DT18 Design and manufacture functional orthodontic appliances

OVERVIEW

This standard describes standards for the construction of functional orthodontic appliances and covers the processes of manufacturing custom-made components, assembling components, blocking out; application of polymeric (through powder and liquid build up techniques, pouring or moulding techniques as used in the construction of prosthetics), curing/processing of polymeric and the final finishing processes. Functional orthodontic appliances are complex specialist custom-made dental appliances which are used to correct skeletal and dentoalveolar discrepancies in the developing child or young adult.

In this standard the term client has been used to mean the clinician who has prescribed and specified the orthodontic appliance. Clients may be external to the organisation (such as other laboratories, dental practitioners, training schools) or internal (eg within a dental hospital). The patient is the individual for whom the appliance 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. skeletal anatomy and physiology necessary for functional orthodontic appliance construction
2. the function and movement of the oral musculature and temporomandibular joint
3. principles of balanced articulation and its effect on the function of functional orthodontic appliances
4. disorders and diseases affecting the oral cavity
5. tooth morphology (both deciduous and permanent) including crowns and roots, and the form of the anterior and posterior teeth
6. the aetiology and classifications of malocclusions
7. growth and eruption patterns of both deciduous and permanent teeth
8. the physiological changes related to tooth movement
<table>
<thead>
<tr>
<th></th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>growth and development of maxilla and mandible</td>
</tr>
<tr>
<td>10</td>
<td>limitations of growth modifications; restrictions and contraindications to growth modification</td>
</tr>
<tr>
<td>11</td>
<td>the broader factors (sociological, behavioural, environmental and economic) that contribute to oral health and illness.</td>
</tr>
<tr>
<td>12</td>
<td>the aims and objectives of orthodontic treatment</td>
</tr>
<tr>
<td>13</td>
<td>key factors in the success of orthodontic treatment, common problems and the common causes of failure of treatment</td>
</tr>
<tr>
<td>14</td>
<td>the stages in, and types of, orthodontic treatment and how they relate to each other</td>
</tr>
<tr>
<td>15</td>
<td>principles of design and manufacture of functional orthodontic appliances</td>
</tr>
<tr>
<td>16</td>
<td>the scope of orthodontic treatment using functional orthodontic appliances</td>
</tr>
<tr>
<td>17</td>
<td>principles of baseplate and interlocking posterior guideplane design and construction</td>
</tr>
<tr>
<td>18</td>
<td>the nature and purpose of study casts</td>
</tr>
<tr>
<td>19</td>
<td>application and magnitude of the forces used in the movement of teeth and the development of mandibular growth</td>
</tr>
<tr>
<td>20</td>
<td>the different types of functional orthodontic appliances and the components that are required</td>
</tr>
<tr>
<td>21</td>
<td>the different components used in functional orthodontic appliances, the purposes and uses of each</td>
</tr>
<tr>
<td>22</td>
<td>the use of casts in the design, manufacture and positioning of components for appliances</td>
</tr>
<tr>
<td>23</td>
<td>methods of activation and reactivation of components</td>
</tr>
<tr>
<td>24</td>
<td>methods of activation and reactivation of functional appliances</td>
</tr>
<tr>
<td>25</td>
<td>how appliances are fitted, adjusted and activated</td>
</tr>
<tr>
<td>26</td>
<td>methods of modification, repair and maintenance of functional appliances</td>
</tr>
<tr>
<td>27</td>
<td>the records (paper and material) that are required</td>
</tr>
<tr>
<td>28</td>
<td>principles and application of myofunctional appliance technology</td>
</tr>
<tr>
<td>29</td>
<td>methods of measurement and analysis of cephalometrics, eg characteristics, skeletal patterns, facial height, incisor relationships</td>
</tr>
<tr>
<td>30</td>
<td>how the curing process affects the choice of materials and manufacturing processes</td>
</tr>
<tr>
<td>31</td>
<td>how to identify the size and type of components that will be required</td>
</tr>
<tr>
<td>32</td>
<td>the range of pre-formed components that are available and methods to assess their suitability for use in constructing an appliance</td>
</tr>
<tr>
<td>33</td>
<td>the different gauges of wire that are used for different types of components and methods for identifying which is required and suitable</td>
</tr>
<tr>
<td>34</td>
<td>methods of straightening and bending wire and the tools that are used</td>
</tr>
<tr>
<td>35</td>
<td>handling tolerances of wires, the effects of over-handling and how to identify when this has happened</td>
</tr>
<tr>
<td>36</td>
<td>the purpose, function and use of protective equipment in the manufacture of components</td>
</tr>
<tr>
<td>37</td>
<td>methods of assessing the suitability of manufactured components</td>
</tr>
<tr>
<td>38</td>
<td>the purpose and use of the different types of biteplanes and how these are constructed</td>
</tr>
<tr>
<td>39</td>
<td>methods for the application of polymeric, why different techniques are used</td>
</tr>
<tr>
<td>40</td>
<td>uses of spot welding and soldering - when, where, how, why and what</td>
</tr>
<tr>
<td>41</td>
<td>how the duration and level of current affects the strength and viability of the join produced</td>
</tr>
<tr>
<td>42</td>
<td>methods of calibrating equipment, how to determine the correct settings for the size and type of materials being welded</td>
</tr>
</tbody>
</table>
43. how to judge when metals have been heated sufficiently to melt solder, but not interfere with the metals mechanical structure
44. the consequences of over-heating metals and solder during soldering (such as weakening and softening metals and causing solder to spatter rather than flow smoothly), the effect of these on the strength and integrity of the join and the remedial action that can be taken
45. how to identify reasons for soldered joint failure
46. the different curing methods, how each works, their effect and the situations in which each is best used
47. how the curing process affects the materials and components that can be used
48. physical characteristics of materials used in appliances and how the curing processes affect them
49. the different separating media, when and why these are used
50. methods of deflasking
51. the ways in which appliances are cleaned in preparation for finishing and polishing
52. techniques for finishing and polishing appliances
53. the different types of abrasive and polish, the purposes and uses of each
54. methods for the safe, effective disinfection of appliances
55. methods of assessing and checking the safety, aesthetic, functional and clinical acceptability of completed appliances
56. the selection of a suitable articulator for the type of appliance being designed and manufactured
57. centric occlusion records
58. lateral and protrusive movement records and their uses
59. analysis of dentate occlusions requiring onlays
60. 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
61. the purpose of personal protective equipment
62. methods for the safe moving, handling and storage of materials and equipment
63. location, function and use of emergency equipment.
64. the reasons for maintaining records throughout the process and of clearly identifying the products during the manufacturing process
65. 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
66. 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
67. principles of quality assurance (including effective recording and sampling); processes and procedures for quality assurance in the workers workplace
68. methods of setting and calibrating equipment and of testing that this is correct
69. 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).
70. the requirements of the Medical Devices Directive in monitoring the progress of devices through the production process
71. legal requirements of the contract of employment, confidentiality and employers regulations
72. 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)
73. legal requirements relating to third party insurance.
74. the competency range of other members of the oral healthcare team (and the
closer health and social care team)
75. the regulatory functions of the General Dental Council
76. legal and ethical obligations of regulated members of the oral healthcare team
77. the need for lifelong learning and professional development and responsibilities in
relation to this for regulated members of the oral healthcare team
78. the oral healthcare team's wider responsibility to the community as a whole

PERFORMANCE CRITERIA

You must be able to do the following:

1. identify from an analysis of the patient's treatment plan the need for any
   modifications to the cast and make any such modifications prior to manufacture
2. analyse the cast and identify:
   1. the malocclusion and development problem that are to be corrected
   2. the tooth movement and retention that will be required to correct the
      malocclusion
   3. the components that will be required to achieve the required function
3. design a functional orthodontic appliance and its individual components which:
   1. has the potential to achieve the required function within the patient's mouth
   2. incorporates sufficient anchorage and fixation
   3. achieves the best possible balance between function, aesthetics and cost
4. determine the depth of and block out undercut areas which might:
   1. prevent removal or insertion of the appliance
   2. cause ulceration in situ
5. select an appropriate articulator and articulate casts correctly using the postured
   jaw relationship provided by the client
6. prepare and block out the cast in a manner which is suitable for the processing
   method to be used
7. select and use appropriate spacing materials to make any necessary
   modifications to the cast
8. evaluate the cast and design and decide on the basis of cost, time and function:
   1. where pre-formed components can be used within the appliance
   2. which components will need to be custom-made
   3. any necessary adjustments to component design
9. select the required pre-formed components, make any necessary modifications for
   them to perform the correct function, and confirm they are fit for purpose
10. select wire of the correct gauge and material for the required custom-made
    components, cut it accurately to the required length and straighten it in a manner
    which avoids unwanted material stress
11. form wire components to the required design and size in a manner which
    minimises the risks of over-work of the material
12. repeatedly check components during manufacture to confirm that:
    1. they fit to the cast
    2. they provide the correct extensions against the working cast
3. they will not damage surrounding tissues in the mouth
4. the developing appliance is complying with the prescription and design (and make any adjustments which are required)

13. evaluate the design of the developing appliance to confirm that it:
   1. will function as required by the prescription
   2. will not interfere with or damage the patients tissues

14. fix components:
   1. securely in the required position to the cast to prevent their movement during processing
   2. in a manner which is appropriate to the processing method to be used

15. prepare the cast suitably for the application of polymeric material in a manner appropriate to:
   1. the type of polymeric material
   2. the curing process to be used

16. apply appropriate material to the cast to form a baseplate of the required thickness and extension which will secure the components effectively and to provide the required function

17. select and use appropriate materials for manufacturing the functional orthodontic appliance required in the prescription

18. process the appliance using equipment and techniques which are appropriate to:
   1. the baseplate material
   2. the strength and type of finish required

19. produce any required interlocking posterior guideplanes of a sufficient thickness of polymeric material to:
   1. open the bite to the degree required in the prescription
   2. meet the pre-determined angulation specified by the client

20. separate the appliance from the cast once processing is complete, and appropriately clean the appliance in preparation for finishing and polishing.

21. select methods, materials and equipment for joining components that are appropriate to:
   1. the type and materials of the components to be joined
   2. the strength and type of join required

22. identify accurately areas where a soldered joint would not interfere with the function and performance of the component being joined

23. position components:
   1. accurately for the design
   2. in a manner that enables the optimum join to be made

24. calibrate the level and duration of current in spot-welding equipment so that it is correct for the size, thickness and type of material to be joined

25. confirm that electrodes are free from erosion and take the appropriate action to remedy those that display levels of erosion which are likely to adversely affect the quality of the join

26. identify accurately areas where a spot-welded join would not interfere with the function and performance of the component, correctly position components and accurately spot-weld them at the correct points to form secure, strong and viable joins

27. accurately apply flux to those areas where solder is required and block out with anti-flux those where solder is not required so that:
   1. there is no incursion of solder
   2. the required range of movement is allowed

28. apply an appropriate heat-protective material to minimise damage to surrounding areas
29. 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 components being joined

30. apply and control the solder to:
   1. give an even flow
   2. achieve the thickness and coverage required for optimum durability and maximum strength

31. evaluate each finished join for its:
   1. position
   2. strength
   3. integrity
   4. function
   5. fitness for purpose (and remake any which give cause for concern)

32. place the appliance on the cast after joining and check that the appliance:
   1. fits the cast
   2. complies with the prescription
   3. will not damage surrounding tissues in the patient's mouth (and make any necessary adjustments)

33. remove flux, anti-flux and excess solder once welding and soldering is complete, replace the appliance on the cast and confirm the fit

34. finish and polish metal components to leave a smooth surface free of sharp edges and irregularities.

35. select methods, materials and equipment for trimming, finishing and polishing functional orthodontic appliances that are appropriate to the type and materials of the components in the appliance

36. confirm that the active components have the full range of movement required in the prescription

37. trim and finish the baseplate to the thickness and coverage required

38. finish and polish metal components to leave smooth surfaces that are free of sharp edges and irregularities and which do not cause damage to the patient's tissues

39. evaluate the finished appliance and confirm that it:
   1. is effective
   2. fits the cast
   3. is free of defects
   4. meets the requirements of the planned design
   5. complies with the prescription
   6. is fit for purpose

40. correctly identify the finished appliance with the patient's unique reference and date of production

41. effectively clean and disinfect the finished appliance, prepare and package it safely for despatch together with instructions for the patient and client

42. make complete, accurate and up-to-date records relating to the identification, components and manufacture of the appliance 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