



## The Effectiveness of the Use of "Special Grip Toothbrushes" on Dental Hygiene for Indonesian Patients with Ischemic Stroke

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### Abstract

**Objective:** To find out the effectiveness of specially made brushes with special grips for use by groups of ischemic stroke sufferers for oral hygiene. **Material and Methods:** A sample of 30 stroke patients were taken at the Makassar Stroke Center, Indonesia, with criteria for extreme hemisphere ischemic stroke patients and willing to participate in the study and fill out informed consent. Brush making with a special grip design (modified brush) with Clay mixed material. The oral hygiene assessment procedure of the sample using a modified toothbrush was done in 3 stages before the brush, after brush and on the seventh day. Oral and oral hygiene was measured using the index of Oral Hygiene Index Simplified (OHI-S). The oral hygiene assessment procedure was done in 3 stages before the brush, after brush and on the seventh day. To find out the difference in effectiveness before and after the intervention was analyzed using the paired t-test. The level of significance was set at 5%. **Results:** The highest percentage of stroke patients were female (53.3%), aged 40-60 years (66.7%) with an education level below junior high school (56.7%). There is a difference in the average OHIS score before and after using a special grip toothbrush ( $p < 0.01$ ). **Conclusion:** A special grip toothbrush that is used for Stroke sufferers can help to clean his teeth and mouth.

**Keywords:** Cerebrovascular Disorders; Stroke; Oral Hygiene; Dental Devices, Home Care.

## Introduction

Globally, stroke is the second leading cause of death in people over the age of 60 years and the leading cause of fifth death in people aged 15 to 59 years, common in developing countries [1-3]. In Korea, stroke is the third leading cause of death [4]. In China in 2010, stroke has been a major cause of disease and the prevalence of stroke incidence has increased significantly [5]. The prevalence of stroke in Indonesia amounted to 57.9% of the results of the examination and diagnosed health personnel [6]. Various factors related to psychological and environmental factors, including time, sex, hypertension, and hyperlipidemia [4].

There are two types of strokes: ischemic and hemorrhagic. Approximately 85% of all strokes are ischemic and 15% hemorrhagic [7,8]. Ischemic stroke is caused by blockage of blood supply to the brain, blockage can be caused by the formation of blood clots in arteries that lead to the brain or one of the small blood vessels present in the brain [9] and hemorrhagic stroke caused when blood in the blood vessels burst inside or on the surface of the brain. Because blood leaks into the brain tissue with high pressure, the damage can be greater than the damage caused by a blood clot [10].

Stroke is the second most common cause of disability worldwide in individuals over 60 years; the most common motor dysfunction is hemiparesis because of lesions on the opposite side of the brain. Hemiparesis or weakness on one side of the body is a symptom of motor dysfunction and one type of hemiparesis is dextra hemiparesis which is a weakness or right side paralysis due to damage to the left brain [9]. According to previous research stroke patients have a risk of 4 times the occurrence of disability [11].

Patients with stroke ischemic hemiparesis dextra have problems in grasping, manipulating or controlling toothbrushes, decreasing their effectiveness in using normal manual toothbrushes. So one way that is done to help stroke patients clean the teeth is to make a toothbrush grip that is adjusted to the grip of stroke patients. Modified grips can provide a stable grip for patients to manipulate toothbrushes during cleaning [4,12]. In this study, it was found that stroke patients had oral health status was measured by OHIS index with an average of 4.13. Research has been carried out on various parameters (tooth loss, dental caries experience, and periodontal status) of stroke patients with "bad" conditions [13].

The oral and dental health of stroke patients is generally poor [14], due to the inability to clean the teeth and mouth, from the results of the study that 83.9% of stroke patients in hospitals have difficulty brushing teeth because it depends on the nurse to maintain health their mouths. Dysphagia is common in stroke patients who increase the risk of xerostomia; therefore, oral health education should be given during their stay in the hospital [15,16]. Research using toothbrushes with special handles made of acrylic material [17]. Preparation of special toothbrushes with special handles of acrylic materials by patients has difficulties in processing time, while researchers before conducting research on toothbrushes are specially made from clay material mixed with several easily available ingredients around us [18]. Clay material is a material commonly used by children to make

models of toys. The results of the study showed that the reduction of plaque on the surface of the dental prosthesis was 13.1%, while the percentage of plaque reduction was 21.2%.

Based on the results of the study of the effects of using a toothbrush with a special handle made of Clay material before, this study aimed to determine the effect of using a modified toothbrush to oral hygiene in stroke patients' ischemic hemiparesis dextra.

## Material and Methods

### Study Design and Sample

This type of research is a quasi-experiment with one group pre and post-test design. This study was conducted at Makassar Stroke Center where the number of patients treated at Makassar Stroke Center was 91 people and there were 30 stroke patients according to the study criteria. Samples were selected based on the inclusion criteria of Ischemic stroke patients Hemiparesis Dextran; Has at least 10 remaining teeth; Stroke patients who are willing to participate in the study.

### Data Collection

Oral and oral hygiene was measured using the index of Oral Hygiene Index Simplified (OHI-S). The OHI-S index or index is used to measure the tooth surface area covered by debris or calculus. For the OHI-S examination, the index teeth used were 4 posterior teeth, 2 anterior teeth. How to assess the OHIS index by measuring the debris index and plaque index on the subject. The degree of oral hygiene clinically in OHI-S can be categorized as follows: Good = (0,0 - 1,2); Medium (1.3 - 3.0); Bad (3,1 - 6,0) [8,10]. Brush making with a special grip design (modified brush) (Figure 1) with Clay mixed material [18]. The oral hygiene assessment procedure of the sample using a modified toothbrush was done in 3 stages before the brush, after brush and on the seventh day.



Figure 1. Example of toothbrush made with special grips.

### Data Analysis

Data were analyzed using IBM SPSS Statistics for Windows Software, version 24 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to calculate the absolute and relative frequencies, mean and standard deviation. To find out the difference in effectiveness before and after the intervention was analyzed using the paired t-test. The level of significance was set at 5%.

### Ethical Aspects

This research has received a recommendation from the Research Ethics Committee of Oral Dental Hospital of the Hasanuddin University of Dentistry, and before conducting prior research the patient or family of patients fill out and sign the informed consent sheet. Permission is also given by the Central Hospital Stroke Makassar.

### Results

Table 1 shows the distribution of the sample according to the demographic characteristics. It is possible to observe that the majority were between 40 and 60 years old (66.7%), were female (53.3), did not work (66.7%), the highest level of education is Junior High School graduates (36.7%) and had undergone the stroke between 0 and 4 years (86.7%).

**Table 1. Distribution of the sample according to the demographic characteristics.**

Characteristics	Frequency	
	N	%
Age (in Years)		
<40	2	6.7
40 to 60	20	66.7
>60	8	26.7
Sex		
Male	14	46.7
Female	16	53.3
Work		
Government Employees	2	6.7
Farmers	1	3.3
Traders	6	20.0
Entrepreneur	1	3.3
Does not Work	20	66.7
Level of Education		
No School	1	3.3
Elementary School	5	16.7
Junior High School	11	36.7
High School	10	33.3
University Level	3	10.0
Long Stroke (in Years)		
0 to 4	26	86.7
5 to 9	3	10.0
10 to 14	1	3.3

Table 2 shows the state of pre-treatment dental conditions for the age group 60 years (2.69), male sex (2.65), public servant (2.83), according to the level of education in the group yet finished

primary school (2.87) and according to stroke duration in stroke group <4 years (2.78). The highest mean OHIS values for each assessment variables <40 years of age group (4.75), male (4.3), does not work (4.28); by educational level, the uneducated group had the highest OHIS score of 4.74.

**Table 2. Average Distribution of CIS, DIS, and OIS values before brushing, after brushing on the first day and after brushing on the seventh day.**

Variables	Before			After 1 (Day 1)			After 2 (Day 7)		
	DIS	CIS	OHIS	DIS	CIS	OHIS	DIS	CIS	OHIS
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Age (in Years)									
<40	2.59±0.59	2.25±0.59	4.75±1.20	1.00±0.47	2.08±0.35	3.00±0.85	0.09±0.12	2.08±0.35	2.10±0.28
40 to 60	2.42±0.59	1.58±0.59	3.87±1.08	0.78±0.44	1.57±0.59	2.30±0.88	0.24±0.28	1.57±0.59	1.78±0.77
>60	2.69±0.36	2.02±0.63	4.63±0.94	1.27±1.01	2.00±0.66	3.21±1.54	0.52±0.45	2.00±0.66	2.45±1.01
Sex									
Male	2.65±0.47	1.79±0.65	4.30±1.00	1.11±0.71	1.79±0.65	2.81±1.22	0.36±0.42	1.79±0.65	2.08±0.98
Female	2.36±0.56	1.71±0.63	3.98±1.15	0.76±0.58	1.67±0.60	2.39±1.06	0.26±0.28	1.67±0.60	1.89±0.74
Work									
Government	2.83±0.00	1.42±0.12	4.20±0.14	0.67±0.00	1.42±0.12	2.00±0.14	0.00±0.00	1.42±0.12	1.40±0.14
Farmers	1.33±0.00	0.67±0.00	1.90±0.00	0.67±0.00	0.67±0.00	1.20±0.00	0.00±0.00	0.67±0.00	0.60±0.00
Traders	2.42±0.62	1.78±0.68	4.12±1.22	0.86±0.63	1.78±0.68	2.58±1.25	0.42±0.42	1.78±0.68	2.13±1.02
Entrepreneur	2.33±0.00	1.17±0.00	3.40±0.00	0.83±0.00	1.17±0.00	1.90±0.00	0.33±0.00	1.17±0.00	1.40±0.00
Does not Work	2.56±0.49	1.85±0.61	4.28±1.03	0.98±0.73	1.82±0.60	2.76±1.17	0.32±0.35	1.82±0.60	2.09±0.82
Level Education									
No School	2.87±0.22	1.90±0.71	4.74±0.89	1.53±0.74	1.90±0.71	3.40±1.32	0.47±0.38	1.90±0.71	2.32±1.08
Elementary SC	2.23±0.61	1.50±0.51	3.64±1.06	0.59±0.39	1.47±0.50	2.02±0.74	0.18±0.16	1.47±0.50	1.60±0.56
Junior High SC	2.62±0.31	1.98±0.65	4.39±0.97	1.08±0.69	1.98±0.65	2.99±1.16	0.48±0.43	1.98±0.65	2.40±0.92
High School	2.33±0.87	1.28±0.25	3.57±1.10	0.45±0.39	1.28±0.25	1.67±0.59	0.00±0.00	1.28±0.25	1.27±0.25
University LE	2.48±0.56	1.77±0.62	4.13±1.11	0.96±0.67	1.76±0.63	2.67±1.15	0.34±0.36	1.76±0.63	2.04±0.88
Long Stroke (Years)									
0 to 4	2.78±0.25	1.67±0.88	4.40±1.08	0.89±0.38	1.55±0.69	2.37±1.08	0.00±0.00	1.55±0.69	1.53±0.68
5 to 9	2.17±0.00	1.33±0.00	3.40±0.00	0.00±0.00	1.33±0.00	1.30±0.00	0.33±0.00	1.33±0.00	1.60±0.00
10 to 14	2.50±0.56	1.67±0.59	4.04±1.06	0.93±0.68	1.65±0.57	2.53±1.12	0.29±0.36	1.65±0.57	1.89±0.82
Total	2.49±0.53	1.74±0.62	4.13±1.07	0.92±0.65	1.72±0.61	2.59±1.13	0.3±0.34	1.72±0.61	1.97±0.85

DIS: Debris Index; CIS: Calculus Index; OHIS: Simplified Oral Hygiene Index; Government: Government Employees; Elementary SC: Elementary School; Junior High SC: Junior High School; University LE: University Level.

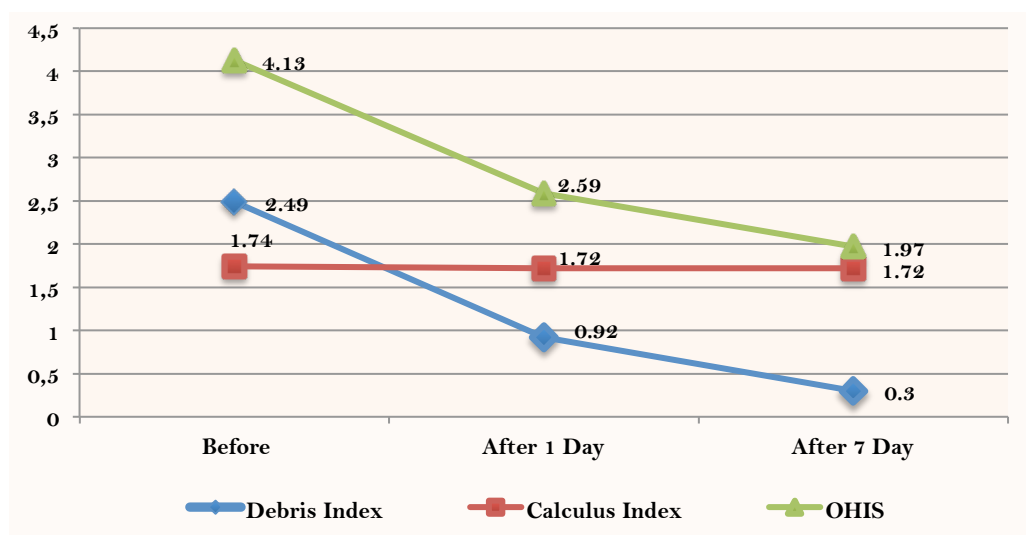
Table 3 shows that by age group there was a significant difference in mean OHIS before and after intervention for the 40-60 year group and >60 years group ( $p<0.001$ ), for the <40 years age group there was no difference in mean score OHIS before and after intervention ( $p = 0.056$ ). By sex there was a significant difference in mean OHIS values before and after intervention ( $p<0.001$ ). For groups of occupations (traders, employers and unemployed), there was a significant difference before and after intervention ( $p<0.001$ ). According to the duration of the stroke, all groups obtained there was a significant difference ( $p<0.001$ ).

Figure 2 shows the mean values of DIS, CIS, and OHIS before and after the intervention. The DIS value before the intervention with an average of 2.49 decreased after the intervention to 0.9 and on the seventh day to 0.3. For CIS values, there was no significant decrease from 1.74 to 1.72. For OHIS averages before intervention averaged 4.13 dropped to 2.59 on the first day of intervention and 1.97 on the seventh day.

**Table 3.** The average difference in OHIS values before and after intervention on the first day, and the seventh day.

Variables	Pre (Day 1) Mean $\pm$ SD	Post (Day 1) Mean $\pm$ SD	Post (Day 7) Mean $\pm$ SD	p-value
Age (in Years)				
<40	4.75 $\pm$ 1.20	3.00 $\pm$ 0.85	2.10 $\pm$ 0.28	0.056
40 to 60	3.87 $\pm$ 1.08	2.30 $\pm$ 0.88	1.78 $\pm$ 0.77	<0.001*
>60	4.63 $\pm$ 0.94	3.21 $\pm$ 1.54	2.45 $\pm$ 1.01	<0.001*
Sex				
Male	4.30 $\pm$ 1.00	2.81 $\pm$ 1.22	2.08 $\pm$ 0.98	<0.001*
Women	3.98 $\pm$ 1.15	2.39 $\pm$ 1.06	1.89 $\pm$ 0.74	<0.001*
Work				
Government Employees	4.20 $\pm$ 0.14	2.00 $\pm$ 0.14	1.40 $\pm$ 0.14	>0.05
Farmers	1.90 $\pm$ 0.00	1.20 $\pm$ 0.00	0.60 $\pm$ 0.00	>0.05
Traders	4.12 $\pm$ 1.22	2.58 $\pm$ 1.25	2.13 $\pm$ 1.02	<0.001*
Entrepreneur	3.40 $\pm$ 0.00	1.90 $\pm$ 0.00	1.40 $\pm$ 0.00	<0.001*
Does Not Work	4.28 $\pm$ 1.03	2.76 $\pm$ 1.17	2.09 $\pm$ 0.82	<0.001*
Level Education				>0.05
No School	4.74 $\pm$ 0.89	3.40 $\pm$ 1.32	2.32 $\pm$ 1.08	
Elementary School	3.64 $\pm$ 1.06	2.02 $\pm$ 0.74	1.60 $\pm$ 0.56	<0.001*
Junior High School	4.39 $\pm$ 0.97	2.99 $\pm$ 1.16	2.40 $\pm$ 0.92	<0.001*
High School	3.57 $\pm$ 1.10	1.67 $\pm$ 0.59	1.27 $\pm$ 0.25	<0.001*
University Level	4.13 $\pm$ 1.11	2.67 $\pm$ 1.15	2.04 $\pm$ 0.88	<0.006*
Long Stroke (Years)				
0 to 4	4.40 $\pm$ 1.08	2.37 $\pm$ 1.08	1.53 $\pm$ 0.68	<0.001*
5 to 9	3.40 $\pm$ 0.00	1.30 $\pm$ 0.00	1.60 $\pm$ 0.00	<0.001*
10 to 14	4.04 $\pm$ 1.06	2.53 $\pm$ 1.12	1.89 $\pm$ 0.82	<0.001*
Total	4.13 $\pm$ 1.07	2.59 $\pm$ 1.13	1.97 $\pm$ 0.85	0.001*

\*Anova test; \*Statistically Significant.



**Figure 2.** The average value of debris, calculus and OHIS before and after intervention.

Figure 3 shows the effectiveness of the use of a toothbrush with a special grip obtained a reduction of before and after intervention on the first day for DIS of 51.54%, before and after the intervention of the seventh day to 89.23%. To reduce the percentage of OHIS value by 45% after the first-day intervention and rise to 52.2% on the seventh day.

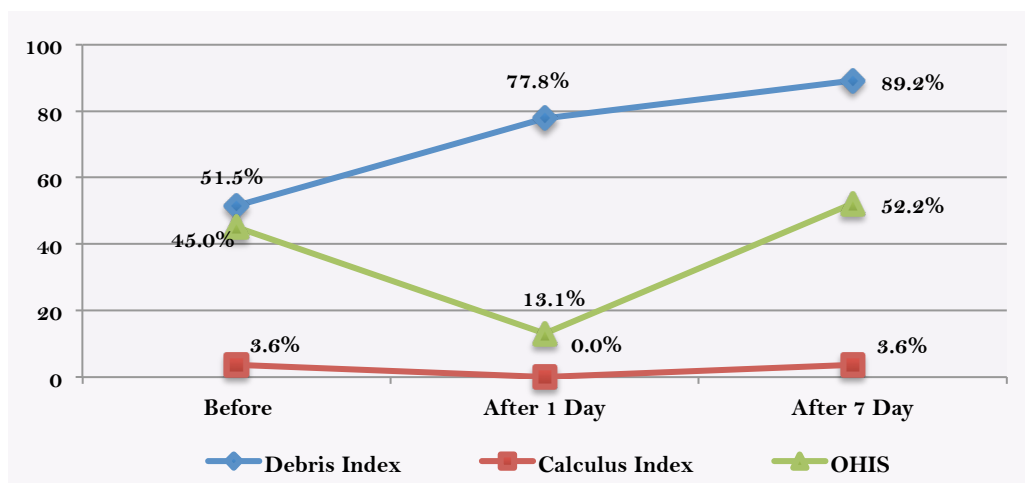


Figure 3. Percentage reduction of debris, calculus and OHIS before and after.

Figure 4 shows the state of oral hygiene of stroke patients before and after the intervention. Circumstances before the intervention where the "bad" oral hygiene status of 86.6% decreased to 10% after using a special toothbrush; while the "moderate" status before only 13.3%, after intervention increased to 73.3%.

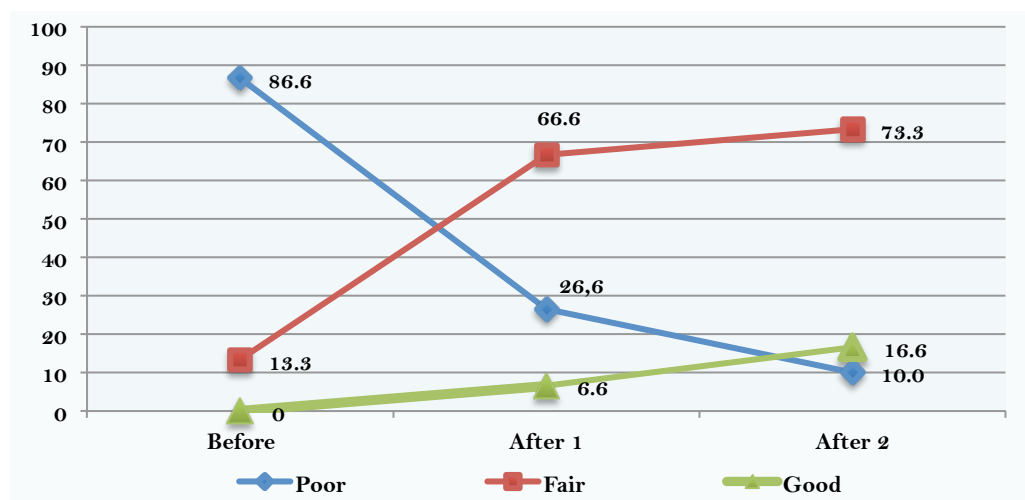


Figure 4. Distribution of percentage of oral hygiene status before and after treatment.

## Discussion

The samples used in this study were stroke ischemic hemiparesis dextra patients, due to problems of grasping, manipulating or controlling toothbrushes, decreasing the effectiveness of using normal manual toothbrushes.

Handling stroke patients for their survival is highly competitive services of high quality. The dental team is part of a multidisciplinary approach to the treatment of stroke patients. The role of the dental team is to advise and assist care services in maintaining proper oral health during the early stages after a stroke [19].



Oral hygiene management for people with stroke is very important because it is known that the oral hygiene of stroke patients is so that it can increase the prevalence of oral disease. It can cause dry mouth, mouth ulcers, and stomatitis, thus adding to the poor oral health of stroke patients. Based on the results of a meta-analysis showing the relationship between periodontitis and ischemic stroke [20]. Therefore, maintenance and promotion of oral health of stroke patients are important factors.

Generally, dental and oral hygiene factors are poorly addressed by the health care workers, and the treatment of stroke patients [6,14,21]. The highest prevalence of stroke patients is a group of people who do not work (66.7%). This group is found in many developing regions. It is suspected that the cause of this group stroke is stress or depression. If grouped based on Family Development Index (FDI), including people with the very severe category. The results of research conducted in Bau-Bau Indonesia were obtained equal to 83.3%, so they really needed to be given special attention in maintaining their health [22].

The results of this study are in line with other studies which state that modified toothbrushes can significantly reduce the amount of dental plaque, in addition to other studies on the ability of parents to clean plaques on full denture prostheses with special toothbrush designs that suggest a decrease 21.8% plaque accumulation compared to conventional toothbrushes of 14.2% [4]. The presence of plaque from poor oral hygiene can lead to decreased salivary deficits of stroke disease [16].

Other studies also say that 89.3% of stroke patients have difficulty in maintaining their own teeth due to illness and inability to communicate on their own and relying on nurses or family families to maintain oral health [14]. Special attention is needed for stroke sufferers other than making special grips as well as how to store toothbrushes, either using chemical solutions or using ultraviolet sanitizing tools [23].

The modified toothbrush is a conventional toothbrush enlarged in accordance with the handle of each individual. The material used to enlarge the toothbrush handle is clay. Clay is a material that is easy to obtain, easy to form, and can dry if on the go so that the manufacturing process is not difficult. This modified toothbrush is aimed at individuals who have limited motor in grasping and using toothbrushes. Increasing the volume of the toothbrush handle can stabilize the grip making it easier for the individual to control and use a toothbrush. The use of this modification toothbrush can be reserved for those who have motor limitations such as children with special limitations. The results of this study are also in accordance with other studies, which state that the ability of "mentally handicapped" children at 12 years is lower than the age of normal children so that "mentally handicapped" children have difficulty in holding and using toothbrush [24].

## Conclusion

The percentage of oral hygiene status of stroke patients with "bad" condition is high and after using special toothbrush can raise the "good" status to be higher, so based on the results it can



be concluded that individual toothbrush with special grip effective in reducing oral hygiene of stroke patient ischemic.

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**Conflict of Interest:** The authors declare no conflicts of interest.

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