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(54) **Title:** A DENTAL APPLIANCE

(57) **Abstract:** A dental appliance (20) for correcting tooth alignment. The appliance (20) includes a body (22) for seating on an arch of teeth. The body (22) is at least partially elastically deformable and has a seated condition into which it is elastically deformable to be seated on an arch of teeth. The body (22) is constructed, when seated on an arch of teeth, for applying, by virtue of said elastic deformation, a correction force on one or more misaligned teeth, at or adjacent a base of the crown of each misaligned tooth, in a direction in which each misaligned tooth is to be moved to correct its alignment.

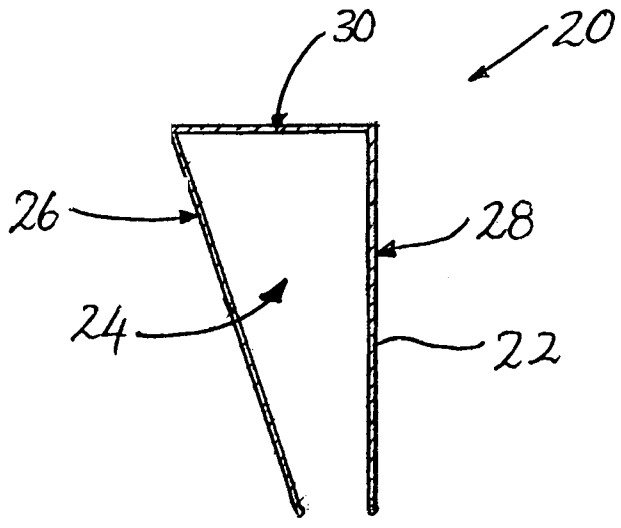

FIG. 2

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A DENTAL APPLIANCE

Technical Field

The present invention generally relates to a dental appliance and, more particularly, to a dental appliance for correcting tooth alignment, and to a set of such appliances. The invention relates also to a method of forming a dental appliance for correcting tooth alignment, and to a method of correcting tooth alignment.

Background of the Invention

Dental or orthodontic appliances such as braces are known for correcting tooth alignment. These appliances are, however, regarded by many patients, especially adults, as unsightly.

A known alternative to braces comes in the form of a removable appliance which, in the general fashion of a mouthguard, is received over an arch of teeth of a patient. An appliance of the type in question is at least partially elastically deformable, being constructed to be elastically deformed when received over an arch of teeth including a misaligned tooth or teeth, so that, by virtue of the elastic deformation, the appliance applies correction forces on a misaligned tooth or teeth. These type of appliances are of transparent construction, so that they have little or no obvious adverse aesthetic effects on the appearance of a patient.

However, because of the material from which these appliances are constructed, corrective movement of a tooth by a single appliance is limited, so that a great number of sequential appliances (e.g. 40) are required to correct tooth alignment, especially in cases where significant alignment correction is required. Another disadvantage of these type of appliances is that their construction is of such a nature that they do not naturally properly seat on an arch of teeth. When an appliance in question is forced to seat properly on an arch of teeth, it, on the one hand, may lead to damage of the appliance and, on the other hand, may cause discomfort to a patient and/or cause tissue and/or tooth damage. For example, excessive force applied to a tooth by means of an appliance in question may result in root resorption or, in some cases, may restrict blood supply to the tooth, which adversely affects the vitality of the tooth with consequential discoloration of the tooth.

Object of the Invention

It is the object of the present invention to substantially overcome or at least ameliorate one or more of the above disadvantages, or at least to provide a useful alternative.

Summary of the Invention

In accordance with a first aspect, the present invention provides a dental appliance for correcting tooth alignment, the appliance including a body for seating on an arch of teeth, the body being at least partially elastically deformable and having a seated condition into which it is elastically deformable to be seated on an arch of teeth, and the body being constructed, when seated on an arch of teeth, for applying, by virtue of said elastic deformation, a correction force on one or more misaligned teeth, at or adjacent a base of the crown of each misaligned tooth, in a direction in which each misaligned tooth is to be moved to correct its alignment.

Preferably, the body of the appliance is provided with a recess for receiving teeth, the body having a pre-seated condition from which it is elastically deformable into said seated condition, and the recess, when the body is in its pre-seated condition, providing accommodation for a misaligned tooth in a required post-alignment position and for at least part of the misaligned tooth in a pre-alignment position.

Preferably, when the body is in its seated condition its recess provides for simultaneous accommodation of a misaligned tooth in its required post-alignment position and in its pre-alignment position.

The body of the appliance is, preferably, constructed such that when it is in its seated condition, its recess provides for simultaneous accommodation of the entire crown of each misaligned tooth both in its pre-alignment position and its required post-alignment position. The appliance is thus associated only with crowns of teeth.

The appliance is removable. Preferably, the appliance is at least partially transparent. Conveniently, the entire appliance is transparent. Thus, the appliance will not be obviously visible when worn by a patient.

As the appliance is intraoral in nature, it is to be appreciated that the material from which it is constructed is suitable for intraoral use.

The appliance is preferably constructed such that the recess of its body accommodates all, or at least a majority of, the teeth in an arch.

