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(54) Title: JIGS FOR PLACING DENTAL IMPLANT ANALOGS IN MODELS AND METHODS OF DOING THE SAME

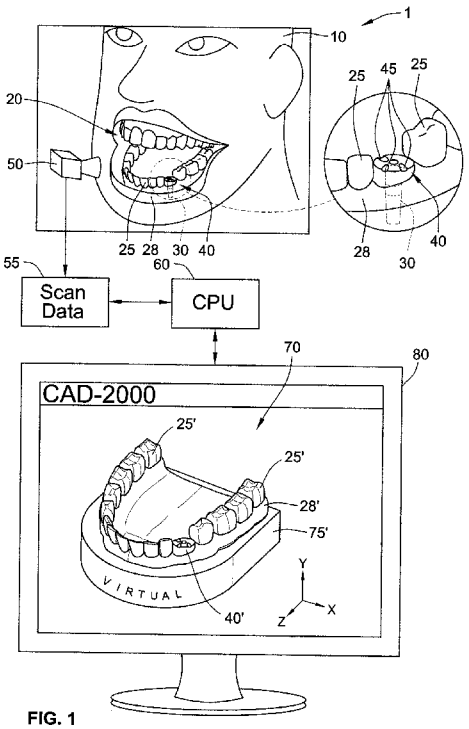


FIG. 1

(57) Abstract: A placement jig for locating a dental implant analog in a physical model of a patient's mouth includes a base, a guide-strut receiving feature, a throughbore, and an angled receiving feature. The guide-strut receiving feature is positioned within the base and is configured to receive a guide-strut of the physical model thereby positioning a lower surface of the placement jig at a desired distance from an opening of a bore in the physical model. The throughbore receives a screw therethrough that engages the dental implant analog such that the dental implant analog is removably coupled to the base. The angled receiving feature is positioned about the throughbore on the lower surface of the base. The angled receiving feature includes a mating surface that is configured to abut a custom abutment positioned between the mating surface and the dental implant analog.

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AMENDED CLAIMS
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CLAIMS

1. A method of locating a dental implant analog in a model of a patient's mouth for use in creating a tooth prosthesis, comprising:

scanning at least a portion of the patient's mouth to generate scan data, the scanned portion of the patient's mouth including teeth and an attachment member, the attachment member including at least one informational marker indicating the location of a dental implant installed in the patient's mouth;

creating a three-dimensional computer model of at least a portion of the patient's mouth using the scan data, the three-dimensional computer model including (i) virtual teeth that correspond with the teeth in the patient's mouth, (ii) a virtual bore at a position based on the at least one informational marker, and (iii) at least one virtual guide strut positioned adjacent to the virtual teeth and spaced from the virtual bore; and

fabricating, using a fabrication machine, a physical model of the at least a portion of the patient's mouth based on the three-dimensional computer model, the physical model including (i) a bore corresponding to the virtual bore, and (ii) at least one guide strut corresponding to the at least one virtual guide strut, the at least one guide strut to be used in positioning the dental implant analog within the bore of the physical model at a position and an orientation corresponding to the location and the orientation of the dental implant in the patient's mouth.

2. The method of claim 1, further comprising coupling the dental implant analog to a placement jig, the placement jig including at least one guide-strut receiving feature.

3. The method of claim 2, further comprising registering the placement jig on the physical model of the at least a portion of the patient's mouth, the registering including mating the at least one guide-strut receiving feature of the placement jig with the at least one guide strut of the physical model such that the dental implant analog is positioned within the bore of the physical model at the position and the orientation corresponding to the location and the orientation of the dental implant in the patient's mouth.

4. The method of claim 3, wherein the dental implant analog is coupled to the placement jig such that a central axis of the dental implant analog is perpendicular to a base of the placement jig.

AMENDED SHEET (ARTICLE 19)

5. The method of claim 4, wherein the at least one guide strut and a central axis of the bore of the physical model are at an angle α with respect to vertical such that in response to the registering, the dental implant analog is positioned within the bore with its central axis at the angle α with respect to vertical.

6. The method of claim 5, wherein the angle α is based on an angle of a central axis of the dental implant in the patient's mouth with respect to vertical.

7. The method of claim 2, wherein the placement jig further includes an angled receiving feature.

8. The method of claim 7, further comprising fabricating, using a milling machine, the placement jig from a stock jig blank, the fabricating including milling the angled receiving feature in the stock jig blank based on the three-dimensional computer model.

9. The method of claim 7, wherein the coupling further comprises placing a custom abutment between the angled receiving feature of the placement jig and the dental implant analog.

10. The method of claim 2, further comprising designing a virtual placement jig based on the three-dimensional computer model.

11. The method of claim 10, further comprising developing three-dimensional jig instructions from the designed virtual placement jig for fabricating the placement jig.

12. The method of claim 11, further comprising transmitting the developed three-dimensional jig instructions to the fabrication machine or a different fabrication machine to fabricate the placement jig.

13. The method of claim 12, further comprising fabricating, using the fabrication machine or a different fabrication machine, the placement jig based on the three-dimensional jig instructions.

14. The method of claim 1, further comprising coupling the dental implant analog to an adjustable arm of a placement jig, the adjustable arm having at least two degrees of rotational freedom with respect to a base of the placement jig, the base of the placement jig further including at least one guide-strut receiving feature.

15. The method of claim 14, further comprising manually adjusting the orientation of the adjustable arm with respect to the base of the placement jig based on the three-dimensional computer model.

16. The method of claim 14, further comprising automatically adjusting the orientation of the adjustable arm with respect to the base of the placement jig in response to the placement jig receiving an input.

17. The method of claim 16, wherein the input is based on the three-dimensional computer model.

18. The method of claim 14, further comprising registering the placement jig on the physical model of the at least a portion of the patient's mouth, the registering including mating the at least one guide-strut receiving feature of the placement jig with the at least one guide strut of the physical model such that the dental implant analog is positioned within the bore of the physical model at the position and the orientation corresponding to the location and the orientation of the dental implant in the patient's mouth.

19. The method of claim 18, wherein the registering automatically causes the adjustable arm of the placement jig to move such that a central axis of the dental implant analog coupled thereto is substantially coaxial with a central axis of the bore of the physical model.

20. The method of claim 1, wherein the three-dimensional computer model further includes a virtual attachment member that corresponds with the attachment member in the patient's mouth, the method further comprising removing the virtual attachment member from the three-dimensional computer model.

21. The method of claim 1, further comprising developing three-dimensional physical model instructions from the three-dimensional computer model for fabricating the physical model of the at least a portion of the patient's mouth and transmitting the developed three-dimensional physical model instructions to the fabrication machine to fabricate the physical model of the at least a portion of the patient's mouth.

22. The method of claim 18, further comprising securing the dental implant analog to the bore of the physical model with a securing material.

23. The method of claim 22, further comprising decoupling the placement jig from the dental implant analog and coupling a custom abutment to the dental implant analog.

24. The method of claim 23, further comprising creating the tooth prosthesis using the physical model of the at least a portion of the patient's mouth with the secured dental implant analog and the custom abutment coupled to the dental implant analog.

25. A method of locating a dental implant analog in a model of a patient's mouth for use in creating a tooth prosthesis, comprising:

creating a three-dimensional computer model of at least a portion of the patient's mouth using scan data from a scan of the patient's mouth, the three-dimensional computer model including (i) virtual teeth that correspond with teeth in the patient's mouth, (ii) a virtual bore at a position based on at least one informational marker on an attachment member in the patient's mouth, the at least one informational marker indicating the location and the orientation of a dental implant installed in the patient's mouth, and (iii) a virtual guide strut positioned adjacent to the virtual teeth and spaced from the virtual bore;

fabricating, using a fabrication machine, a physical model of the at least a portion of the patient's mouth based on the three-dimensional computer model, the physical model including (i) a bore corresponding to the virtual bore, and (ii) a guide strut corresponding to the virtual guide strut; and

coupling the dental implant analog to a placement jig, the placement jig including a guide-strut receiving feature to be used in conjunction with the guide strut of the physical model in positioning the dental implant analog within the bore of the physical model at a position and an orientation corresponding to the location and the orientation of the dental implant in the patient's mouth.

26. The method of claim 25, further comprising registering the placement jig on the physical model by mating the guide-strut receiving feature with the guide strut.

27. The method of claim 26, wherein the dental implant analog is coupled to the placement jig such that a central axis of the dental implant analog is perpendicular to a base of the placement jig and wherein a central axis of the guide strut and a central axis of the bore are both at an angle α with respect to vertical such that in response to the registering, the dental implant analog being positioned within the bore with its central axis at the angle α with respect to vertical, the angle α being based on an angle of a central axis of the dental implant in the patient's mouth with respect to vertical.

28. The method of claim 27, further comprising securing the dental implant analog to the bore of the physical model with a securing material and decoupling the placement jig from the dental implant analog and coupling a custom abutment to the dental implant analog.

29. The method of claim 28, further comprising creating the tooth prosthesis using the physical model of the at least a portion of the patient's mouth with the secured dental implant analog and the custom abutment coupled to the dental implant analog.

30. A method of locating a dental implant analog in a physical model of a patient's mouth for use in creating a tooth prosthesis, comprising:

creating a three-dimensional computer model of at least a portion of the patient's mouth using scan data from a scan of the patient's mouth, the three-dimensional computer model including (i) virtual teeth that correspond with teeth in the patient's mouth, (ii) a virtual bore at a position based on at least one informational marker on an attachment member in the patient's mouth, the at least one informational marker indicating the location and the orientation of a dental implant installed in the patient's mouth, and (iii) a virtual guide strut positioned adjacent to the virtual teeth;

fabricating, using a fabrication machine, a physical model of the at least a portion of the patient's mouth based on the three-dimensional computer model, the physical model including (i) a bore corresponding to the virtual bore, and (ii) a guide strut corresponding to the virtual guide strut; and

coupling the dental implant analog to an adjustable arm of a placement jig, the adjustable arm having at least two degrees of rotational freedom with respect to a base of the placement jig, the base of the placement jig further including a guide-strut receiving feature to be used in conjunction with the guide strut of the physical model in positioning the dental implant analog within the bore of the physical model at a position and an orientation corresponding to the location and the orientation of the dental implant in the patient's mouth.

31. The method of claim 30, further comprising manually adjusting the orientation of the adjustable arm with respect to the base of the placement jig based on the three-dimensional computer model.

32. The method of claim 30, further comprising automatically adjusting the orientation of the adjustable arm with respect to the base of the placement jig in response to the placement jig receiving an input, the input being based on the three-dimensional computer model.

33. The method of claim 30, further comprising registering the placement jig on the physical model, the registering including mating the guide-strut receiving feature with the guide strut such that the dental implant analog is positioned within the bore of the physical model at the position and the orientation corresponding to the location and the orientation of the dental implant in the patient's mouth.

34. The method of claim 33, wherein the registering automatically causes the adjustable arm of the placement jig to move such that a central axis of the dental implant analog coupled thereto is substantially coaxial with a central axis of the bore of the physical model.

35. The method of claim 34, further comprising securing the dental implant analog to the bore of the physical model with a securing material and decoupling the adjustable arm of the placement jig from the dental implant analog and coupling a custom abutment to the dental implant analog.

36. The method of claim 35, further comprising creating the tooth prosthesis using the physical model of the at least a portion of the patient's mouth with the secured dental implant analog and the custom abutment coupled to the dental implant analog.