains significant today, with annual consumption typically estimated to be approximately70 tonnes worldwide[1]. However, with an increasingly wide range of alternative materials available for dental repairs, it is considered appropriate to review the current gold based technology available today and thereby highlight the exceptional performance that competing materials must demonstrate if they are to displace gold from current uses. New gold-based dental technologies are also highlighted.

Uses of Gold In Dentistry

In conservative and restorative dentistry, as well as in orthodontics, gold is used either as a pure metal, or alloyed together with noble metals and base metals. This use of pure gold is limited to direct filling of small occlusal cavities and no standard exists for the application and properties of direct filling gold. However, pure gold used in this application is very soft (HV 25), has a very low 0.2% proof stress (30 MPa) and a large elongation (45%). As a result it can be very easily cold worked, a necessary requirement for precisely filling a cavity.

Since gold fillings do not have high mechanical resistance against masticatory forces, they are only suitable for very small cavities. In recent years pure gold has also been used through the electroforming process. Electroformed inlays and on lays are suitable to be cemented into cavities after they have been veneered with porcelain. Tooth restorations such as porcelain veneered copings for crowns and bridgework can be electroformed with pure gold. Unfortunately, no standard yet exists for this process, which is rapidly becoming an established mainstream technique in modern dentistry.

The Future of Gold in Dentistry

The historical development work concerning the use of gold in conservative and restorative dentistry has provided the industry with a wide array of gold-based dental alloys suitable for application in an extensive range of uses. If longevity, functionality, aesthetics, and biocompatibility, together with ease of manufacture are considered as the most important requirements, the optimum material for dental restorations is still a well-approved high gold alloy. It is no co-incidence that in all testing and development of competing materials, gold is always defined as the standard material to be judged against. It is interesting to note that if practising dentists are asked what type of material for a restoration they prefer for themselves, with few exceptions the answer is always gold[2]. Nonetheless, attention is increasingly focussing on the extensive range of alternative materials. These new materials include titanium and cobalt/nickel base alloys and all-ceramic crowns. The latter have excellent aesthetic properties, but do not have the long-term clinical approval that gold has. For example, zirconia has only passed clinical tests during the last.

4 years. In addition, the CAD/CAM techniques associated with the use of these materials are, in many instances, prohibitively expensive. Furthermore, the problems of poor Aesthetics often associated with porcelain-fused-to-metal techniques might be addressed through the use of extremely high gold content alloys, which have recently been patented.

It is considered that as CAD/CAM technology progresses, special high gold alloys should be developed, which are well suited to milling and grinding operations and have sufficiently

high strength for long span bridges and small cross sections [3].

Of the other competing materials, problems encountered with casting titanium remain, preventing widespread use of this material. Long-term use of cobalt/chromium alloys are increasing, and there are fewer problems with casting compared to titanium. Besides long term clinical approval and longevity, the most important advantages of gold alloys are easy workability, biocompatibility, aesthetics and maximum range of indications. The development of electroforming technology with pure gold offers new opportunities for future research. For highly stressed parts in dental restorations, electroformed pure gold is still too soft and thus has limited uses. Efforts have been made in recent years to develop increased strength through dispersion strengthening by incorporating a suspension of ceramic particles [4].

Another area for electroforming research may focus on the deposition of multilayer by electrochemical structure modulation. Both of these research efforts should have the objective of developing thick deposits of pure gold with high strength [4].

CONCLUSION

Application of Gold salts found great application in the treatment of autoimmune disorders like rheumatoid arthritis, pemphigus vulgaris ,chronic gingivo stomatitis etc. The uses of gold salts should only be considered following unsuccessful trails of other less toxic and expensive immunosuppressive agents.

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