The recess of the body is preferably shaped such that when the body is in both its pre-seated condition and its seated condition, it accommodates each tooth whose alignment does not require correction in the current position of the tooth. The body of the appliance will thus, when seated on teeth of an arch, anchor against teeth whose alignment do not require correction.

Preferably, the body of the appliance is generally in the form of a shell which, when seen in outline in plan view, follows the general outline of an arch of teeth. Preferably, the body is in the form of a relatively thin-walled shell, following the contours of the teeth in an arch.

By virtue of its aforedescribed construction, the body of the appliance, when seen in cross-section, is roughly U shaped, when to be used in relation to an upper arch of teeth, or roughly inverted U-shaped, when to be used in relation to a lower arch of teeth. The body thus preferably includes a lingual portion associated with lingual surfaces of teeth, a facial portion associated with facial surfaces of teeth, and a connecting portion associated with tips, i.e. cusps in the case of molars or pre-molars, of teeth, the connecting portion connecting the lingual portion and the facial portion together. When the body of the appliance is deformed from its pre-seated condition to its seated condition, a part or parts of the lingual portion and/or the facial portion of the body associated with misaligned teeth will be elastically deformed away from the other one of the lingual portion and the facial portion about the connecting portion. That part of the connecting portion associated with each misaligned tooth is preferably wide enough simultaneously to cover the tip of each misaligned tooth when the tooth is in its pre-alignment position and its required post-alignment position, thereby permitting proper seating of the appliance on an arch of teeth including misaligned teeth.

In use, with the appliance seated on an arch of teeth, the alignment force applied by the appliance on each misaligned tooth will thus be applied, by said one of the lingual portion and the facial portion of the body which has been elastically deformed, on the tooth at or adjacent the base of the crown of the tooth. This, in the case of translational movement, i.e. movement in a lingual or facial direction, of a tooth, ensures bodily movement of the tooth, as opposed to tipping of the tooth.

As foreshadowed above, an appliance according to this aspect of the invention can be used in relation to an upper or a lower arch of teeth.

It is to be appreciated that the appliance can be used to effect both translational corrective movement, rotational corrective movement (i.e. movement about a longitudinal

axis of the tooth), lateral corrective movement, vertical upwards corrective movement, and vertical downward corrective movement of a tooth, or a combination of movements.

In accordance with a second aspect, the present invention provides a dental appliance for correcting tooth alignment, the appliance including a plastically deformable body having a lingual portion and a facial portion, the lingual portion and the facial portion generally opposing each other, with one of the lingual portion and the facial portion being elastically deformable away from the other one of the lingual portion and the facial portion to permit seating of the body on an arch of teeth having one or more misaligned teeth with the teeth in the arch being received between the two portions, so that in use the elastically deformed portion of the body applies a correction force on at least one misaligned tooth in the arch in a direction towards the other one of the lingual portion and the facial portion, said deformable portion of the body being constructed such that a correction force applied thereby on a lower portion of the crown of said misaligned tooth exceeds a force applied on an upper part of the crown of the misaligned tooth.

In accordance with a third aspect, the present invention provides a dental appliance for correcting tooth alignment, the appliance including a body for seating on an arch of teeth having one or more misaligned tooth, the body being constructed to be elastically deformed when seated on the arch of teeth and, by virtue of said elastic deformation, to apply a correction force on at least one misaligned tooth in the arch for moving the misaligned tooth, the appliance being constructed for effecting movement of up to about 1mm of said at least one misaligned tooth.

In accordance with a fourth aspect, the present invention provides a dental appliance for correcting tooth alignment, the appliance including an elastically deformable body for seating on an arch of teeth having at least one misaligned tooth, the body being constructed to be elastically deformed when seated on an arch of teeth, and when seated on the arch for applying, by virtue of said elastic deformation, a greater correction force on a lower part of the crown of at least one misaligned tooth in the arch than on an upper part of the crown of the misaligned tooth.

In accordance with a fifth aspect, the present invention provides a dental appliance for correcting tooth alignment, the appliance including an elastically deformable body for seating on an arch of teeth having at least one misaligned tooth, the body being constructed to be elastically deformed when seated on an arch of teeth, and when seated on the arch for applying, by virtue of said elastic deformation, a correction force on at least one misaligned tooth in the arch on a lower part of the crown of the misaligned tooth, for moving the misaligned tooth.

In accordance with a sixth aspect, the present invention provides a set of appliances for correcting tooth alignment, the set including a plurality of appliances as hereinbefore described, each having a pre-seated condition and a seated condition, to be used in series for incrementally correcting tooth alignment.

Preferably, the appliances of the set are shaped such that the pre-seated condition of the body of one appliance, as far as accommodation of a lower part or base of the crown of each misaligned tooth by its recess is concerned, substantially corresponds with the seated condition of the body of the succeeding appliance in the set.

In accordance with the seventh aspect, the present invention provides a method of forming an appliance for correcting tooth alignment, the method including:

manipulating a three-dimensional representation of an arch of teeth in pre-alignment positions to include also a required post-alignment position of each misaligned tooth in the arch; and

forming the appliance based on the manipulated three-dimensional representation of the teeth in the arch.

Preferably, manipulation of the three-dimensional representation include discarding part of each misaligned tooth, so that the manipulated representation represents part of each misaligned tooth in its pre-alignment position and the entire misaligned tooth in its post-alignment position. Preferably, the manipulated model will include an upper part of each misaligned tooth in its misaligned position.

The method, prior to said manipulation of the three-dimensional representation, preferably includes creating the three-dimensional representation of the teeth in the arch in their pre-alignment positions. The three-dimensional representation can be created by making use of photographs, X-rays, and the like. The three-dimensional representation can be created digitally, so that it is in the form of a computer simulated model, or it can be created manually, so that it is in the form of a physical model.

When a set of appliances is to be formed, the method preferably, after forming of each individual appliance, includes manipulating the three-dimensional representation.

In accordance with an eighth aspect of the invention, there is provided a method of correcting tooth alignment, the method including applying a correction force by means of an elastically deformable tooth alignment appliance on a lower part of the crown of a misaligned tooth.

Naturally, the correction force will be applied to the misaligned tooth in a direction in which the tooth is to be moved to correct its alignment. Thus, the misaligned tooth will be moved from a pre-aligned position to a post-aligned position.

The method, in one embodiment, includes simultaneously correcting alignment of more than one tooth.

In accordance with a ninth aspect, the present invention provides a method of correcting tooth alignment, the method including using an appliance as hereinbefore described.

Brief Description of the Drawings

A preferred embodiment of the present invention will now be described, by way of example only, with reference to the accompanying schematic drawings wherein:

Figure 1 is a top plan view of an embodiment of an appliance for correcting tooth alignment;

Figure 2 is a partial cross-sectional view of the appliance shown in Figure 1;

Figure 3 is a top plan view of part of a lower arch of teeth of a patient;

Figure 4 is a side elevation of the arch of teeth shown in Figure 3;

Figure 5 is a partial cross-sectional view of the appliance shown in Figures 1 and 2 superimposed over a side elevation of the teeth shown in Figure 3; and

Figures 6-10 are partial cross-sectional views of the appliance in accordance with the invention at various stages during correction of alignment of the teeth shown in Figure 3.

Detailed Description of the Preferred Embodiments

With reference to the drawings, an embodiment of an appliance for correcting tooth alignment is generally designated by reference numeral 20. The appliance 20, as will be described further hereunder, is a removable appliance which in use seats on an arch of teeth in the general fashion of a mouthguard, and employs elasticity to correct misalignment of teeth. As will become more apparent hereunder, the appliance 20 is custom made in accordance with a particular set of teeth whose alignment requires correction.

The appliance 20 comprises an elongated body 22 defining a recess 24 for accommodating teeth when the appliance 20 is seated on an arch of teeth.

The body 22 of the appliance 20 is generally in the form of a transparent thin-walled shell which is shaped such that when seen in outline in plan view (Figure 1), it follows the general profile of an arch of teeth. Although the appliance is shown schematically in the drawings, it will in practise be contoured such that it follows the contours of the teeth in an arch. In this regard, it is to be appreciated that the body 22,

when seen in outline in cross-sectional view, will in practise, by virtue of the shape of the profiles of teeth, be generally U-shaped where it is associated with posterior teeth, and generally V-shaped where it is associated with anterior teeth.

The body 22 includes a lingual portion 26, a facial portion 28 and a connecting portion 30 connecting the lingual portion 26 and the facial portion 28 together. The various portions 26, 28, 30 are integrally formed with each other, so that the appliance 20 is of unitary construction. The recess 24 of the body 22 is thus defined between the lingual portion 26, the facial portion 28 and the connecting portion 30. The illustrated embodiment of the appliance 20 is to be used in the context of a lower arch of teeth, so that the connecting portion 30 defines an upper end or roof of the body 22, with a lower end of the body 22, i.e. that end defined between free ends of the lingual portion 26 and the facial portion 28, being open to provide for receipt of teeth into the recess 24. An interior face of the body 22, i.e. that face thereof facing into the recess 24, subject to what is said below, generally follows the contours of the teeth in an arch. Thus, contrary to the illustrations, the body 22 of the appliance 20 will be smoothly contoured.

Turning now to Figures 3 and 4 of the drawings, two central lower teeth 32, 34 and one lateral lower tooth 36 of a patient are shown in top plan view and in side elevation. Only the crowns of the teeth are shown in these figures, and the gums of the patient are also omitted from these figures. The same applies to the other figures in which the teeth 32, 34, 26 are shown. The central tooth 32, which is misaligned, is shown in broken lines in the drawings in a pre-alignment position, and is shown in full lines in a post-alignment position. The misaligned tooth 32 has a lingual surface 32.1, facing towards an interior of the patient's mouth, and a facial surface 32.2, facing towards the exterior of the patient's mouth. Likewise, the teeth 34 and 36 have lingual and facial surfaces which are respectively designated by reference numerals 34.1, 34.2 and 36.1, 36.2. The lingual portion 26 of the body 22 is associated with the lingual portions 32.1, 34.1, 36.1 of the teeth 32, 34, 36, and the facial portion 28 is, in turn, associated with the facial portions 32.2, 34.2, 36.2 of the teeth 32, 34, 26. As can be seen, alignment of the tooth 32 needs to be corrected in relation to the teeth 34, 36 by movement of the tooth 32 in an outward or facial direction, which direction is indicated by arrow 38.

