OVERVIEW

This standard focuses on the design and manufacture of prostheses using precision attachments; dental devices which are custom-made to fit the patients unique mouth shape and which replace one or more missing teeth and incorporate the use of a precision connector of two or more parts. One part of the attachment is connected to a root, tooth or an implant, the other part to an artificial prosthesis; this provides mechanical retention. Precision attachments can be used in place of clasp arms: to retain partial dentures with extra or intra-coronal attachments. In complete dentures they can be used on roots or implants carrying studs or bars.

A partial or complete prosthesis using precision attachments should restore a natural dental appearance in colour, shape and size; fit and occlude in the patients mouth comfortably, be retained firmly in place in the patients mouth and should not attract a build-up of food debris. In order to manufacture a prosthesis which meets aesthetic, fit, occlusal and functional requirements, the technician needs to have an accurate cast, an accurate record of the relationship between the patients upper and lower jaw and a record of the patients tooth shade. The production of custom-made trays, casts, baseplates and occlusal registration rims is not included in this standard.

The term client is used to mean the member of the oral health care team who has prescribed the custom-made prosthesis. Clients may be external to the organisation (such as general dental practitioners) or internal (eg within a dental hospital). The patient is the individual for whom the custom-made prosthesis is being made.

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

Version No 1

KNOWLEDGE AND UNDERSTANDING

You will need to know and understand:

1. the skeletal anatomy and physiology of the head and neck
2. the structure, function, and movement of the oro-facial musculature (including the tongue) and temporomandibular joint
3. disorders and diseases affecting the oral cavity (eg angular cheilitis and denture trauma, denture stomatitis, denture induced hyperplasia, erosive lichen planus and chronic aphthous ulceration and dry mouth)
4. tooth morphology and the form of the natural anterior and posterior teeth
5. the aetiology and classifications of malocclusions
6. the physiological and pathological changes associated with the ageing process and trauma (eg 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)
7. the importance of retention of the periodontal ligament and the changes in proprioception due to loss of periodontal ligament
8. the broader factors (sociological, behavioural, environmental and economic) that contribute to oral health and illness
9. articulation
   1. the selection of a suitable dental articulator for the type of prosthesis
   2. the benefits and restrictions of the various types of dental articulator
   3. the various methods of transferring clinical information to the dental articulator
   4. the use and need for kinematic relators (facebows, earbows and pantograph tracings etc.)
   5. the importance of hinge axis for the partially dentate mouth or where there is paranormal function of the temporomandibular joint
   6. the purpose of split mounting and articulation procedures
   7. the need to make adjustments to the various components parts of dental articulators based on the type and form of the patients existing or intended anterior tooth arrangement and occlusion
   8. the purpose of centric and eccentric wafers when making adjustments to dental articulators
10. aesthetics and phonetics
    1. the relevance of the existing natural dentition in the creation of prostheses
    2. the various methods of determining anterior tooth form for the manufacture of prostheses
    3. the importance of posterior tooth form in the development of acceptable aesthetics for the manufacture of prostheses
    4. the importance of tooth material selection on the maintenance of aesthetics of prostheses
    5. the compromises sometimes necessary between aesthetics and function in the provision of prostheses
    6. the role of anatomical contouring in improving the aesthetics of prostheses
    7. the importance of base material selection on the appearance of prostheses
    8. the effect of staining on the aesthetics of prostheses
    9. the challenges presented by overdenture abutments when maintaining acceptable appearance in prostheses manufacture
11. the principles of prostheses design
    1. the classifications of partially dentate mouths
    2. the principles of cast surveying and its application to prostheses design and manufacture
    3. the need to identify the component parts of prostheses
    4. the rationale for the selection of materials to fulfil the design requirements of prostheses
    5. the principles of direct retention when applied to prostheses design
12. the classification and sub-classification of materials on the basis of chemical composition and internal structure
<table>
<thead>
<tr>
<th>13.</th>
<th>the mechanical, physical, thermal, chemical and biological properties of materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>the importance of the evaluation of materials prior to use in the oral cavity</td>
</tr>
<tr>
<td>2.</td>
<td>the ideal properties of materials used in the manufacture of prostheses</td>
</tr>
<tr>
<td>3.</td>
<td>comparison of the materials currently used in dentistry to the ideal properties</td>
</tr>
<tr>
<td>4.</td>
<td>the effects of storage on the properties of the materials used in the manufacture of prostheses</td>
</tr>
<tr>
<td>5.</td>
<td>the properties of materials during manipulation</td>
</tr>
<tr>
<td>6.</td>
<td>the properties of materials during setting</td>
</tr>
<tr>
<td>7.</td>
<td>the effects of processing on the properties of the materials used in the manufacture of prostheses</td>
</tr>
<tr>
<td>14.</td>
<td>products for cast and mould manufacture</td>
</tr>
<tr>
<td>1.</td>
<td>the requirements of products used in the manufacture of casts and moulds</td>
</tr>
<tr>
<td>2.</td>
<td>the composition of products used in the manufacture of casts and moulds</td>
</tr>
<tr>
<td>3.</td>
<td>the manipulation and setting characteristics of products</td>
</tr>
<tr>
<td>4.</td>
<td>the properties of the set materials used in the manufacture of casts and moulds</td>
</tr>
</tbody>
</table>

| 15.  | waxes |
| 1.   | the requirements of wax pattern and base materials |
| 2.   | the composition of dental waxes |
| 3.   | the properties of dental waxes |
| 4.   | the importance of solid/solid transitions in the manipulation of waxes |
| 5.   | the relevance of the coefficient of thermal expansion (CTE) in the use of waxes |
| 6.   | the importance of pattern strain relief in the manufacture of indirect patterns |
| 7.   | the importance of maintaining the physical, mechanical and aesthetic properties of waxes |

| 16.  | dental alloys |
| 1.   | the structure and properties of metals and the methods of crystallisation |
| 2.   | the benefits of combining metals to produce alloys |
| 3.   | the types of binary alloys that can form and the relevance of these structures in the use of dental alloys |
| 4.   | the importance of dislocations in the structure of metals and alloys |
| 5.   | the construction of thermal equilibrium diagrams from the cooling curves of different binary alloy compositions |
| 6.   | the important features of thermal equilibrium diagrams for alloys that form solid solutions |
| 7.   | the important features of thermal equilibrium diagrams for alloys that exhibit partial solid miscibility |
| 8.   | the relevance of the eutectic mixture on the composition of dental alloys and solders |
| 9.   | the importance of phase precipitation in alloys that exhibit partial solid miscibility on the hardening mechanisms and corrosion resistance |
| 10.  | the relevance of non equilibrium cooling conditions on the structure of alloys |
| 11.  | the importance of homogenisation heat treatments on cast alloys |
| 12.  | the relevance of refining elements on the castability and eventual crystal structure of alloys |
| 13.  | the importance of cooling cycles on the physical and mechanical properties of dental alloys |
| 14.  | the importance of primary, secondary and tertiary creep |
| 15.  | the effects of cold working on dental alloys and its relevance to anisotropic properties |
| 16.  | the terms stress relief anneal, recrystallisation and grain growth and its |
17. principles of precision attachment work
   1. the relationship of materials selection to the functional requirements of bridges and crowns depending upon span and location
   2. the design of structures and substructures to meet clinical and functional requirements, and materials properties

18. methods of constructing dental bridges and crowns using precision attachments
   1. the selection and management of materials and processes to meet client requirements and functional requirements
   2. principles of bridge and crown design including abutment and retainer selection
   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
   4. quality assured manufacturing techniques, calibration of furnaces, continual evaluation of technical development
   5. effect of manufacturing procedures upon the clinical and functional performance of the restoration
   6. the factors which determine the selection of materials in relation to periodontal health

19. techniques of soldering used in dental work
   1. materials, post ceramic soldering, pre-ceramic soldering
   2. associated refractory materials and transfer cast system
   3. solder metals used in restorative dentistry including precious and non-precious alloys, using blow torch or furnace methods and laser welding

20. dental refractory materials
   1. the need for the use of refractory materials
   2. the rationale for the selection of refractory materials
   3. the use of phosphate bonded and gypsum bonded refractory materials
   4. the setting characteristics of the two main types of investment used in dentistry
   5. the importance of thermal expansion of investment materials used in casting and soldering processes
   6. the role of the allotropes of silica in the expansion process
   7. the role of colloidal silica on the setting and thermal characteristics of phosphate bonded refractory materials
   8. the important physical and chemical changes that take place during the heating of dental investments
   9. the importance of mould temperature on the crystal structure of cast alloys

21. the relationship between chemical bonds and the properties of solid materials

22. impression, duplicating and disinfection materials
   1. the constituents and uses of different impression materials
   2. the compatibility of impression materials with disinfection procedures
   3. the term viscoelasticity and its relevance to the handling of certain types of impression materials
4. the term elastomeric and the essential characteristics of the materials in this category
23. casting patterns
   1. management of casting pattern selection
   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
24. methods of sprueing various metals and systems
25. methods of surface finishing
26. methods of protection against contamination and cross-infection when handling received impressions and other items which may have been in the mouth, or which are intended to be placed in the mouth; why it is important to do so
27. the purpose of personal protective equipment
28. the reasons for maintaining records throughout the process and of clearly identifying the products during the manufacturing process
29. 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
30. 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
31. principles of quality assurance (including effective recording and sampling); processes and procedures for quality assurance in the workers workplace
32. methods of setting and calibrating equipment and of testing that this is correct
33. the effects of modifying manufacturers products to meet laboratory requirements on the physical properties of products, on quality assured products and the legal implications (eg of inaccurate mixing, inadequate processing)
34. the requirements of the Medical Devices Directive in monitoring the progress of devices through the production process
35. legal requirements of the contract of employment, confidentiality and employers regulations
36. health and safety at work legislation and related procedures and liability; principles of, and how to apply, legislation and regulations (eg COSHH regulations, the Health and Safety at Work Act, Environmental Protection Act)
37. legal requirements relating to third party insurance
38. legal requirements relating to the Dentists Act
39. the competency range of other members of the oral healthcare team (and the wider health and social care team)
40. the regulatory functions of the General Dental Council
41. legal and ethical obligations of regulated members of the oral healthcare team
42. the need for lifelong learning and professional development and responsibilities in relation to this for regulated members of the oral healthcare team
43. the oral healthcare teams wider responsibility to the community as a whole

**PERFORMANCE CRITERIA**

You must be able to do the following:
1. agree with clients:
   1. the workers role in the planning process
   2. the way in which the diagnosis and planning is to be carried out
   3. who is responsible for ordering and paying for the different components

2. find out from clients:
   1. the reason why precision attachments are being considered
   2. how the patient expects the final prosthesis to look and function
   3. any concerns that the client has about the health of surrounding teeth and the overall suitability of the prosthesis for the patient

3. obtain from the patients clinical notes and related assessments:
   4. produce a master cast/die from the impressions received from the client

5. appraise the casts/dies for:
   1. dentition
   2. vertical dimension
   3. spaces to be filled
   4. clearance for attachments (and determine the type of attachment to use for the patient concerned)

6. provide advice to the client on an optimal design for the prosthesis including the following aspects:
   1. oral hygiene
   2. number of abutments
   3. angle and height of abutments
   4. length of free-end saddles
   5. vertical height
   6. ridge structure
   7. possible physical disability
   8. whether the attachment should be rigid or resilient

7. respond appropriately to questions and issues from the client relating to the design of the prosthesis and the treatment as it proceeds

8. evaluate casts and dies against abutment requirements, eliminate any unnecessary undercuts and record and inform the client of any adjustments made

9. assess the occlusion using casts mounted on an articulator to:

10. determine the necessary information for the manufacture of occlusal form

11. determine if adequate clearance has been provided

12. survey the cast to:
   a. establish the alignment of the long axes of the teeth
   b. establish undercut and non-undercut areas of the teeth
   c. find a path of insertion common to all abutment teeth

13. introduce attachments to produce a split design prosthesis in the event of a malalignment of teeth

14. introduce attachments into the design that are appropriate for the space to be filled and ensuring that there is sufficient space for wax contouring and oral hygiene

15. position matrices/patrices with a parallelometer prior to waxing into position or if using anchors and bars accurately measure and position bars in the wax cradles and test for fit

16. convert the pattern using a process appropriate to the alloy and the item

17. devest 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 that are required

18. If any of the parts require soldering, assemble the metallic parts and confirm that components and frameworks are fixed:

19. 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
20. heat components to be soldered to a temperature that:
   1. is sufficient to melt and control the flow of the solder
   2. is sufficient to form a bond
   3. prevents damage to the metallurgical properties of the component
21. select solder of a type appropriate to the alloy, and apply and control the solder to:
   1. give an even flow
   2. achieve the thickness and coverage required by the prescription
22. remove flux, anti-flux and excess solder once soldering is complete
23. place the substructure on the cast after soldering and confirm that:
24. Once the framework is complete, disassemble and assemble the precision attachments with care ensuring that the parts are kept clearly separated and safe
25. compare the developing item throughout the process for its harmonisation with
   1. the patients natural tooth form
   2. tooth morphology
   3. all occlusal exclusive movements
   4. effects of adjacent natural teeth and of restorations
   5. pontic coronal form
   6. profile of pontic in relation to aesthetics, self cleaning and residual ridge
   7. aesthetic requirements
   8. prescription requirements (and make any necessary adjustments)
26. check the item:
27. create appropriate textures on the different surfaces consistent with:
28. finish the item so that it is:
29. verify the finished prosthesis:
   1. for good overall fit of work to die margins and cast parameters
   2. for occlusion and articulation
   3. for proximal contact areas
   4. for appropriate finish of surfaces
   5. against the prescription requirements
30. correctly identify the prosthesis with the patients unique reference and date of production
31. effectively clean and disinfect the finished prosthesis, prepare and package it safely for despatch together with instructions for the patient and client
32. make complete, accurate and up-to-date records relating to the identification, components and manufacture of the prosthesis and store the records in the correct location consistent with relevant legislation

ADDITIONAL INFORMATION

This National Occupational Standard was developed by Skills for Health.

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