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Chair-side procedure for connecting transpalatal arches with palatal implants

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SUMMARY The present investigation examined a chair-side procedure for connecting a transpalatal arch (TPA) with palatal implants, which does not involve any laboratory work. This new technique was compared with the standard procedure in terms of the number of steps, the time required, and the cost. The total chair-side time needed with the standard procedure was 38 minutes, with the material costs amounting to €159.6. With the chair-side procedure the total time required was 55 minutes, and the cost of the material totalled €34.1. The chair-side procedure was derived from orthodontic treatment concepts and is independent of laboratory input. Its major advantage is that it does not require transfers, which necessitate additional steps. These steps, which are inevitable with the standard procedure, resulted in an unexpectedly high cost level and increased the total cost. The difference in the cost of the material between the two procedures amounted to €125.5 and timewise the difference was 17 minutes. Whilst TPA–implant connections can be made with both the standard and chair-side procedures, the standard procedure, although taking considerably less chair-side time, was four times more expensive than the chair-side procedure.

Introduction

Making and maintaining anchorage systems is a common problem in orthodontic treatment. To solve it both extra- and intra-oral devices have been used. Extra-oral systems include headgear and the Hickham and Delaire masks. Of the intra-oral anchorage systems, the transpalatal and lingual arches, the Nance appliance, and the Jasper Jumper®, as well as inter- and intra-maxillary elastics, are most widely employed (Diedrich, 1993). While children and adolescents generally accept these devices, which are vital for the success of orthodontics, adults often reject them for occupational and social reasons. This particularly applies to extra-oral devices. Temporary implants for stable intra-oral anchorage, which are invisible, are a helpful alternative particularly in this patient group (Shapiro and Kokich, 1988).

For treating patients with full-arch dentitions or for closing extraction sites orthodontically, implants specifically designed for orthodontic anchorage were developed, because the alveolar process is not appropriate for conventional implants (Roberts *et al*., 1989, 1990; Higuchi and Slack, 1991). These are characterized by easy handling, reliable stability, independence of patient co-operation, and minimal surgery. In the maxilla the palate has been reported to be a useful implant site (Triaca *et al*., 1992; Glatzmeier *et al*., 1995; Block and Hoffmann, 1995; Wehrbein *et al*., 1999a,b; Bernhart *et al*., 2000). As the bone volume available at this site is limited and the orthodontic forces applied are low, devices reduced in length and dimension can be used successfully (Wehrbein *et al*., 1996; Kanomi, 1997).

Depending on the clinical situation and the orthodontic treatment concept, implants for

anchorage can be loaded directly or indirectly. Direct anchorage implies that the force is applied to the implant itself (Bernhart *et al*., 2001). Indirect anchorage, by contrast, implies that the teeth forming the reactive unit are stabilized through the palatal implant. This is ensured by a transpalatal arch (TPA) of adequate dimensions (Wehrbein *et al*., 1999a), which prevents loss of anchorage due to the intrinsic elasticity of the system. While standardized, the procedure for connecting the teeth to be stabilized with the implant is relatively complex and time-consuming.

The aims of this investigation were to assess a chair-side procedure for connecting TPAs with palatal implants, which does not involve any laboratory work, and to compare it with the standard procedure in terms of the number of steps, the time required, and the material costs.

Procedure

Both procedures were performed consecutively in one patient by one orthodontist. The time needed for the various steps was recorded with a stopwatch and rounded to full minutes. The cost incurred included the additional implant components as impression coping with screw and implant replica (Branemark®), the laboratory work, and the materials needed. Implant components needed for both procedures were not considered.

Standard procedure for connecting TPAs with palatal implants

Step 1 An alginate impression is made for the study cast.

Step 2 The stone cast and the custom tray are made in the laboratory. The custom tray is used for obtaining a master cast and has an occlusal window at the site of the implant. Through this window the screw of the impression coping can be easily accessed (Figure 1).

Step 3 The impression coping is screwed onto the implant (Figure 2).