The appliance 20 is constructed of a material which is suitable for intraoral use and, as foreshadowed above, is at least partially elastically deformable. In particular, in the illustrated example, at least the lingual portion 26, where it is, along the length of the body 22, associated with the misaligned tooth 32 is elastically deformable. By virtue of said elasticity, the body 22 has a pre-seated condition (Figures 2, 5 and 10), from which

pre-seated condition it, in particular in this example the lingual portion 26 thereof, is elastically deformable to a seated condition (Figure 6) to permit, as described further hereunder, proper seating of the appliance on an arch of teeth. In its pre-seated condition (see in particular Figure 5), the recess 24 of the body 22 simultaneously provides accommodation for the misaligned tooth 32 in its post-alignment position and for at least the tip part of the crown of the tooth 32 in its pre-alignment position. The connecting portion of the body 22 is thus wide enough simultaneously to cover, in this case bridge, the tip of the tooth 32 both with the tooth in its pre-alignment and its post-alignment positions. The lingual portion 26 of the body 22, when the body 22 is in its pre-seated position, slants operatively downwardly towards the facial portion 28. To deform the body 22 into its seated condition, the lingual portion 26 is deformed about the connecting portion 30. The aforedescribed open lower end of the body 22 is thus widened upon deformation of the body 22 towards its seated condition.

Turning now in particular to Figure 5, when forming the appliance 20, both the pre-alignment position (shown in broken lines) of the misaligned tooth 32, as well as the post-alignment position (shown in full lines), i.e. a required aligned position, are taken into account. In particular, when forming the appliance 20, a three-dimensional representation of teeth in an arch is created, each tooth being represented in its present position, i.e. in the case of a misaligned tooth its pre-alignment position. The three-dimensional representation is then manipulated to include also a representation of each misaligned tooth in the arch in a post-alignment position, and to discard or exclude a lower part of each misaligned tooth in its pre-alignment position. The post-alignment position of a misaligned tooth, depending on the degree of alignment required, can be a final required position of the misaligned tooth, or can be an intermediate aligned position. The body 22 of the appliance is then formed such that its recess 24, when the body is in its pre-seated condition (as shown in Figure 5), provides space for simultaneously accommodating the tip of the crown of the misaligned tooth 32, in its pre-alignment position, as well as the entire tooth 32 in its post-alignment position, and such that when the body 22 is in its seated condition, its recess 24 provides accommodation for the entire crown of the tooth 32 in both its pre-alignment and its post-alignment positions.

In one embodiment the manipulated three-dimensional representation is in the form of a physical model, the model serving as a negative for forming the appliance 20. In another embodiment, the manipulated three-dimensional representation is in the form of a digital model, i.e. a computer simulated model, which is then used to form the appliance 20.

In use, as is illustrated in Figures 6-10, the body 22 of the appliance 20 is deformed to its seated condition when the body 22 is seated on teeth of a lower arch. As can be seen in particular in Figures 6 and as briefly mentioned above, the elastic construction of the body 22 is such that, with the body 22 in its seated condition, the recess 24 thereof accommodates the misaligned tooth 32 in its pre-alignment condition, whilst simultaneously still providing a space for accommodating the tooth 32 in a post-alignment position, which space is progressively occupied by the tooth 32 as its alignment is being corrected. With the body 22 of the appliance 20 in its seated condition, and being seated on the teeth on a lower arch, the facial portion 28 of the body 22 engages the facial surfaces 34.2, 36.2 of the teeth 34, 36. In turn, the lingual portion 26 engages and applies, by virtue of said elastic deformation, an alignment force, in the direction of arrow 38, on the lingual surface 32.1 of the tooth 32, in particular at or adjacent the base of the crown of the tooth 32, for moving the tooth 32 towards its required post-alignment position. When the body 22 is deformed from its pre-seated condition to its seated condition, an enclosed angle formed between the lingual portion 26 and the connecting portion 30 increases. As the body returns to its pre-seated condition as the tooth 32 is moved towards its post-alignment condition, said enclosed angle decreases.

By virtue of the correction force being applied on the tooth 32 at or adjacent the base of its crown, the tooth 32 is bodily moved as its alignment is being corrected, as opposed to tipping of the tooth 32 which may result from a greater alignment force being applied to the a tooth at or adjacent its tip.

Depending upon the extent of misalignment of a tooth, a series of appliances 20, each providing for incremental movement of a misaligned tooth, may need to be used. In this regard, it is envisaged that movement of a tooth of up to 1mm can be attained by a single appliance 20. In such a set, the appliances 20 will be shaped such that the pre-seated condition of the body 22 of one appliance 20, as far as accommodation of a lower part or base of the crown of each misaligned tooth by its recess 24 is concerned, substantially corresponds with the seated condition of the body 22 of a successive appliance 20 of the set, i.e. an appliance 20 to be used after said one appliance 20.

