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A tooth-borne oral device for quadriplegics

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Summary:

The dental technology profession participates in the development of an aiding device for quadriplegics, because in this specific case the patient requires a tooth-borne oral appliance because she is unable to retain a device with biting forces. Retention to the natural dentition is a well understood concept in dental technology and therefore makes this case relevant to dental technology.

Patient history:

The specific patient for which this aiding device is made, is an eleven year old female and she is a permanent resident at the Tygerberg hospital. She suffers from Gillain Barre syndrome which causes paralysis from the neck down in this specific case. She is thus a quadriplegic which means that she has no use of her upper or lower limbs.

More on Gillain Barre syndrome:

Gillain Barre syndrome causes paralyses of the limbs and chest and it can even effect the facial muscles to a certain extend like in the case with this patient. The cause of the disease is still unknown and up to date there is no
cure for it and we only no that it is a viral infection. The disease effects 1 in every 100000 people, but it effects no particular race, gender or age group. Usually there is a partial or total recovery, but sometimes the paralyses is indefinite like in the case of this particular patient.¹

**Patient condition:**

The patient is a quadriplegic with limited movement of the head. She is connected to a respirator and she now has the need to be more independent in the sense that she wants to use a computer with the aid of a device using the movement of her head to guide the device. She is an eleven year old girl meaning that her dentition is still changing constantly. This makes the fabrication of a tooth-borne appliance difficult as the appliance will have to be replaced regularly as not to interfere with the eruption of the teeth. This problem is overcome by making a device with a mechanical part removable from the tooth-borne part so that just the tooth-borne part can be replaced.
Background:

A prosthesis was made by an occupational therapist for the patient and the prosthesis was gripped by biting forces. The mouthpiece was bitten and a stick connected to that mouthpiece exited the mouth and operated the keyboard. The appliance was unsuccessful because of the constant pressure necessary by her weak masseter muscles to retain the appliance.

Importance of this case:

The reasons that this case is now done by a dental technologist and not an occupational therapist are that:

1. All similar devices are retained by biting forces.
2. This candidate needs a device that is tooth-borne because of her weak facial muscles.
3. Retention must be of such a nature that it doesn't interfere with the tooth eruption of the young candidate.
4. Retention of a device to the natural dentition is well understood and practiced in dental technology which makes this case relevant to dental technology.

A functional device based on a device created by occupational therapists combined with the retentive element created by dental technologists will be the result of this case.

**Possible action plans:**

![Mouthstick device: Rappaport; Smokler:1979](image)

1. **Mouthstick device:** This is a tooth-borne oral device with a stick exiting the mouth operating the keyboard with head movement.

   **Advantages of this device include:**
   1. This device is easy to fabricate.
   2. The device is inexpensive to fabricate.
   3. The device is simple to use.
   4. No biting forces are necessary to retain this device.

   **Disadvantages of this device include:**
1. The length of the device can't be altered by the user.

2. The user may have difficulty communicating when having this device in the mouth.²

2. **Telescopic mouth device:** This is a tooth-borne oral device with a stick exiting the mouth with a motor and switches that are operated by the tongue to extend or retract the stick.

**Advantages of this device include:**

1. The user will be more self supportive with this device.

2. The user will be able to extend or retract the stick of the device.

3. No biting forces are necessary to retain this device.³

**Disadvantages of this device include:**

1. This device is very difficult to fabricate.

2. This device is expensive to fabricate.

3. This device is complicated to use especially for a young user.³
3. Extra oral chin cap: This is a chin cap with a stick extending from the cap to operate the keyboard. The cap is secured with straps around the head.

Advantages of this device include:
1. The patient will have ease at communicating when having this device in the mouth.
2. It is easy to keep this device clean.

Disadvantages of this device include:
1. It is uncomfortable to wear this device.
2. The user has no independence with this device as this device will have to be put on and taken off by another person.

Most suitable and chosen treatment option:

The mouthstick device

Reasons:
1. It is inexpensive to fabricate this device.
2. It is easy to fabricate this device.
3. The user has movement of the head, therefore it is not necessary to be able to extend or retract the device.
4. This device is simple to use for this young user.
Laboratory procedures:

Models were poured from the impressions received. The models were articulated and a special two-ply mouth guard material was applied to the upper model and it was then trimmed in the usual manner as for a gum guard. Orthodontic acrylic was applied to the gum-guard to form a thicker section over the upper arch and then special screw sleeves were inserted into the acrylic for the mechanical part to be screwed into.

With the retentive oral part done, plans were drawn for the mechanical part based on the mouthstick device discussed earlier. The mechanical part was then made by the H.G. Molenaar engineering company who made the device free of charge for the young patient. The mechanical part was made of aluminium for the device to be light weight. After the piece was completed, it was polished and screwed to the retentive part.
A magnet was fixed in the pipe of the device approximately 2.5cm from the tip so that the removable tip can attach itself to the device when the patient slides the device over the tip so that the tip slides into the pipe of the device until it reaches the magnet.

This removable tip has a screw screwed into it so that the tip can attach itself to the magnet as indicated on the photo. It is a steel screw as aluminium is not magnetic. The removable tip also has a thinned section seen on the photo that will fit into the stand. The patient will then be able to retract the device and the tip will stay in the stand and another tip with another function can be picked up with the device.

A variety of tips will be made in future, all with same design except for the functional tip that will be different with each tip each with its own function. These tips will include one with a rubber sleeve over the tip so that a keyboard can be operated and also other tips with for example a paint brush
connected to the tip to paint with. There are many more possibilities to think of.

( Finished prosthesis)
References:

