

# A Six-Month Assessment of Oral Health-Related Quality of Life of Complete Denture Wearers Using Denture Adhesive: A Pilot Study

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### Keywords

Oral quality of life; complete denture; adhesive.

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#### Abstract

**Purpose:** Edentulism and conventional complete denture treatment have been shown to have a negative impact on oral health quality of life (OHQoL). The use of an adhesive agent can provide an alternative to implant-supported prostheses. The objective of this study was to show that new complete dentures using a denture adhesive (DA) improve oral health-related quality of life.

**Materials and Methods:** The oral health QoL of 143 patients was assessed after 3 months of wearing new complete dentures. Fourteen participants presented a low geriatric oral health assessment index (GOHAI) score and were included in this study and asked to use a DA. Oral health QoL and masticatory parameters were assessed at the beginning of the study, then at 3 and 6 months.

**Results:** Significant improvements were observed in the scores obtained for each field of GOHAI (function, pain, discomfort, psychosocial); however, even after use of the DA, no statistically significant change in masticatory parameters was found.

**Conclusions:** These results show that using a DA may improve subjects' ability to manage conventional dentures and enhance their oral quality of life. A larger, prospective, multicenter study is subsequently needed to confirm these results.

Edentulism and conventional complete denture treatment have been shown to have a negative impact on oral health quality of life (OHQoL).<sup>1</sup> The success or failure of oral rehabilitation by conventional dentures hinges on many factors, including the practitioner's technical skills or unfavorable oral conditions.<sup>2</sup> The psychological aspect of complete denture rehabilitation is of great importance, and the patient/practitioner relationship is paramount.<sup>3</sup> Sometimes, despite a practitioner's best efforts and a patient's full cooperation, it remains impossible to meet the expectations of both practitioner and patient. In this situation, the practitioner may propose dental implants.<sup>4</sup> Implants have been shown to improve denture stability and retention, consequently improving oral comfort and oral health QoL for patients;<sup>5,6</sup> however, implant therapy may not be possible for either medical or financial reasons.

A reasonable alternative for patients reporting dissatisfaction with conventional dentures could be to use a denture adhesive (DA), defined as a material used to make a denture adhere to the oral mucosa.<sup>7</sup> Although vegetable gums were originally used as the primary ingredient for DAs, starting in the 1970s synthetic materials have come to dominate today's formulations. There are currently two types of DA in the market: insoluble and soluble fixatives. Insoluble products (pads and wafers composed of a mesh impregnated with an adhesive ingredient such as sodium

alginate or ethylene oxide polymer) do not flow when applied to the base of the dentures.<sup>8,9</sup> Their use can lead to alteration of occlusal relations and thus damage to bearing tissue.<sup>9</sup> Nonetheless, pads and wafers are reported to be more convenient for disabled patients because there is less adhesive left in the mouth after denture removal, and cleansing of the denture is easy to do by peeling off the pad with only light scrubbing required to remove any remaining adhesive.<sup>8,9</sup> Soluble products, such as creams, pastes, and powders, are produced using a blend of fast- and low-solubility polymer salts (carboxy methyl cellulose and poly vinyl ether methyl cellulose), or calcium and zinc salts as adhesive ingredients.<sup>8,9</sup> Inert components such as petroleum, mineral oil, and polyethylene oxide are added to creams to improve binding, as are dyes for color, and silicone dioxide and calcium stearate are added to powders to minimize clumping.<sup>8,9</sup> Peppermint oil and menthol are added for flavoring, as are sodium borate and methylparaban or polyparaban, as preservatives.<sup>8,9</sup> The choice between a powder and a cream is highly subjective. Powder should be sprayed onto the intaglio surface of the denture in a thin layer, and any excess then shaken off before insertion. This process allows for the use of smaller quantities of adhesive, and therefore both denture and mouth are easier to clean. Two possible applications for creams have been described.<sup>8,9</sup> The "strip method," involves placing two thin strips of DA on the denture bases along the ridge in the molar areas and an additional strip along the midpalate line. The "spot method" is recommended by Grasso and consists of placing small spots of DA distributed over the denture base.<sup>8</sup>

There are reports in the literature of potential adverse effects of DA.<sup>10-13</sup> Ekstrand et al<sup>10</sup> reported cytotoxic effects and some cases of microbial contamination. DeVengencie et al<sup>11</sup> claimed that one-third of DA composition was not biocompatible. Al et al<sup>12</sup> described the irritation potential of five DAs and showed that cytotoxicity either appeared or tended to increase in relation to time of exposure to DA; however, these in vitro results may not be systematically applied to a clinical context. In normal settings, cytotoxicity would be expected to diminish as contact between DA and mucosa was decreased by frequent DA replacement.<sup>11,12</sup> Furthermore, denture stomatitis is commonly caused by microbial contamination of the prostheses and the bonding agent in the denture base material.<sup>14</sup> Under these conditions, it is difficult to reach a conclusion regarding the negative or positive effect of DA use. Under normal use and with suitable oral hygiene, DAs do not present side effects:<sup>8,15,16</sup> however, DAs are not systematically given to those patients most likely to benefit from using them, and those who are given a DA are rarely coached on how to use it.<sup>17,18</sup> Although there are no published reports of severe DA-related side effects,<sup>15</sup> and although studies have demonstrated that DA is a useful device, <sup>16,18-25</sup> information for patients about DAs seems to be more readily provided by advertising material than by practitioners. The reason for this is that DA use has been stigmatized by dentists for decades, based on the rationale that any case of dentures requiring DA would reflect badly on a practitioner's technical skills.21

Many studies have explored the efficacy of DA use in terms of objective parameters (retention, stability, chewing parameters),<sup>22-32</sup> but there have been no clinical studies on the impact of DA on the oral health-related quality of life (OHRQoL) of denture wearers. Practitioners can draw on a number of instruments for evaluating the oral health QoL of the elderly, including the oral health impact profile (OHIP), oral impacts on daily performances, and geriatric oral health assessment index (GOHAI).<sup>33,34</sup> These questionnaires explore the functional, social, and psychological impacts of oral disorders. The GOHAI is a 12-item assessment questionnaire originally developed by Atchinson and Dolan in 1990 for use with elderly populations,35 later renamed the General Oral Health Assessment Index,<sup>36</sup> and has also been used in younger adults.<sup>37</sup> It measures patient-reported oral functional problems (6 of the 12 items explore functional limitations or pain and discomfort) together with the psychosocial impacts associated with oral disease. GOHAI has been validated in various languages,38-45 including French.<sup>46</sup> Oral pain, denture dislodgements, and xerostomia influence masticatory difficulties.47-49 The GOHAI has been shown to be sensitive to the provision of dental care,<sup>50</sup> more appropriate when considering functional and psychosocial impacts, and better able to detect change within a subject than OHIP-14,<sup>51</sup> often used in OHROoL evaluations.<sup>52</sup> The objective of this study was to assess whether the use of an adhesive agent could improve the OHRQoL (subjective approach) and masticatory parameters (objective approach) of complete denture wearers.

# **Materials and methods**

## Population

The participants were taken from a sample of 143 patients referred to the Clermont-Ferrand Dental Hospital (France) over a 3-year period (2004-2007) for complete denture treatment. Those participants presenting a low GOHAI score (poor OHRQoL) were included in this study and asked to use a denture adhesive (Polident, GlaxoSmithKline, Philadelphia, PA) on both prostheses, daily, for a 6-month period, following the "strip method" protocol described by Grasso<sup>8</sup> and Shay.<sup>9</sup> New dentures were constructed, and two prosthodontist experts (calibrated to the evaluation) checked the conformity of the prosthetic design. After a 3-month period of adaptation to their new dentures,<sup>1</sup> the patients were assessed in terms of OHROoL using the GOHAI questionnaire. Those patients able to answer the GOHAI questionnaire and whose GOHAI score was low (<50)were included in the study.<sup>35</sup> Participants were excluded if they were: (1) having overdenture treatment on implants or natural teeth, (2) living in a healthcare institution (negative impact on QoL in general), (3) unable to speak or read comfortably, or (4) suffering from serious depression or proven psychiatric disorders (negative effect on integration of the prostheses).<sup>53</sup> Fourteen participants (7 women, 7 men) were included in the study. Mean age was  $65 \pm 7$  years. The participants were explained the aim, benefits, and risks of the experiment, and each participant signed a consent form.

The recordings (GOHAI questionnaire and mastication parameters) were done at three periods in time:

T0 = at the beginning of the study, prior to the use of DA. This was followed by a 3-month period where the subjects were instructed on how to use DA.

T1 = T0 + 3 months, during which time the participants used the DA, after which they were asked to decide whether they wanted to stop using the DA (Group 1, 4 participants) or continue using it (Group 2, 10 participants).

T2 = T0 + 6 months, corresponding to the end of the evaluation period.

GOHAI is a questionnaire on oral QoL. It comprises 12 items grouped into three fields: (1) the functional field (eating, speaking, swallowing), (2) the psychosocial field (concerns, relational discomfort, appearance), (3) the pain or discomfort field (drugs, gingival sensitivity, discomfort when chewing certain foods). The method used in this study was the cumulative method (GOHAI-Add), which consists of summing the scores obtained for each of the 12 GOHAI questions. Each question is scored from 1 to 5. The maximum score is 60 (20 = functional field; 25 = psychosocial field; 15 = pain or discomfort field). According to Atchison and Dolan,<sup>35</sup> a score of 57 to 60 is regarded as high and corresponds to a satisfactory oral QoL. A score from 51 to 56 is regarded as average, and a score of 50 or less is regarded as a low score, reflecting a poor oral QoL.

## **Evaluation of masticatory parameters**

At T0, T1, and T2, chewing parameters were recorded using a video method validated for complete denture wearers.<sup>54</sup> Recordings were made during the mastication of apple and

Group 1



20 Group 2 16 12 8 то **T1** T2 Steps

Figure 1 Evolution during the 6-month study period (T0 to T2) of the mean geriatric oral health assessment index score together with standard deviation is presented for Group 1 Identure adhesive (DA) use stopped at T1] and Group 2 (DA use at T1 and T2).

boiled cheese food samples identical in size and shape (discs of 2 cm in diameter and 1 cm in length). For each recording session, two samples of each food type were chewed by each participant in random order. Video sequences were analyzed using Windows Media Player (Microsoft Inc., Redmond, WA).<sup>54</sup> The chewing parameters measured for each sample were: masticatory sequence duration (vCD); number of chewing cycles per masticatory sequence (vCC); chewing rate (vCF = vCC/vCD).

## Data acquisition and analysis

Statistical analysis was performed using SPSS 11.5 software (SPSS Inc., Chicago, IL). Masticatory parameters obtained from the video recordings were analyzed via a general linear model (GLM) on repeated measures [variable: masticatory parameters at T0, T1, T2; fixed variable: type of food, Group (1/2)]. Data from the GOHAI questionnaire at T0, T1, and T2 were analyzed by applying a repeated-measure GLM [variable: GOHAI parameters; fixed variable: group (1/2)].

# Results

Prior to using DA, the participants enrolled had presented low GOHAI scores. There was a significant improvement in the GOHAI-Add score (F = 12, p < 0.001) from T0 through T1 to T2, even though some participants had stopped using DA (Fig 1). Group 2 participants presented a lower mean GOHAI score  $(39.3 \pm 6.3)$  than those Group 1 participants who had stopped using DA (44.3  $\pm$  2.6). At the end of the study, oral QoL of the participants reached the "average" bracket (51  $\leq$ GOHAI < 56). There was a significant improvement in the mean scores obtained for the GOHAI questionnaire functional field (F = 7, p = 0.01) (Fig 2) and pain or discomfort field (F = 8, p < 0.01) (Fig 3) from T0 through T1 to T2. For the psychosocial field (F = 7, p = 0.01), the mean scores improved from T0 to T1 (Fig 4). There were no between-group differences.

Figure 2 Evolution over the three evaluation steps (T0, T1, T2) of the mean scores obtained for the functional field of geriatric oral health assessment index for Group 1 Identure adhesive (DA) stopped at T11 and Group 2 (DA at T1 and T2).

### **Masticatory parameters**

Functional field

Table 1 presents the means of the data obtained during the cheese and apple sample mastication sequences for each group of participants. The repeated-measure GLM did not show differences between periods T0, T1, and T2 for the cheese samples. Group 1 participants showed a slight decrease in number of chewing cycles when using DA. The repeated-measure GLM revealed between-period differences for apple samples, with those participants using DA performing fewer chewing cycles. Statistical analysis showed between-group differences in the number of chewing cycles per sequence, regardless of the food





Figure 3 Evolution over the three evaluation steps (T0, T1, T2) of the mean scores obtained for the pain/discomfort field of geriatric oral health assessment index for Group 1 [denture adhesive (DA) stopped at T1] and Group 2 (DA at T1 and T2).



Figure 4 Evolution over the three evaluation steps (T0, T1, T2) of the mean scores obtained for the psychosocial field of geriatric oral health assessment index for Group 1 [denture adhesive (DA) stopped at T1] and Group 2 (DA at T1 and T2).

(F = 3, p < 0.05 for cheese; F = 6, p < 0.01 for apple). Group 1 participants (DA stopped) performed more cycles per masticatory sequence than Group 2 (DA continued) participants at time points T0, T1, and T2 (F = 10, p < 0.01).

# **Masticatory sequence duration**

The repeated-measure GLM did not show food or period differences in masticatory sequence duration. There was a slight decrease for Group 1 participants and a marked increase for Group 2 participants at T1 when using DA. Statistical analysis showed significant between-group differences (F = 30, p < 0.05) for cheese but not for apples. Group 1 participants masticated longer when eating cheese than did Group 2 participants at all time points (F = 12, p < 0.01).

#### **Chewing rate**

There were no between-group or between-period differences in chewing rates for apple or cheese.

## Discussion

The results of this study showed a significant improvement in the participants' oral QoL and slight modifications in their chewing parameters. Prior to using DA, the participants with new dentures presented low GOHAI scores. There was a significant improvement in oral QoL at 3 months (T1) and at 6 months (T2), even though some participants had stopped using DA. GOHAI scores increased more significantly at T1, with T2 values showing less improvement, especially in those Group 1 participants who had elected to stop using DA. The use of DA during the first 3 months facilitated the neuromuscular and psychological integration of the complete denture wearers. During this period, the DA stabilized the dentures, leading to more regular chewing cycles, more efficient mastication, and

**Table 1** Data obtained from mastication of samples of cheese and apple are presented (mean and standard deviation) for each period (T0: beginning of the study; T1: after 3 months of denture adhesive (DA) use; T2: end of the study) for participants of Group 1 (DA stopped at T1) and Group 2 (DA use throughout the study). Chewing parameters (Variable) were recorded using a video method and are represented by VMT (duration of masticatory sequence), VMC (number of cycles performed during a sequence), and VFQ (chewing rate)

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Food	Step	Variable	Group 1		Group 2	
			Mean	SD	Mean	SD
	TO	VMT	22.7	10.5	11.9	4.3
		VMC	28.5	14.4	14.1	5.7
		VFQ	1.2	0.2	1.2	0.3
Cheese	T1	VMT	18.9	9.0	13.1	4.5
		VMC	22.8	8.9	15.4	5.5
		VFQ	1.3	0.2	1.2	0.2
	T2	VMT	19.3	4.1	13.8	6.9
		VMC	22.0	11.6	14.0	4.3
		VFQ	1.1	0.5	1.1	0.3
	TO	VMT	21.6	8.3	12.2	3.0
		VMC	24.2	10.5	15.5	5.7
		VFQ	1.1	0.3	1.3	0.5
Apple	T1	VMT	18.3	8.0	13.1	5.7
		VMC	23.3	10.5	15.0	4.7
		VFQ	1.3	0.2	1.2	0.4
	T2	VMT	16.1	4.7	13.5	4.4
		VMC	19.9	8.4	16.1	4.7
		VFQ	1.3	0.5	1.2	0.3

patients being more comfortable with their dentures. In this study, DA use led to enhanced prosthesis acceptance and function. During the second period (T1 to T2), the use of DA in Group 2 did not increase GOHAI scores to the same extent as it had between T0 and T1. GOHAI scores for Group 1 increased slightly between T1 and T2, perhaps indicating the limits of the participants' ability to cope with their conventional dentures even when using DA.

Masticatory parameters did not improve significantly with the use of DA, suggesting that these participants had already reached their denture adaptability limits. For Group 1 participants (DA stopped at T1), GOHAI scores did not evolve between T1 and T2, suggesting that their denture adaptability limits had been reached at T1, and that they did not feel the need to continue using the DA. Hence, the Group 1 participants used the DA as a tool for adapting to dentures, and when the participants felt better with their prosthesis, they considered the DA less convenient to use (messy, hard to clean). GOHAI scores from these participants did not decrease between T1 and T2, suggesting that they kept the benefits of the adaptation gained through using the DA even after they had stopped using it. Similarly, DA use also led to an improvement in masticatory parameters, as the participants performed fewer chewing cycles and chewed for less time per masticatory sequence. They maintained this improvement at T2.

These results showed that using DA can improve subjects' ability to adapt to conventional dentures and improve their oral QoL, although the DA-enhanced improvement in QoL was limited. These limits could be extended by using implants to retain or stabilize the denture, as suggested by previous studies.<sup>4-6</sup>

The psychosocial field explored by the GOHAI questionnaire was related to concepts of comfort and well-being. At the beginning of the study, the psychosocial field for Group 2 (DA for 6 months) was scored as acceptable, but at T1 it had shown an improvement, reaching a good score, and this score was maintained at T2. These results confirmed previous reports that subjects using an adhesive agent develop greater confidence in their dentures.<sup>19,24-29</sup> At the beginning of the study, the mean score for the pain and discomfort field was relatively low. With the use of the DA, this score improved significantly at 3 and 6 months. One of the explanations for this improvement may be that the DA increases the amount of the denture seating surface in contact with the denture-bearing tissues, meaning less denture movement.<sup>19</sup> This may translate into less pain. Another explanation may be that the adhesive has a cushioning effect, protecting the tissues and reducing the number of particles collected under the denture flanges.<sup>22,30</sup> Other studies have related an increase in denture retention quality<sup>31</sup> and duration<sup>30</sup> to an overall improvement in chewing "comfort."<sup>15</sup>

This study also explored the functional field of the GOHAI, highlighting a progressive and significant improvement in functional scores over the 6-month period. Scores at T0 were low but increased to a level that could be considered as satisfactory by the end of the study. It has been previously reported that using DA leads to less denture movement<sup>32</sup> during mastication and speech<sup>19,20</sup> by increasing denture retention<sup>16,27,28</sup> and making it easier to refit the prostheses on bearing tissues.<sup>55</sup> DA use increases incision capacity<sup>19,26,29</sup> and occlusion force<sup>17</sup> and reduces denture slippage, meaning more force can be applied when chewing.<sup>22,26</sup> These effects are particularly beneficial when clinical conditions are not favorable to denture rehabilitation (damaged tissues, xerostomia), or when the patient presents decreased learning capability or poor neuromuscular coordination.<sup>21</sup>

Previous studies have shown a positive influence of DA on masticatory parameters.<sup>16,19,56</sup> In this study, no significant improvement of chewing function was found. This could be explained by the inclusion criteria, which screened participants in good general health, with a low GOHAI score. These participants can be considered to be the pathology-free portion of patients unable to adapt and live comfortably with conventional dentures. Further studies would be useful to determine which parameters could be predictors of limited denture adaptability of healthy subjects in order to elaborate protocols to enhance their adaptation to denture use.

Even in situations where an improvement in masticatory parameters was demonstrated, the impact of DA on chewing effectiveness still has to be evaluated. This study reported that 3-month DA use appeared useful in improving adaptation to complete dentures in participants presenting a low GOHAI score. Consequently, this study justifies the implementation of techniques enhancing denture retention. Therefore, protocols should include implant stabilization, and, when not possible for financial or clinical reasons, the systematization of DA use. A larger, prospective, multicenter study according to consort statement is thus needed to confirm these results.<sup>57</sup>

# Conclusions

This study confirms for those individuals in the study with low oral health QoL per the GOHAI that 3 months of DA use led to improvements in all fields explored by the GOHAI questionnaire, that is, function, pain or discomfort, and psychological levels; however, no statistical differences of masticatory parameters were observed.

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