Referring briefly back to the formation of the appliance, it is to be appreciated that when a set of appliances 20 are formed, so that intermediate post-alignment positions of a misaligned tooth comes into play, said intermediate positions will be taken into account when forming the various appliances 20, i.e. the model used for forming the appliances 20 will be manipulated after forming of each appliance 20.

Although the example herein described and illustrated pertains particularly to lower anterior teeth, it should be appreciated that it can be applied to correct alignment of any tooth in either the upper or lower arch. Likewise, although in this example the misaligned tooth 32 is moved in a facial or outward direction, it should be appreciated that the appliance 20 can equally advantageously be employed to move misaligned teeth in a lingual or inward direction. In fact, misaligned teeth in an arch can simultaneously respectively be moved in a facial and a lingual direction. It should further be appreciated that although the illustrated example of the embodiment deals with translational movement of a misaligned tooth, i.e. movement in a lingual or facial direction, an appliance of the type described can equally advantageously be employed to effect rotational movement of a tooth, i.e. movement about a longitudinal axis of the tooth. Likewise, the appliance 20 can be used laterally to move a tooth, or to effect a combination of one or more of translational, rotational and lateral movement.

Because of the particular construction of the appliance herein described, significant movement of misaligned teeth can be obtained by use of a single appliance. Furthermore, because the appliance properly seats on the teeth in an arch, correction forces which will be applied by the appliance on the teeth in the arch can be predicted, thereby reducing the risk of damage to the appliance and/or the gum tissue of a patient due to excessive forces.

Although the invention has been described with reference to preferred embodiments, it would be appreciated by persons skilled in the art that the invention may be embodied in many other forms.

Claims:

1. A dental appliance for correcting tooth alignment, the appliance including a body for seating on an arch of teeth, the body being at least partially elastically deformable and having a seated condition into which it is elastically deformable to be seated on an arch of teeth, and the body being constructed, when seated on an arch of teeth, for applying, by virtue of said elastic deformation, a correction force on one or more misaligned teeth, at or adjacent a base of the crown of each misaligned tooth, in a direction in which each misaligned tooth is to be moved to correct its alignment.

2. The dental appliance as claimed in claim 1, wherein the body of the appliance is provided with a recess for receiving teeth, the body having a pre-seated condition from which it is elastically deformable into said seated condition, and the recess, when the body is in its pre-seated condition, providing accommodation for a misaligned tooth in a required post-alignment position and for at least part of the misaligned tooth in a pre-alignment position.

3. The dental appliance as claimed in claim 1 or 2, wherein, when the body is in its seated condition its recess provides for simultaneous accommodation of a misaligned tooth in its required post-alignment position and in its pre-alignment position.

4. The dental appliance as claimed in claim 1, 2 or 3, wherein the body of the appliance is constructed such that when it is in its seated condition, its recess provides for simultaneous accommodation of the entire crown of each misaligned tooth both in its pre-alignment position and its required post-alignment position.

5. The dental appliance as claimed in any one of the preceding claims, wherein the appliance is removable.

6. The dental appliance as claimed in any one of the preceding claims, wherein the appliance is at least partially transparent.

7. The dental appliance as claimed in claim 6, wherein the entire appliance is transparent.

8. The dental appliance as claimed in any one of the preceding claims, wherein the appliance is constructed from a material suitable for intraoral use.

9. The dental appliance as claimed in any one of the preceding claims, wherein the appliance is constructed such that the recess of its body accommodates at least a majority of the teeth in an arch.

10. The dental appliance as claimed in claim 9, wherein the appliance is constructed such that the recess of its body accommodates all of the teeth in an arch.

11. The dental appliance as claimed in any one of the preceding claims, wherein the recess of the body is shaped such that when the body is in both its pre-seated condition and its seated condition, it accommodates each tooth whose alignment does not require correction in the current position of the tooth.

12. The dental appliance as claimed in any one of the preceding claims, wherein the body of the appliance is generally in the form of a shell which, when seen in outline in plan view, follows the general outline of an arch of teeth.

13. The dental appliance as claimed in claim 12, wherein the body is in the form of a relatively thin-walled shell, following the contours of the teeth in an arch.

14. The dental appliance as claimed in any one of the preceding claims, wherein the body of the appliance, when seen in cross-section, is roughly U shaped, when to be used in relation to an upper arch of teeth, or roughly inverted U-shaped, when to be used in relation to a lower arch of teeth.

15. The dental appliance as claimed in claim 14, wherein the body includes a lingual portion associated with lingual surfaces of teeth, a facial portion associated with facial surfaces of teeth, and a connecting portion associated with tips of teeth, the connecting portion connecting the lingual portion and the facial portion together.

16. The dental appliance as claimed in claim 15, wherein, when the body of the appliance is deformed from its pre-seated condition to its seated condition, a part or parts of the lingual portion and/or the facial portion of the body associated with misaligned teeth will be elastically deformed away from the other one of the lingual portion and the facial portion about the connecting portion.

