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Design and manufacture metallic substructures and metallic bridge components



Overview

This standard describes the design and manufacture of metallic substructures and metallic bridge components. Metallic substructures will receive anatomical forms on to them in tooth coloured materials. They are likely to be complex in form given that they combine two or more units. The worker needs to design and manufacture the metallic substructures and bridge components, finish and assure their quality ready for fitting in the patient's mouth.

The term 'client' is used to mean the member of the oral health care team who has prescribed the restoration. Clients may be external to the organisation (such as other laboratories, dental practitioners, training schools) or internal (e.g. within a dental hospital). The patient is the individual for whom the custom-made restoration is being made. A cast is a dimensionally accurate positive form of areas of the oral cavity produced from a negative impression. A die is a section of cast made of an individual tooth.

Users of this standard will need to ensure that practice reflects up to date information and policies.

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Performance criteria

You must be able to:

- P1 evaluate casts and dies against abutment requirements, eliminate any unnecessary undercuts and record and inform the client of any adjustments made
- P2 assess the occlusion to determine the necessary information for the manufacture of occlusal form
- P3 form the appropriate abutment retainers in an appropriate pattern material
- P4 form pontics which are required for supporting tooth coloured material and locate them appropriately to the retainers on the abutments
- P5 convert the pattern using a process appropriate to the alloy and the item
- P6 invest the metallic substructure in a manner that maintains the integrity of the metal, place the parts on the cast and dies, check for fit and occlusal contact and make any adjustments which are required
- P7 assemble the metallic parts and confirm that components and frameworks are fixed:
 - P7.1 securely
 - P7.2 in the required position
 - P7.3 using an appropriate material
 - P7.4 in a manner that enables the optimum join to be made
- P8 accurately apply flux to those areas where solder is required and block out with anti-flux those where solder is not required so that there is no incursion of solder in investing, casting and trimming
- P9 heat components to be soldered to a temperature that:
 - P9.1 is sufficient to melt and control the flow of the solder
 - P9.2 is sufficient to form a bond
 - P9.3 prevents damage to the metallurgical properties of the component
- P10 select solder of a type appropriate to the alloy, apply and control the solder to:
 - P10.1 give an even flow
 - P10.2 achieve the thickness and coverage required by the prescription
- P11 remove flux, anti-flux and excess solder once soldering is complete
- P12 place the metallic substructure on the cast after soldering and confirm that:
 - P12.1 it fits the cast
 - P12.2 it complies with the prescription
 - P12.3 it will not damage surrounding tissues in the patient's mouth and make any necessary adjustments
- P13 compare the developing item throughout the process for its

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- harmonisation with
 - P13.1 the patient's natural tooth form
 - P13.2 tooth morphology
 - P13.3 effects of adjacent natural teeth and of restorations
 - P13.4 pontic coronal form
 - P13.5 profile of pontic in relation to aesthetics, self cleaning and residual ridge
 - P13.6 aesthetic requirements
 - P13.7 prescription requirements
 - P13.8 and make effectively any adjustments which are necessary
- P14 check the item:
 - P14.1 for faults
 - P14.2 general fitand undertake any necessary rework
- P15 create appropriate textures on the different surfaces consistent with:
 - P15.1 the alloy
 - P15.2 the item's design
 - P15.3 the requirements of the prescription
- P16 finish the item so that it is:
 - P16.1 capable of maintaining accuracy of fit
 - P16.2 of the appropriate shape
- P17 verify the finished substructure and bridge components:
 - P17.1 for good overall fit of work to die margins and cast parameters
 - P17.2 for occlusion and articulation
 - P17.3 for proximal contact areas
 - P17.4 for appropriate finish of surfaces
 - P17.5 against the prescription requirements
- P18 correctly identify the restoration with the patient's unique reference and date of production
- P19 effectively clean and disinfect the finished restoration, prepare and package it safely for despatch together with instructions for the patient and client
- P20 make complete, accurate and up-to-date records relating to the identification, components and manufacture of the restoration and store the records in the correct location consistent with relevant legislation

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Knowledge and understanding

You need to know and understand:

- K1 the skeletal anatomy and physiology of the head and neck
- K2 the structure, function, and movement of the oro-facial musculature (including the tongue) and temporomandibular joint
- K3 disorders and diseases affecting the oral cavity (e.g. angular cheilitis and denture stomatitis candidiasis, erosive lichen planus and chronic aphthous ulceration and dry mouth)
- K4 tooth morphology and the form of the natural anterior and posterior teeth
- K5 the aetiology and classifications of malocclusions
- K6 the physiological and pathological changes associated with the ageing process and trauma (e.g. the changes in enamel, dentine and pulp that occur with age and how these affect tooth shape and colour, the effect of tooth loss on the supportive dental tissue, the processes and effect of ridge resorption)
- K7 the importance of retention of the periodontal ligament and the changes in proprioception due to loss of periodontal ligament
- K8 the broader factors (sociological, behavioural, environmental and economic) that contribute to oral health and illness.
- K9 articulation
 - K9.1 the selection of a suitable dental articulator for the type of restoration
 - K9.2 the benefits and restrictions of the various types of dental articulator
 - K9.3 the various methods of transferring clinical information to the dental articulator
 - K9.4 the use and need for kinematic relators (facebows, earbows and pantograph tracings etc.)
 - K9.5 the importance of hinge axis for the partially dentate mouth or where there is parafunction of the temporomandibular joint
 - K9.6 the purpose of split mounting and articulation procedures
 - K9.7 the need to make adjustments to the various components parts of dental articulators based on the type and form of the patient's existing or intended anterior tooth arrangement and occlusion
 - K9.8 the purpose of centric and eccentric wafers when making adjustments to dental articulators
- K10 aesthetics and phonetics
 - K10.1 the relevance of the existing natural dentition in the creation of restorations
 - K10.2 the various methods of determining anterior tooth form for the

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- manufacture of restorations
- K10.3 the importance of posterior tooth form in the development of acceptable aesthetics for the manufacture of restorations
- K10.4 the importance of tooth material selection on the maintenance of aesthetics of restorations
- K10.5 the compromises sometimes necessary between aesthetics and function in the provision of restorations
- K10.6 the role of anatomical contouring in improving the aesthetics of restorations
- K10.7 the importance of base material selection on the appearance of restorations
- K10.8 the effect of staining on the aesthetics of restorations
- K10.9 the challenges presented by overdenture abutments when maintaining acceptable appearance in restorations manufacture
- K11 the principles of restoration design
 - K11.1 the classifications of partially dentate mouths
 - K11.2 the principles of cast surveying and its application to restoration design and manufacture
 - K11.3 the need to identify the component parts of restoration
 - K11.4 the rationale for the selection of materials to fulfil the design requirements of restoration
 - K11.5 the principles of direct retention when applied to restoration design
- K12 the constituents of restorations (onlays, crowns, post and cores, inlays) and how they are made
 - K12.1 the management of materials and process selection to meet client requirements and functional requirements of restorations
 - K12.2 the constituents and physical properties of the different alloys used for restoration construction
 - K12.3 the selection of construction processes to ensure the accuracy of fit of restorations
 - K12.4 the function and operation of computer aided manufacturing systems
- K13 the classification and sub-classification of materials on the basis of chemical composition and internal structure
- K14 the mechanical, physical, thermal, chemical and biological properties of materials
 - K14.1 the importance of the evaluation of materials prior to use in the oral cavity
 - K14.2 the ideal properties of materials used in the manufacture of restorations
 - K14.3 comparison of the materials currently used in dentistry to the ideal properties
 - K14.4 the effects of storage on the properties of the materials used in

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- the manufacture of restorations
- K14.5 the properties of materials during manipulation
- K14.6 the properties of materials during setting
- K14.7 the effects of processing on the properties of the materials used in the manufacture of restorations
- K15 products for cast and mould manufacture
 - K15.1 the requirements of products used in the manufacture of casts and moulds for restorations
 - K15.2 the composition of products used in the manufacture of casts and moulds
 - K15.3 the manipulation and setting characteristics of products
 - K15.4 the properties of the set materials used in the manufacture of casts and moulds
- K16 waxes
 - K16.1 the requirements of wax pattern and base materials
 - K16.2 the composition of dental waxes used in the manufacture of restorations
 - K16.3 the properties of dental waxes used in the manufacture of restorations
 - K16.4 the importance of solid/solid transitions in the manipulation of waxes
 - K16.5 the relevance of the coefficient of thermal expansion (CTE) in the use of waxes
 - K16.6 the importance of pattern strain relief in the manufacture of indirect patterns
 - K16.7 the importance of maintaining the physical, mechanical and aesthetic properties of waxes
- K17 dental alloys
 - K17.1 the structure and properties of metals and the methods of crystallisation
 - K17.2 the benefits of combining metals to produce alloys
 - K17.3 the types of binary alloys that can form and the relevance of these structures in the use of dental alloys
 - K17.4 the importance of dislocations in the structure of metals and alloys
 - K17.5 the construction of thermal equilibrium diagrams from the cooling curves of different binary alloy compositions
 - K17.6 the important features of thermal equilibrium diagrams for alloys that form solid solutions
 - K17.7 the important features of thermal equilibrium diagrams for alloys that exhibit partial solid miscibility
 - K17.8 the relevance of the eutectic mixture on the composition of dental alloys and solders
 - K17.9 the importance of phase precipitation in alloys that exhibit

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- partial solid miscibility on the hardening mechanisms and corrosion resistance
- K17.10 the relevance of non equilibrium cooling conditions on the structure of alloys
- K17.11 the importance of homogenisation heat treatments on cast alloys
- K17.12 the relevance of refining elements on the castability and eventual crystal structure of alloys
- K17.13 the importance of cooling cycles on the physical and mechanical properties of dental alloys
- K17.14 the importance of primary, secondary and tertiary creep
- K17.15 the effects of cold working on dental alloys and its relevance to anisotropic properties
- K17.16 the terms stress relief anneal, recrystallisation and grain growth and its relevance to the use of dental alloys
- K17.17 the importance of maintaining the crystal structure of wrought dental alloys
- K17.18 the important principles in the soldering, brazing and welding processes used in modern dentistry
- K17.19 the relevance of electrolytic corrosion in the use of dental alloys
- K17.20 the importance of the use of electrobrightening of certain dental alloys
- K17.21 the rationale for the selective plating of dental alloys
- K18 principles of bridge work
 - K18.1 the relationship of materials selection to the functional requirements of bridges depending upon bridge span and location
 - K18.2 the design of bridge structures and substructures to meet clinical and functional requirements, and materials properties
- K19 methods of constructing dental bridges
 - K19.1 the selection and management of materials and processes to meet client requirements and functional requirements
 - K19.2 principles of bridge design including abutment and retainer selection
 - K19.3 occlusal protection of fixed component production methods of lost wax casting, polymeric temporary, lost wax and refractory die, light cure composite, light cure composite and metal, all ceramic alumina refractory, technical ceramic, ceromer technology hydro-thermic porcelain and low fusing, ceramic porcelain systems
 - K19.4 quality assured manufacturing techniques, calibration of furnaces, continual evaluation of technical development
 - K19.5 effect of manufacturing procedures upon the clinical and functional performance of the restoration

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- K19.6 the factors which determine the selection of materials in relation to periodontal health
- K20 techniques of soldering used in dental bridgework
 - K20.1 materials, post ceramic soldering, pre-ceramic soldering
 - K20.2 associated refractory materials and transfer cast system
 - K20.3 solders metals used in restorative dentistry including precious and non-precious alloys, using blow torch or furnace methods and laser welding
- K21 dental refractory materials
 - K21.1 the need for the use of refractory materials
 - K21.2 the rationale for the selection of refractory materials
 - K21.3 the use of phosphate bonded and gypsum bonded refractory materials
 - K21.4 the setting characteristics of the two main types of investment used in dentistry
 - K21.5 the importance of thermal expansion of investment materials used in casting and soldering processes
 - K21.6 the role of the allotropes of silica in the expansion process
 - K21.7 the role of colloidal silica on the setting and thermal characteristics of phosphate bonded refractory materials
 - K21.8 the important physical and chemical changes that take place during the heating of dental investments
 - K21.9 the importance of mould temperature on the crystal structure of cast alloys
- K22 the relationship between chemical bonds and the properties of solid materials
- K23 impression, duplicating and disinfection materials
 - K23.1 the constituents and uses of different impression materials
 - K23.2 the compatibility of impression materials with disinfection procedures
 - K23.3 the term viscoelasticity and its relevance to the handling of certain types of impression materials
 - K23.4 the term elastomeric and the essential characteristics of the materials in this category
- K24 casting patterns
 - K24.1 management of casting patterns selection
 - K24.2 range of casting pattern materials, natural waxes, synthetic waxes, polymeric materials. structure and properties of waxes, effect of manipulative techniques, changes in temperature and resting of waxes on accuracy
- K25 methods of spruing various metals and systems
- K26 methods of surface finishing
- K27 methods of protection against contamination and cross-infection when handling received impressions and other items which may have been in

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- the mouth, or which are intended to be placed in the mouth; why it is important to do so
- K28 the purpose of personal protective equipment.
 - K29 the reasons for maintaining records throughout the process and of clearly identifying the products during the manufacturing process
 - K30 organisational procedures and requirements for the recording of information about incoming work, work in progress and work delivered to clients, and the purpose of this
 - K31 quality audit systems: their purpose, nature and procedures; impact of the Medical Devices Directive on the recording of incoming work, the detailed design and manufacturing specification and the recording of materials and processes
 - K32 principles of quality assurance (including effective recording and sampling); processes and procedures for quality assurance in the worker's workplace
 - K33 methods of setting and calibrating equipment and of testing that this is correct
 - K34 the effects of modifying manufacturers' products to meet laboratory requirements on the physical properties of products, on quality assured products and the legal implications (e.g. of inaccurate mixing, inadequate processing)
 - K35 the requirements of the Medical Devices Directive in monitoring the progress of devices through the production process
 - K36 legal requirements of the contract of employment, confidentiality and employers' regulations
 - K37 health and safety at work legislation and related procedures and liability; principles of, and how to apply, legislation and regulations (e.g. COSHH regulations, the Health and Safety at Work Act, Environmental Protection Act)
 - K38 legal requirements relating to third party insurance
 - K39 the competency range of other members of the oral healthcare team (and the wider health and social care team)
 - K40 the regulatory functions of the General Dental Council
 - K41 legal and ethical obligations of regulated members of the oral healthcare team
 - K42 the need for lifelong learning and professional development and responsibilities in relation to this for regulated members of the oral healthcare team
 - K43 the oral healthcare team's wider responsibility to the community as a whole

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Additional Information

Links to other NOS

This standard follows on from standard DT10 which focuses on producing custom-made trays, casts and dies for the design and manufacture of restorations.

External Links

This standard links with the following dimension within the NHS Knowledge and Skills Framework (October 2004):

Dimension: HWB9 Equipment and devices to meet health and wellbeing needs

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Relevant occupations Health, Public Services and Care; Medicine and Dentistry; Managers and Senior Officials; Associate Professionals and Technical Occupations; Health and Social Services Officers; Health Associate Professionals; Personal Service Occupations; Healthcare and Related Personal Services

Suite Dental Technology

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