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# The Effects of Using Mandibular Free End Frame Denture First and Second Class Lever toward on Level IL-1β of Abutment Teeth

**Lisda Damayanti[1], Harmas Yazid Yusuf [2], Agus Susanto[3], Gian Nur Alamsyah[4]**

[1,2,3,4] Universitas Padjadjaran, Faculty of Dentistry, Jl. Sekeloa Selatan 1, Bandung Indonesia

**Abstract:** ***The purpose of this research is to analyze the effects of using mandibular free end frame denture first and second lever towards on levels IL-β of abutment teeth. Materials and Steps: 38 cases of missing mandibular free end teeth, either unilateral or bilateral, were made a free end frame denture design retainer first and second lever on each groups (19 cases). Before insertion and after 12 weeks of using mandibular free end frame denture, they were taken gingival crevicular fluid to measure the levels of IL-1β d by using ELISA (Enzyme Linked Immunosorbent Assay) method. This research is an experimental design research, using single blind which is given actions by using mandibular free end frame denture first and second class lever. Statistical analysis begins with doing characteristic test of both groups. Both groups' numerical data are done to compare each groups' first and second class lever with non-paired test (data distributes normally) and Mann Whitney (data doesn't distribute normally). According to non-paired test, there were obtained p value 0.000 (p value<0.005) which has statistic differentiation for IL-1β level using mandibular free end frame denture first and second class lever. IL-1β level of teeth abutment of first class lever has higher than second class lever. Conclusion: First class lever has a greater influence on elevated inflammation cytokin level of IL-1β teeth abutment.***

**Keywords:** Mandibular free end frame denture, first class lever, second class lever, IL-1β level

## 1. Introduction

Missing maxilla and mandibular posterior teeth effects mastication function a lot, the losing of continuity of dental arch results not balanced stomatognatic system inside oral cavity.[1] One of undertaken efforts to replace missing mandibular posterior teeth is by making removable partial denture (RPD). [1,2,3] Free end RPD/free end denture is a removable denture which supported by either the teeth or tissue that covers residual ridge where on one or both saddle sides are expanded towards posterior. This kind of removable denture doesn't get the whole support from the teeth, but also depends on residual ridge as a support. Abutment teeth is a relatively passive support, while the soft tissue which covers residual ridge has a bigger and more variated moving degree.[4,5,6]

The most common issues of free end denture is that the removable denture stays unstable, it moves easily either horizontally of vertically (rotating). This caused by tissue compressibility differences between anterior and posterior free end saddle. The movement of soft tissue under removable denture base approximately 350-500 µm, while movement of the teeth around 20 µm with the same pressure.[7] Then, the unstable removable denture will cause issues towards remained oral cavity health. Because there are differences of support compressibility between one and other mucosa, between mucosa and abutment teeth periodontal tissue, the removable denture will lifted vertically when masticating. Also, because there's no teeth beside saddle's distal, its free end will move more freely.[1,3,5,13]

Leverage towards apical from unstable removable denture's base will cause the masticatory forces distribute unequally. Apical towards masticatory forces will concentrate more on the posterior side (free end side), it causes too much forces (overload/overfunction) which next causes greater resorption of alveolar residual ridge on the side.[1,14]

Leveraged removable denture, besides causing greater resorption of alveolar residual ridge, also leverages abutment teeth. The main factor which causes greatest leverage force is the pressure/masticatory force, that causing leverage on the saddle side will move towards apical/alveolar residual ridge. First leverage, where its retention point and masticatory loads are across the fulcrum point/line, the free end removable denture will move apically and the abutment teeth as if rotated and pulled towards posterior. Because this happens continually, there will be damages on abutment teeth's periodontal tissue.

Second leverage happens when retention point and masticatory loads (on free end saddle) are on one side with the fulcrum point/line. On this circumstances, if the free end saddle pressured apically because of masticatory force, retentive arms will also going down towards apical, so that the abutment teeth won't leveraged, but causing removable denture becomes more unstable compared first leverage when masticatory force happened towards apical. Leverages caused by masticatory force towards apical are concentrated around alveolar residual ridge.[1,3,5,14,15]

Bio-mechanic principles which must be noticed are; the emerged of removable denture's leverage may causes pressures towards abutment teeth, when free end removable denture's saddle is going down when accepting masticatory loads will causes leverage on abutment teeth. The forces obtained by that abutment teeth also called torque force. Occlusal loads distribution on teeth and alveolar bones covered by soft tissue, factors affecting the value of distributed loads on abutment teeth are; the longer the removable denture, then the bigger forces obtained by abutment teeth, a wide alveolar residual ridge will obtain more functional forces so there will be minimal forces

obtained by abutment teeth, a healthy mucosa with normal thickness endure occlusal loads better compared to thin mucosa, atrophy and occlusion factor are balanced.[1,22]
Hill and friends pointed that mucosal inflammation that caused by tissue under removable denture base which got pushed, may cause a variety of chronic inflammations, immune reactions, and broken periodontal tissue through the making of arachidonat acid metabolic or Interleukin (IL), and also has a strong activity of alveolar bone resorption IL-1β acts as the key of mediator inflammation to determine periodontal health parameter.[23,24,26]

## 2. Materials and Steps

The research is done to 38 cases of missing mandibular free end posterior teeth/mandibular free end denture, along with missing unilateral and bilateral teeth cases, the subjects' age range are around 35 until 54 years old. Cases missing free end bilateral teeth are around 68,4%. The research's plot includes the preparation of research's subjects which are protocol preparation, research form and permissions from research's ethical commissions, and also mouth preparation on research subjects. The making of mandibular free end frame denture first and second leverage are in a private lab. Gingival crevicular fluid were taken to measure IL-1β and level with ELISA method which has been done before and 12 weeks after using mandibular free end frame denture first and second leverage. Before the fluid was taken, the first and second mandibular premolar teeth were isolated with cotton roll to prevent samples from salivary contamination and blood, then those were dried with air sprayer. Sterilized paper point were put into gum sulcus in the depth of 1 mm for 20 seconds. Paper point is gone inside the tube eppendorf which already filled with Phosphat Buffer Solution (PBS) and kept it inside a box filled with ice, and then the sample got moved to -70 Celcius degrees until the time of concentration test is done.

Examination and measurement with ELISA method for IL-1 β are done through the making of standard assay IL-1 β curve.

The making of standard assay IL-1 β curves by creating 6 dilution multilevel variations, which are 125 ; 62,5 ; 31,2 ; 15,6 ; 7,8 ; and 3,9 pg/mL from IL-1 β standard with 250 pg/mL concentration, also with Calibrator RD5-5. Put the standard/blank which has been made into the well in amount of 200 β L. Do the incubation with room temperature for 2 hours with see saw. Throw away the solution, then wash it with Wash Buffer 1x for 3x repeating. Add IL-1 β Conjugate as many as 200 β L, then incubate it on room temperature for 1 hour with see saw tool. Throw away the solution again and wash it using wash buffer 1x for 3x repeating. Add 200 β L substrat solution A and substrat solution B with comparison 1:1. Do the incubation for 20 minutes and protect it from sunlight (the color will turn blue). Add stop solution into the well, then there will be changing from blue to yellow. Measure it before 30 minutes on 450 nm and 490 nm.

Procedure of examination and measurement of gingival crevicular fluid's IL-1 β level

Put the standard/blank which has been made into the well in amount of 200 β L. Throw away the solution, then wash it with Wash Buffer 1x for 3x repeating. Throw away the solution again and wash it using wash buffer 1x for 3x repeating. Add 200 β L substrat solution A and substrat solution B with comparison 1:1. Do the incubation for 20 minutes and protect it from sunlight (the color will turn blue). Add stop solution into the well, then there will be color changing from blue to yellow. Measure it before 30 minutes on 450 nm and 490 nm.

## 3. Result of The Research

**Table 1:** Research Subject's Characteristic (N=38)

| | |
|---|---|
| **Age** | |
| Mean±SI | 44.76±7.820 |
| Median | 47.000 |
| Interval (min-max) | 34.00-54.00 |
| **Gender** | |
| Male | 10(26.3%) |
| Female | 28(73.7%) |
| **Missing Mandibular Posterior Teeth Cases** | |
| Unilateral free end | 12 cases (31.6%) |
| Bilateral free end | 13 cases (68.4%) |

Numerical data are presented with mean, standard intersection, median, while categorical data are presented with value/frequency and percentage; SI: Standard Intersection

Table 1 describes the characteristic of overall research patient subjects according to their ages and genders. The average number of age is 44.76±7.820. There are 10 males or 26.3% and 28 females or 73.7%. The cases of missing mandibular unilateral free end posterior teeth are 31.6% and bilateral free end are 68.4%.

**Table 2:** Delta of IL-1β Level of Abutment Teeth between First and Second Class Lever

| *IL-1β (pg/ml)* | *Group* | | *P Value* |
|---|---|---|---|
| | First Class Lever | Second Class Lever | |
| | N=19 Cases | N=19 Cases | |
| **Delta IL-1β** | | | **0.003*** |
| Mean±Std | 173.67±93.442 | 143.35±84.773 | |
| Median | 144.860 | 150.520 | |
| Range (min-max) | 43.31-373.53 | -19.49-315.91 | |

The average of delta IL-1β level for first class lever: 173.67±93.442 pg/ml, second class lever: 143.35±84.773 pg/ml. According to non paired test, there were obtained p value 0.003 (p value<0.005) which has statistic differentiation for IL-1β level using mandibular free end frame denture first and second class lever. IL-1β level of teeth abutment of first class lever has higher than second class lever.

## 4. Discussion

Interleukin-1 (IL-1) is a multifunctional cytokines with a wide activity on various tissues and also a mediator of immune cell that functioned on controlling bone resorption and increase prostaglandin syntesis.14 IL is a mediator key from body respond to micro-bacterial , immunology

reactions, and tissue trauma. IL-1 consists of 2 peptides, which are α and β, interleukin 1β (IL-1β) secreted with monocyte, some macrofags, endothelial cells, fibroblasts, and ephidermal cells which are activated by some kind of stimulus.12 IL-1β increases PMN bond and monocyte/macrofag towards endothelial cells, stimulating prostaglandin E2 production, release lysosomal enzymes, and stimulating bone resorption.12,13 The value of IL-1β will increase on various kinds of immune responds, including bone resorption and inflammation responds such as gingivitis and periodontitis.[14,15,16]

This result shows that there were significant differences and patient's IL-1β level also increased from before and after using mandibular free end frame denture either on first and second class lever (table 2). This result suits Grieve and friends' research which stated that if there is any mechanical pressure, then IL-1β production will increase, periodontal tissue cells will produce IL-1β if it got pressured and will increase inside the gingival crevicular fluid.17 Kurtis and friends' research stated that IL-1β on periodontal tissue and gingival crevicular fluid will increase along with the severity of the disease.[9,16] This result shows the increasement of IL-1β level on gingival crevicular fluid after using mandibular free end frame denture first class lever is higher than second class lever (table 2). This higher IL-1β is caused because on first class lever, the hoe direction from distal to mesial, fulcrum on distal, are suitable with biomechanical law, fulcrum point put in the middle of retention point and loads, so if there any loads that touch the base of removable denture apically, then the retentive hands will move occlusally to balance this movement.[9] The end of retentive hands which located beside distal will keep leveraging the abutment teeth which will cause inflammation on that abutment teeth, this shows that mechanical pressure on tissue will increase the level of IL-1β.[16]

Kurtis and friends' research stated that mechanical pressure causes inflammation on abutment teeth's supporting tissue, which will cause damage on adhesion between supporting tissue and alveolar bone.18 The using of removable denture may also increase the accumulation of plaque and bactery that are inside the plaque and interacts on ephitel cell, leucosit, and fibroblast that stimulate cytokines production such as IL-1β.[16]

## 5. Conclusion

The result of this research showed level of IL-1β (p=0.003) on teeth abutment higher on first class lever in the using of mandibular free end frame denture.

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