17. The dental appliance as claimed in claim 16, wherein the part of the connecting portion associated with each misaligned tooth is wide enough simultaneously to cover the tip of each misaligned tooth when the tooth is in its pre-alignment position and its required post-alignment position, thereby permitting proper seating of the appliance on an arch of teeth including misaligned teeth.

18. The dental appliance as claimed in claim 17, wherein, in use, with the appliance seated on an arch of teeth, the alignment force applied by the appliance on each misaligned tooth will thus be applied, by said one of the lingual portion and the facial portion of the body which has been elastically deformed, on the tooth at or adjacent the base of the crown of the tooth.

19. A dental appliance for correcting tooth alignment, the appliance including a plastically deformable body having a lingual portion and a facial portion, the lingual portion and the facial portion generally opposing each other, with one of the lingual

portion and the facial portion being elastically deformable away from the other one of the lingual portion and the facial portion to permit seating of the body on an arch of teeth having one or more misaligned teeth with the teeth in the arch being received between the two portions, so that in use the elastically deformed portion of the body applies a correction force on at least one misaligned tooth in the arch in a direction towards the other one of the lingual portion and the facial portion, said deformable portion of the body being constructed such that a correction force applied thereby on a lower portion of the crown of said misaligned tooth exceeds a force applied on an upper part of the crown of the misaligned tooth.

20. A dental appliance for correcting tooth alignment, the appliance including a body for seating on an arch of teeth having one or more misaligned tooth, the body being constructed to be elastically deformed when seated on the arch of teeth and, by virtue of said elastic deformation, to apply a correction force on at least one misaligned tooth in the arch for moving the misaligned tooth, the appliance being constructed for effecting movement of up to about 1mm of said at least one misaligned tooth.

21. A dental appliance for correcting tooth alignment, the appliance including an elastically deformable body for seating on an arch of teeth having at least one misaligned tooth, the body being constructed to be elastically deformed when seated on an arch of teeth, and when seated on the arch for applying, by virtue of said elastic deformation, a greater correction force on a lower part of the crown of at least one misaligned tooth in the arch than on an upper part of the crown of the misaligned tooth.

22. A dental appliance for correcting tooth alignment, the appliance including an elastically deformable body for seating on an arch of teeth having at least one misaligned tooth, the body being constructed to be elastically deformed when seated on an arch of teeth, and when seated on the arch for applying, by virtue of said elastic deformation, a correction force on at least one misaligned tooth in the arch on a lower part of the crown of the misaligned tooth, for moving the misaligned tooth.

23. A set of appliances for correcting tooth alignment, the set including a plurality of the appliances as claimed in any one of the preceding claims, each having a pre-seated condition and a seated condition, to be used in series for incrementally correcting tooth alignment.

24. The set of appliances as claimed in claim 23, wherein the appliances of the set are shaped such that the pre-seated condition of the body of one appliance, as far as accommodation of a lower part or base of the crown of each misaligned tooth by its

recess is concerned, substantially corresponds with the seated condition of the body of the succeeding appliance in the set.

25. A method of forming an appliance for correcting tooth alignment, the method including:

manipulating a three-dimensional representation of an arch of teeth in pre-alignment positions to include also a required post-alignment position of each misaligned tooth in the arch; and

forming the appliance based on the manipulated three-dimensional representation of the teeth in the arch.

26. The method as claimed in claim 25, wherein manipulation of the three-dimensional representation include discarding part of each misaligned tooth, so that the manipulated representation represents part of each misaligned tooth in its pre-alignment position and the entire misaligned tooth in its post-alignment position.

27. The method as claimed in claim 26, wherein the manipulated model includes an upper part of each misaligned tooth in its misaligned position.

28. The method as claimed in claim 27, wherein the method, prior to said manipulation of the three-dimensional representation, includes creating the three-dimensional representation of the teeth in the arch in their pre-alignment positions.

29. The method as claimed in any one of claims 25 to 28, wherein the three-dimensional representation can be created by making use of photographs, X-rays, and the like.

30. The method as claimed in any one of claims 25 to 28, wherein the three-dimensional representation is created digitally.

31. The method as claimed in claim 30, wherein the three-dimensional representation is in the form of a computer simulated model.

32. The method as claimed in any one of claim 25 to 28, wherein the three-dimensional representation is created manually.

33. The method as claimed in claim 32, wherein the three-dimensional representation is in the form of a physical model.

34. The method as claimed in any one of claims 25 to 33, wherein, when a set of appliances is to be formed, the method, after forming of each individual appliance, includes manipulating the three-dimensional representation.

35. A method of correcting tooth alignment, the method including applying a correction force by means of an elastically deformable tooth alignment appliance on a lower part of the crown of a misaligned tooth.

36. The method as claimed in claim 35, wherein the method includes simultaneously correcting alignment of more than one tooth.

37. A dental appliance for correcting tooth alignment, the appliance substantially as described herein with reference to Figs. 1 to 5.

38. A method of correcting tooth alignment, the method substantially as described herein with reference to Figs. 6 to 10.

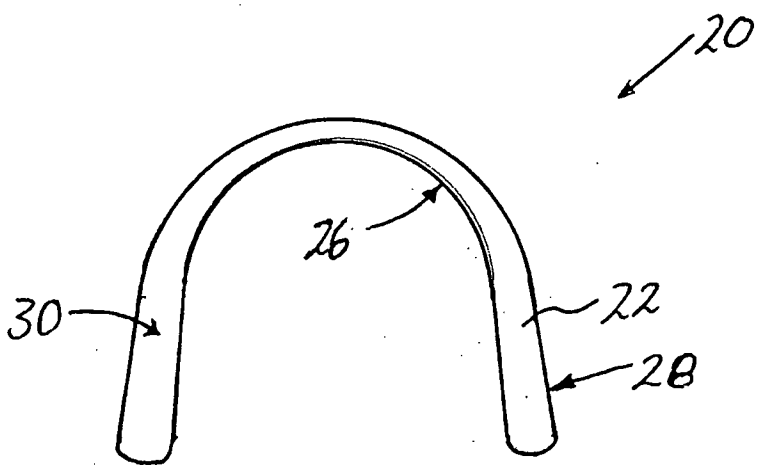

FIG. 1

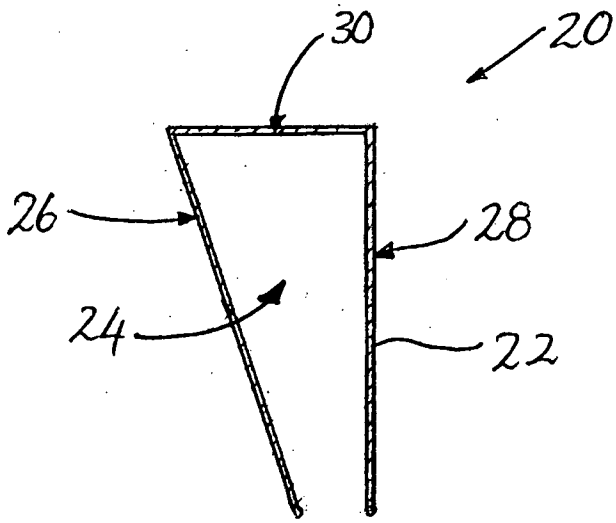

FIG. 2

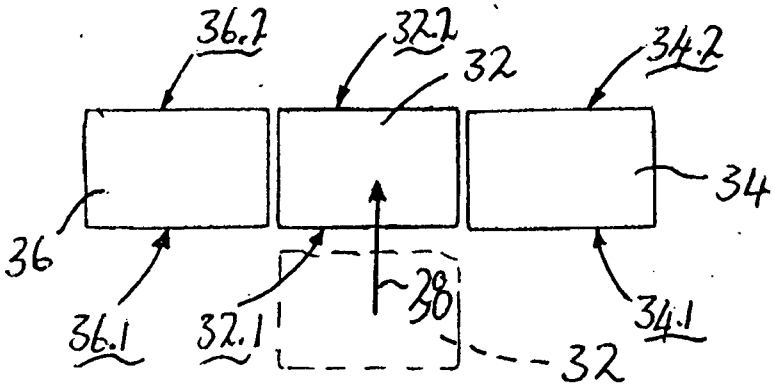

FIG. 3

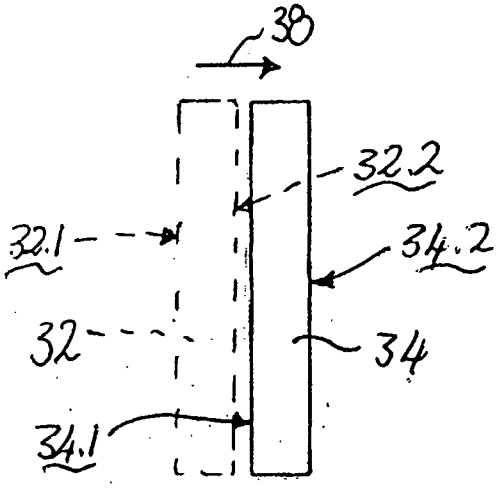

FIG. 4

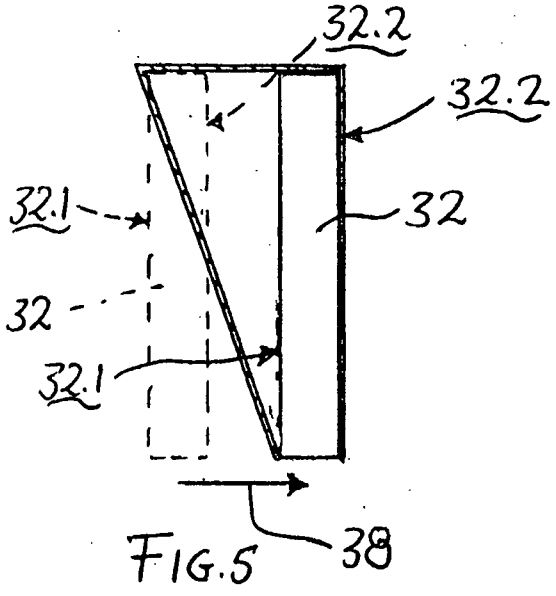

FIG. 5

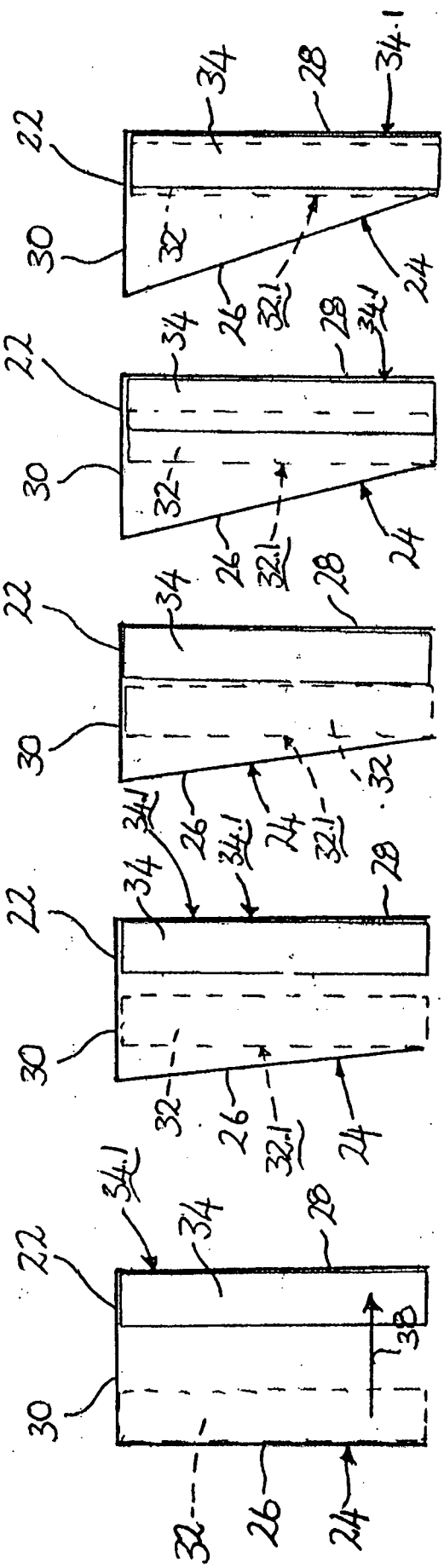

FIG.6

FIG.7

FIG.8

FIG.9

FIG.10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2008/001665

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

A61C 7/00 (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPOQUE: IPC A61C 7/- & KEYWORDS ALIGN, ADJUST, CORRECT, ELASTIC, DEFORMABLE, FLEXIBLE, ORAL, MOUTHGUARD, FORCE, PRESSURE, ORTHODONTIC & OTHERS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US2003/0224311A1 (CRONAUER) 4 December 2003 see page 2 columns 26-28 & figures 1-5	1-24, 35-36
A	US2003/0219690A1 (GRAHAM) 27 November 2003 see page 2 columns 26-29 & figures 1-17	1-24, 35-36
A	US5163840A1 (BOURKE) 17 November 1992 see column 4 line 56 – column 5 line 15 & figures 1-2	1-24, 35-36
A	WO2004004592A1 (UNIVERSITY OF CONNECTICUT) 15 January 2004 see page 7 line 26 – page 8 line 5	1-24, 35-36

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
03 February 2009	25 FEB 2009
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. +61 2 6283 7999	Authorized officer **M.S. HAYNES** AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No : +61 2 6283 2170

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2008/001665

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. [X] Claims Nos.: **37-38**

because they relate to subject matter not required to be searched by this Authority, namely:

Claims 37-38 do not comply with Rule 6.2(a) because they rely on references to the description and/or drawings

2. [ ] Claims Nos.:

because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. [ ] Claims Nos.:

because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. [ ] As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. [ ] As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. [ ] As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. [ ] No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

[ ] The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

[ ] The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

[ ] No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2008/001665

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US5876199A1 (BERGERSEN) 2 March 1999 see column 4 lines 7 – 17 & figures 1-7	1-24, 35-36
X	WO1994010935A1 (ORMCO CORPORATION) 26 May 1994 see entire specification`	25, 29-34
X	US6244861B1 (ANDREIKO ET AL) 12 Jun 2001 see column 3 line 36 – column 6 line 48	25, 29-31, 34

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/AU2008/001665

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	2003224311	AU	2003238784	CA	2488195	US	7104790
		US	7416407	US	2006275730	US	2007184398
		WO	2004017854				
US	2003219690	US	6790036				
US	5163840	AU	79302/91	US	5536168		
WO	2004004592	AU	2003247718	EP	1539020	US	7186115
		US	2004013994	US	2007190478		
US	5876199	AU	92030/98	CA	2302518	EP	1017330
		HU	0101020	PL	345903	WO	9909908
US	6244861	AU	55988/94	DE	4234661	EP	0667753
		EP	0695539	EP	0696444	FR	2682282
		JP	5261124	JP	8168498	JP	8168499
		US	5139419	US	5368478	US	5395238
		US	5431562	US	5447432	US	5454717
		US	5456600	US	5464349	US	5474448
		US	5518397	US	5533895	US	5542842
		US	5683243	US	6015289	US	6616444
		US	2002006597	US	2004115586	WO	9410935

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX