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Specification for

Orthodontic resins

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Committees responsible for this British Standard

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- Association of Dental Hospitals of the United Kingdom
- British Ceramic Research Association
- British Dental Association
- British Dental Trade Association
- British Institute of Surgical Technologists
- British Society for the Study of Orthodontics
- British Society for the Study of Prosthetic Dentistry
- Dental Laboratories Association Limited
- Dental Materials Panel
- Department of Conservative Dentistry
- Department of Health and Social Security
- General Dental Practitioners' Association
- Ministry of Defence
- Orthodontic Technicians' Association
- Society of University Dental Instructors

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Foreword

This British Standard was prepared under the direction of the Health Care Standards Committee.

Resins based on polymethyl methacrylate (PMMA) have been used in the construction of both active and passive removable orthodontic appliances for many years. Initially, denture base resins were used for orthodontic appliances, although modified resins, more suited to orthodontic applications, have become available as a result of the continuing development of denture base resins. In addition, techniques of processing have been adopted that are better suited to the orthodontic technician, one of the most important of which is a method of polymerizing the monomer directly on a cast, frequently described as the pepper and salt technique. This involves wetting the cast and spraying on polymer powder, wetting with monomer and then adding more polymer. An incremental system of polymer build-up has therefore evolved which, with technical skill, may be accomplished rapidly and satisfactorily. This method of preparing the resin part of the removable orthodontic appliance has several potential problems. The resin may be weaker than if conventional flasking and heat systems of polymerization were used, and there may be a greater risk that an appliance will have more residual than for denture base resin monomer. In addition, the high monomer content of the polymer/monomer mix causes increased contraction of the resin on polymerization.

This standard is more comprehensive with regard to performance requirements than BS 2487. In particular, this standard includes requirements and test methods for impact strength and residual monomer which are not included in BS 2487 and it is intended that these additional requirements will be included in the next revision of BS 2487.

This British Standard has been prepared primarily on the basis of data produced by a research programme undertaken under the direction of Dr G D Stafford at Cardiff Dental School. This research took into account replies to a questionnaire sent to the members of the Orthodontic Technicians Association and to Dental Schools, whose assistance in furnishing information on materials and techniques has been invaluable.

Requirements for freedom from biological hazards are not included in this British Standard but it is recommended that in assessing possible biological or toxicological hazards, reference be made to BS 5828.

Attention is also drawn to HSE Guidance Note EH 40 and to the Health and Safety at Work etc. Act, 1974.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 10, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This British Standard specifies performance requirements and describes methods of test for the resins made of acrylic monomers and polymers and used in the construction of removable orthodontic appliances.

Such resins, prepared from a powder (polymer) and a liquid (monomer), are polymerized in an open mould by means of a chemically-activated system accompanied by a combination of heat and pressure.

This standard does not specify requirements for dough-moulded orthodontic resins, which are specified in BS 2487.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this British Standard the definitions given in BS 4492 apply, together with the following.

2.1

test specimen plates

raw, unfinished plates as cast or moulded, without any finishing

2.2

test specimens

test specimen plates after finishing, i.e. in a suitable form for testing

2.3

test specimen strips

test specimens which have been sawn into strips

3 Materials

NOTE For assessment of freedom from biological hazards of dental materials reference should be made to BS 5828.

3.1 Liquid

3.1.1 General. The liquid shall consist of polymerizable acrylic material and other ingredients appropriate to the polymerization system. It shall be free from deposits or sediment when examined visually.

3.1.2 Thermal stability. The liquid shall show no turbidity, deposits or sediment when tested in accordance with Appendix A.

3.2 Powder

The powder shall consist of acrylic polymers and other ingredients appropriate to the polymerization system. It shall be free from extraneous material when examined visually.

3.3 Polymerized resin

3.3.1 Surface properties. When processed in accordance with the manufacturer's instructions and prepared in accordance with **B.1.1** to **B.1.4**, test specimens shall have a surface which, when polished by a conventional dental method, shall be capable of producing a high gloss.

3.3.2 Colour. The colour of the processed resin, when assessed visually using the test specimen prepared in accordance with **B.1.1** to **B.1.4**, shall be as stated by the manufacturer [see **8.1 c**].

3.3.3 Residual methyl methacrylate monomer. The resin, when tested in accordance with Appendix C, shall contain not more than 3.5 % by mass of methyl methacrylate monomer.

3.3.4 Freedom from porosity. When processed in accordance with the manufacturer's instructions and prepared in accordance with **B.1.1** to **B.1.4**, test specimens shall not show evidence of surface or internal porosity when viewed without magnification.

3.3.5 Water sorption. When tested in accordance with Appendix D, the increase in mass of the test specimen shall not exceed 3 %.

NOTE The maximum water sorption is achieved after approximately 4 weeks; however, 85 % to 90 % of the maximum uptake is achieved after 1 week and this test therefore reflects a balance between practical and theoretical considerations. The rate of water uptake or loss may be an important parameter and guidance on the determination of the diffusion coefficient has therefore been given in Appendix E for information.

3.3.6 Transverse deflection. The transverse deflection, when tested in accordance with Appendix B, shall be not greater than 5.0 mm over the force range 15 N to 30 N.

3.3.7 Impact strength. The impact strength, when tested in accordance with Appendix F, shall be not less than 800 J/m².

3.3.8 Hardness. The mean indentation value, when tested in accordance with Appendix G, shall not exceed 160 units (40 µm).

3.3.9 Creep. The creep value, when measured in accordance with Appendix G, shall not exceed 20 % of the original depth of penetration at 5 s.