Frita Ferlita Shafri Djohan, Association Between Handgrip Strength and Gingival Recession:. Journal of Health and Dental Sciences.e-ISSN 2807-3126 Vol. 05 No. 01: pp. 101-112

ASSOCIATION BETWEEN HANDGRIP STRENGTH AND GINGIVAL RECESSION

(HUBUNGAN ANTARA KEKUATAN GENGGAM DAN RESESI GINGIVA)

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JHDS.unjani.ac.id/jite
Doi: 10.54052/jhds.

Article History
Received:00/00/20
Accepted: 00/00/20

ABSTRACT

Gingival recession refers to the apical displacement of the gingival margin from the cemento-enamel junction (CEJ), which can be caused by mechanical trauma such as excessive brushing force. This phenomenon can affect aesthetics, sensitivity, and overall oral health. Handgrip strength is related to tooth brushing motion. This study aims to examine the relationship between handgrip strength and gingival recession. This research used an analytical observational with a cross-sectional design. With purposive sampling, data were collected from 165 pre-elderly individuals in Cimahi City. Handgrip strength was measured by hand dynamometer, while the gingival recession was clinically assessed with visual. Data was analyzed using the Chi-Square test. The study revealed a prevalence of gingival recession at 94.5%. The analysis results indicated a significant relationship between handgrip strength and the occurrence of gingival recession (p<0.05), with moderate handgrip strength showing the highest proportion of gingival recession. Excessive brushing force contributes to gingival recession, accompanied by high-pressure motion to gingiva and time. There is a

significant association between handgrip strength and gingival recession.

Keywords: gingival recession; handgrip strength; mechanical trauma; tooth brushing

ABSTRAK

Resesi gingiva merupakan perpindahan margin gingiva ke arah apikal dari cemento-enamel junction (CEJ), salah satunya diakibatkan karena trauma mekanis seperti menyikat gigi dengan kekuatan berlebihan. Fenomena ini dapat memengaruhi estetika, sensitivitas, dan kesehatan mulut secara keseluruhan. Kekuatan otot genggam berkaitan dengan gerakan menyikat gigi, penelitian ini bertujuan mencari hubungan kekuatan otot genggam dengan resesi gingiva. Penelitian ini menggunakan desain analitik observasional dengan pendekatan cross-sectional. Data dikumpulkan dari 165 sampel masyarakat pra-lansia di Kota Cimahi, yang dipilih secara purposive sampling. Pengukuran kekuatan otot genggam dilakukan menggunakan hand dynamometer, sedangkan resesi gingiva dilakukan pemeriksaan klinis secara visual. Analisis data menggunakan uji Chi-Square. Penelitian menunjukkan prevalensi resesi gingiva sebesar 94,5%. Hasil uji statistik menunjukkan hubungan signifikan antara kekuatan otot genggam terhadap terjadinya resesi gingiva ($p<0,05$), dengan kekuatan otot genggam kategori sedang menunjukkan proporsi resesi gingiva tertinggi. Menyikat gigi terlalu kuat dapat berperan terhadap terjadinya resesi gingiva, disertai gerakan dengan tekanan kuat pada gingiva dan waktu. Terdapat hubungan bermakna antara kekuatan otot genggam dengan resesi gingiva.

***Kata kunci**: kekuatan otot genggam; menyikat gigi; resesi gingiva; trauma mekanis*

INTRODUCTION

Tooth brushing is the common way to maintain dental and oral hygiene. It aims to prevent dental plaque elimination, clean stains and debris, induce soft tissue regeneration, and caries prevention, periodontal disease or sensitivity. In the last 50 years, tooth brushing has been developed and introduced, such as Bass, Stillman, Charter, Roll and Scrub. There isn't a consistent best method of tooth brushing shown in plaque elimination besides cleaning the dental surface with tooth brushing.[1]

Incorrect tooth brushing can cause damage to hard and/or soft tissues. There are several types of dental hard tissue damage associated with tooth brushing. These include tooth abrasion and gingival recession. In soft tissue, gingival recession is defined as the displacement of the gingival margin apical to the cementoenamel junction of the tooth.[2] In hard tissue, it is called abrasion, which is one of the non-carious cervical lesions in the form of tooth surface loss. Abrasion is caused by the friction of an abrasive external object against the tooth surface, which can be caused by brushing and other mechanical stresses. The morphology of hard and soft tissue lesions is related to the force, duration, frequency and direction of toothbrush use.[1] High prevalence of gingival recession has been reported in the Americas (63%-89%), Europe (25%-84%), and Australia (71%), but lower prevalence has been found in Africa (28%) and Asia (15%).[2] Inappropriate brushing behaviour, combined with excessive hand muscle-like force, can lead to gingival recession, abrasion, periodontal disease, and malocclusion.[3]

Grip strength is important in many daily activities, including brushing teeth. This strength depends on several factors, including age, gender, and the size and structure of the hand muscles.[4] Grasping a toothbrush activates the muscles in the forearm and hand to control the pressure applied to the tooth surface and gum tissue. Too much pressure can increase the risk of gingival recession in the long term.[5] High brushing force influences the incidence of tooth wear compared to brushing speed.[6] Gingival changes resulting in tooth wear can occur if brushing pressure is too high.[6,7] High pressure can be caused by excessive hand muscle strength when gripping the toothbrush.[8] The relationship between hand strength during toothbrushing and the incidence of abrasions has been studied, but there are few studies on the relationship with gingival recession.[9] Based on the above, this study aims to investigate further the relationship between handgrip strength and the incidence of gingival recession.

METHOD

This type of research is an observational analysis with a cross-sectional design to determine the relationship between handgrip strength and the occurrence of gingival recession. The research population was people in Cimahi City, West Java, and the research subjects were pre-elderly people in three sub-districts in Cimahi City. This research obtained ethical clearance from the Health Research Ethics Committee of Universitas Padjadjaran, with ethical approval number 25/UN6/KEP/EC/2025**.** Sampling was done by purposive sampling, and the sample size was determined using the hypothesis test of two proportions difference. The minimum sample size, after being calculated through the formula of the hypothesis test, of two proportions difference was obtained, with as many as 165 samples, so that each sub-district was sampled at least 55 samples. The research instrument consists of a Google form questionnaire, hand dynamometer, latex gloves, masks, basic tools such as explorer, tweezers, mouth glass and excavator, cotton rolls and headlamps. Handgrip strength was measured by hand dynamometer (kg), while the gingival recession was clinically assessed with visual.

Data were processed using Statistical Product and Service Solutions (SPSS) 2017. Data were presented descriptively to determine the characteristics of the study population and the proportions of each variable. Data with ordinal scales were presented with mean, maximum, and minimum according to the sample's age based on gender. The chi-squared test was used for ordinal scale data to test the correlation between gingival recession and handgrip strength.

RESULT

The research was conducted in the North Cimahi Health Centre, Central Cimahi Health Centre and Cirendeu Village, South Cimahi. A total of 165 samples were collected. The samples gave verbal informed consent and provided data on hand muscle strength using a hand dynamometer and clinical oral cavity examination to detect gingival recession. The study's results are divided into the results of hand muscle strength, a description of the hand muscle strength on the incidence of gingival recession, and an analysis of the relationship between hand muscle strength and gingival recession.

Overview of Handhandgrip strength

A total of 165 samples were taken in this study, consisting of 35 male and 130 female samples. Handgrip strength was generally higher in men than in women

(Table 1). The highest mean handgrip strength was 48 kg (4.8 N) for men aged 60-64 years, and the lowest was 9.62 kg (0.962 N) for women aged 65-69.

Table 1. Overview of the handgrip strength of people in Cimahi City

Age	Handgrip strength	Male				Female			
		N	Max	Min	Average	N	Max	Min	Average
45-49	Strong	0	0	0	0	4	51.8	33.96	38.91
	Moderate	5	54.23	35.26	40.79	18	32.13	18.8	24.00
	Weak	3	32.09	23.09	28.66	14	18.46	7.9	12.26
50-54	Strong	0	0	0	0	4	41.93	34.56	38.57
	Moderate	2	43.83	36	39.92	21	28.36	18.44	22.08
	Weak	0	0	0	0	10	15.93	8.06	13.95
55-59	Strong	0	0	0	0	0	0	0	0

Overview of Handhandgrip Strength on the Occurrence of Gingival Recession

The study's results regarding the relationship between handgrip strength and the incidence of gingival recession (Table 2) show that most of the samples in the moderate handgrip strength category experienced gingival recession. In the male group, 94.29% of the 35 samples had a gingival recession, and 5.71% did not. In the female group, 94.62% of the 130 samples experienced gingival recession, while 5.38% of the samples did not experience gingival recession.

Table 2. Overview of the relationship between the strength of the grip muscles and the occurrence of gingival recession

Age	Hand grip strength	Male			Female		
		N	Gingival recession		N	Gingival recession	
			Exist	Absent		Exist	Absent
45-49	Strong	0	0	0	4	3	1
	Moderate	5	5	0	18	18	0
	Weak	3	2	1	14	13	1
50-54	Strong	0	0	0	4	4	0
	Moderate	2	2	0	21	21	0
	Weak	0	0	0	10	10	0
55-59	Strong	0	0	0	0	0	0

Age	Hand grip strength	Male			Female		
		N	Gingival recession		N	Gingival recession	
			Exist	Absent		Exist	Absent
	Moderate	2	2	0	12	12	0
	Weak	0	0	0	6	5	1
	Strong	0	0	0	1	1	0
60-64	Moderate	6	6	0	11	11	0
	Weak	2	2	0	8	7	1
	Strong	2	2	0	5	5	0
65-69	Moderate	5	5	0	3	3	0
	Weak	0	0	0	7	6	1
	Strong	3	3	0	0	0	0
70-99	Moderate	3	3	0	2	1	1
	Weak	2	1	1	4	3	1
Total		**35**	33 (94,29%)	2 (5,71%)	**130**	123 (94,62%)	7 (5,38%)

Correlation between handgrip strength and gingival recession

Measurement of handgrip strength and examination of gingival recession (Table 3) In Cimahi City, the relationship was statistically analyzed using the chi-squared table.

Table 3. Correlation of handgrip strength with gingival recession

		Gingival recession			
		Exist	Absent	Total	*p*-value
Handgrip strength	**Weak**	49 (87.5%)	7 (12.5%)	56 (100%)	0013 *
	Moderate	88 (98.9%)	1 (1.1%)	89 (100%)	
	Strong	19 (95.0%)	1 (5.0%)	20 (100%)	

Based on statistical analysis in the Cimahi City community, the results showed a significant relationship between hand muscle strength and the occurrence of gingival recession (p<0,05). Hand muscle strength with moderate parameters can cause a gingival recession in 88 people (98.9%).

DISCUSSION

Results showed that most pre-elderly samples in this study were women,

130 (78.85%) out of 165 total samples, while men were 35 (21.2%). According to Boy (2019), women, who dominate the total number of samples, are more concerned and attentive to their oral health than men, which affects the sample's enthusiasm for investigating gingival recession.[8] Samples with gingival recession (Table 2) were 156 people (94.5%). The male group with gingival recession was 94.29%, while the female group with gingival recession was 94.62%. About the incidence of gingival recession based on gender, women and men in this study did not have too much of a difference.

From the age of 40, women begin to experience a dramatic decline in the circulating levels of sex hormones, one of which is estrogen. Lowering estrogen is associated with adverse changes in oral and periodontal tissues because estrogen plays a role in collagen formation and maintaining connective tissue integrity[10], so if brushing is too vigorous, it's easier for the gingiva to recede due to brushing.[11,12] This may explain why the percentage of gingival recession tends to be greater in women than in men.[11]

Handgrip strength was higher in men than women in all age groups.[13,14] The highest handgrip strength (Table 1) in men was found in the 60-64 age group at 48 kg (4.8 N), while the lowest handgrip strength in women was found in the 65-69 age group at 9.62 kilograms (0.962 N). Regarding the research by Lee JH (2020), the handgrip strength of 4.8 N is part of the strong group (≥3.5 N), while the handgrip strength of 0.962 N is part of the weak group (<1 N). Differences in grip strength between men and women may be due to several factors, including differences in muscle mass and hormones.[14] Men generally have more muscle mass than women, with about 40-45% of a man's body weight being muscle. It compares to around 30-35% for women. A significant increase in muscle mass and a square-shouldered posture is due to the production of testosterone and insulin-like growth factor 1 (IGF-1). Women produce the hormone estrogen, which leads to increased body fat deposition and hip widening. These hormonal differences also lead to a naturally slower rate of muscle growth in women. Less muscle mass results in lower grip strength in women than in men.[15]

There is a general decline in muscle strength from age 40 onwards. It is because the number and size of skeletal muscle fibres also start to decrease, so muscle mass is progressively reduced, resulting in a loss of muscle strength.[16] Decreased muscle strength can also be related to physical fitness. Physical fitness tends to decline with age, but other factors cause it to

increase or decrease. One of these conditions is physical stress, which can be achieved by exercising.[17] In this study, one of the men aged 60-64 had more muscle strength than the previous age group. It may be related to the physical activity of each sample. Physical activity, such as walking and stretching, and a good diet can help maintain and even increase muscle mass.[17,18]

This study shows a significant relationship between grip strength and the occurrence of gingival recession ($p<0.05$). It is consistent with what was mentioned in Osalodor's (2020) research, which states that one of the factors that may play a role in the occurrence of gingival recession is excessive tooth brushing.[19] Handgrip strength is a factor that may cause gingival recession. Lee JH (2020) states that based on gender, men generally have a 57% higher maximum handgrip strength than women. Hand grip strength is a measure of both hand impairment and function and overall muscle strength.[20] The highest value of handgrip strength was observed in the 30-39 age group (men 46.9 kg and women 29.4 kg), which then decreased. When associated with gingival recession, excessive pressure on the gingiva with a detailed force of ≥3.5 N can cause gingival recession.[7] Weidden (2004) stated that the recommended average force when brushing teeth is 1N or, at most, 3N.[5]. This force is considered a safe brushing force for hard and periodontal tissues.17 Djohan (2025) stated in his study that brushing with inadequate frequency[21], duration, and force may cause damage to hard and periodontal tissues.[22] Bok H (2020) in his research stated that the use of brushing techniques with high strength can cause a shift in the position of the gingival margin towards the apical so that within 20-30 years, there can be a displacement of this position and the impact is visible recession or recession that is directly visible.[23] This is in line with Djohan (2025), which shows that the relationship between handgrip strength and gingival recession in 12-year-old children is insignificant.[22]

CONCLUSION

Based on the results of research on pre-elderly people in Cimahi City, it was found that handgrip strength had a significant relationship with the occurrence of gingival recession. Handgrip strength is an indicator of overall muscle function and strength. The strength of the handgrip certainly affects the strength of tooth brushing. Brushing with excessive force can traumatize teeth and gingiva. This chronic trauma will develop into a visible recession on the gingiva, so brushing should be neither excessive nor inadequate.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

ACKNOWLEDGEMENT

We thank the Faculty of Dentistry, Universitas Jenderal Achmad Yani, for their invaluable support and resources throughout this research.

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