Step 4 A silicon impression is obtained and the master cast with the implant replica is made in the laboratory (Figure 3).

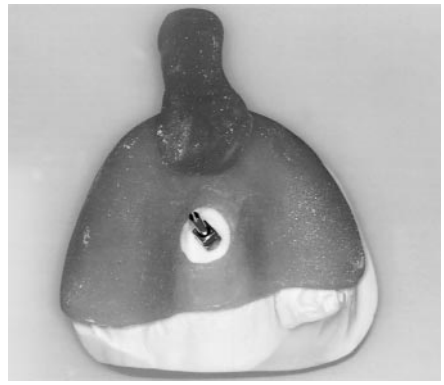

Figure 1 Custom tray with occlusal window for impression coping.

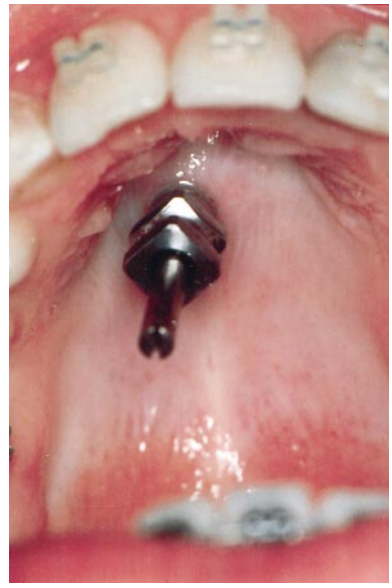

Figure 2 Intra-oral view showing impression coping attached to palatal implant.

Step 5 The TPA–palatal implant connector is made by adapting a 1.2 mm steel wire of spring hardness to the palate and soldering it to the implant cap.

Step 6 The cap is screwed on to the implant with the screw and the TPA is bonded to the teeth to be stabilized (Figure 4).

Chair-side procedure for connecting TPAs with palatal implants

Step 1 The palatal tubes are opened on the occlusal surfaces with a diamond-studded drill so that the TPA can be pulled off occlusally (Figure 5).

Step 2 A small connector made of 0.9 mm steel wire is soldered to the implant cap.

Step 3 The cap is put in place and attached with its screw. The wire ends of the small connector should cross the TPA (Figure 6).

Step 4 The TPA is fixed with Ultra Band-Lok® (Reliance Orthodontic Products Inc., Itasca USA) (Figure 7).

Step 5 A plaster support is made for soldering (Snow White®, Kerr, USA) and the Ultra Band-Lok® cement is removed with a cutter (Figure 8).

Step 6 The two connections are soldered and the anchorage is introduced into the buccal tubes occlusally. The implant cap is screwed onto the implant. The TPA is

Figure 3 Silicon impression with implant replica before filling with plaster to obtain master cast.

Figure 5 The occlusal surface of the first molar band is opened with a diamond-studded drill.

Figure 4 Master cast with completed TPA–implant connection.

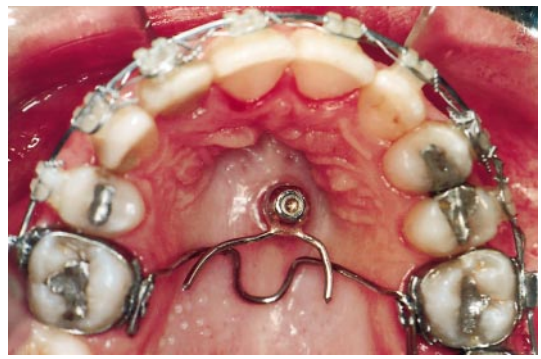

Figure 6 The small connector is screwed down on the palatal implant. The wire ends cross over the TPA.

Figure 7 The wire ends crossing over the TPA are attached with Ultra Band-Lok®.

Figure 8 Plaster support to facilitate soldering. Soldering is carried out serially.

Figure 9 Intra-oral view of completed TPA–implant connection. The implant cap is screwed down, the TPA is attached with a steel ligature and secured with Heliosit® Orthodontic.

attached to the tubes with a 0.010 inch steel ligature and secured with Heliosit® Orthodontic (Vivadent, Liechtenstein) (Figure 9).

Results

The total chair-side time for the standard procedure was 38 minutes excluding laboratory time (Table 1, steps 2 and 5). To connect the TPA with the palatal implant four steps were required at the chair-side.

With the chair-side procedure the total time was 55 minutes for a total of six steps (Table 1).

The net material and manufacturing costs were calculated in Euros (€) (Table 2). With the standard procedure they amounted to €159.6 for a total of seven costing items. With the chair-side procedure the material costs totalled €34.1 for a total of three items (Table 2).

Table 1 Time (minutes) required for each step for both standard and chair-side procedure.

Steps	Standard procedure (minutes)	Chair-side procedure (minutes)
1	6	6
2	0	11
3	2	3
4	12	3
5	0	10
6	18	22
Total	38	55

Table 2 Material and manufacturing costs (Euros) required for both standard and chair-side procedures.

Costs	Standard procedure (€)	Chair-side procedure (€)
Study cast	10.9	10.9
Custom tray	18.2	0
Impression coping with screw	54.3	0
Master cast	10.9	0
Implant replica	14.2	0
Wire, 1.2 mm stainless steel	0.2	0
Laboratory work, making and soldering connector	50.9	0
Wire, 0.9 mm stainless steel	0	0.2
Ultra Band-Lok® syringe	0	23
Total	159.6	34.1

Discussion

Palatal implants providing optimal anchorage in the maxilla have made new orthodontic treatment modalities possible (Triaca *et al*., 1992; Block and Hoffmann, 1995; Glatzmeier *et al*., 1995; Wehrbein *et al*., 1999; Bernhart *et al*., 2000). The concept underlying them has been examined both experimentally and clinically, but specific problems such as connecting the TPA with the palatal implant are still in need of perfection for routine use in the clinic. These problems may be solved by standardizing the procedure and/or by simplifying the technique for connecting the TPA with the palatal implants. Plug-in connectors or adhesive techniques are possible solutions.

The standard procedure for connecting TPAs with palatal implants was derived from prosthodontic work. It is well established, but needs considerable laboratory input and was found to be quite cost- and material-intensive in the present study.

The chair-side procedure, by contrast, was derived from orthodontic treatment concepts and is independent of laboratory input. Its major advantage is that it does not require transfers, which necessitate additional steps including impression taking, preparing a custom tray, and making a master cast with an implant replica. These steps, which are inevitable with the standard procedure, resulted in an unexpectedly high cost level and increased the total cost of materials. No differences have been noted clinically between the two methods in terms of the longevity of the connection between TPA and palatal implants, and in terms of patient comfort.

The difference in cost between the two procedures was €125.5. This means that the chair-side procedure resulted in a saving of 78.6 per cent of the total cost, as the net amount for the standard procedure was €159.6. Interestingly, the implant components accounted for 43 per cent of the total cost versus €34.1 with the chair-side procedure. This amount included the price of the cement syringe (Ultra Band-Lok®) for the first use. But based on the amount of cement used in this study, 10 indexes can be made with a single cement syringe in the chair-side procedure.

The time difference between the two procedures was 17 minutes. The standard procedure took 31 per cent less time than the chair-side procedure mainly because two steps were delegated to the laboratory. In orthodontic practices without laboratory facilities the additional logistics required would, however, add to the time needed. This was not considered in the present study. Similarly, the time spent on the three visits of the patient for finalizing the TPA–palatal implant connection with the standard procedure was not taken into account. The chair-side procedure can be undertaken in a single visit so that patient administration is simplified.

Conclusion

TPA–implant connections can be made with both the standard and chair-side procedures. The major advantage of the chair-side procedure is that the cost can be reduced because laboratory work is unnecessary. While the standard procedure was four times as expensive as the chair-side procedure, it took considerably less chair-side time. However, several visits were necessary to finalize the connection. These substantially increased the time and effort needed for patient administration.

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