

Role of working memory in the assessment of Quality of life after impacted third molar surgery

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Abstract: Psychologists use the term 'working memory' to describe the ability we have to hold in mind and mentally manipulate information over short periods of time. Working memory is often thought of as a mental workspace that we can use to store important information in the course of our mental activities. Post-operative instructions are usually given verbally after surgical procedures. In all surgical procedures patient will be in a tensed state of mind reducing the capabilities of working memory and a significant data loss. This study is done to assess the role of working memory in the post-operative recovery of patients after surgical removal of impacted 3rd molar. Previous study on the post-operative Quality of life after surgical removal of impacted third molar showed that working memory plays an important role in patients faithfully following the post-operative instructions leading to their speedy recovery.

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I. Introduction

Surgical removal of impacted third molar is the most common surgical procedure done in maxillofacial surgery after simple tooth extraction. Patients who seek third molar surgery expect the surgeon to explain the risks and benefits of the planned procedure as well as details of recovery from the surgery. In the literature, many complications associated with lower third molar removal are described, e.g., pain, swelling, trismus, infection, inflammation, and nerve damage. Proper post-operative care after removal of impacted 3rd molars is important to obtain successful end result despite the best pre-operative preparation and operative procedure; avoidable problem may be magnified if the patient is not given adequate post-operative instructions or if they were not followed¹. Working memory plays an important role in the patient's ability to follow the post-operative instructions given to them in a tensed situation like "immediately after surgery"².

This study compares the effectiveness of reinforcement of working memory of the patient via a pamphlet and over phone on the next day of surgery and its effect on the overall improvement of post-operative quality of life (POQoL) of the patient using questionnaire. The effect on post-operative quality of life³ is assessed using PoSSe scale⁶ seven days after surgery.

II. Material And Methods

This interventional comparative study was carried out on the patients reporting to the Department of Oral and Maxillofacial Surgery at Government Dental College, Thiruvananthapuram, Kerala from January 2013 to December 2013. A total of 150 adult subjects (both male and females) in the age group of 20 to 40 years were included in this study.

Study Design: Interventional study

Reference Population: Patients who need surgical removal of impacted third molars

Study Population: Patients requiring surgical removal of impacted third molars reporting to the Department of Oral and Maxillofacial Surgery at Government Dental College, Thiruvananthapuram.

Study Location: This study was conducted in the Department of Oral and Maxillofacial Surgery at Government Dental College, Thiruvananthapuram which is a tertiary health care centre in Kerala.

Study Duration: January 2013 to December 2013.

Sample size: 150 patients.

Sample size calculation: The sample size has been calculated for the present study. The sample size has been calculated using the formula: $N = \frac{2S^2 f(\alpha, \beta)}{d^2}$, where d – Clinically Significant Difference; S – Standard Deviation; N – Sample Size

With a clinically significant difference of 3%, and an expected standard deviation of 9%, the sample size required for this study was calculated as 144 and a total rounded off to 150 patients.

Subjects & selection method:

The study population was drawn from patients who presented to the Dept of Oral and Maxillofacial Surgery at Govt Dental College Thiruvananthapuram who require surgical removal of third molar from January 2013 to December 2013.

Inclusion criteria:

1. Patients in the age group of 20-40yrs
2. ASA I & II
3. Those with Pedersen's difficulty index between 3-6 (mild-moderate difficult)

Exclusion criteria:

1. Medically compromised patients
2. Pregnant women
3. Patients with communicable diseases
4. Those patients unwilling to sign informed consent

Randomisation

Simple random method using coin toss

Groups

Group 1- patients with routine instructions

Group 2-patients with reinforced instructions

Outcome Measurements

- 1) PoSSe Scale
- 2) Visual Analogue Scale

Procedure methodology

Healthy patients (ASA I or II) aged between 20 to 40 years requiring surgical extraction of one lower third molar were selected and categorized into two groups randomly. At the first appointment the purpose of the intervention was explained, with all its possible complications and the anticipated post-operative course. Patients were asked to sign an informed consent. Phone numbers were procured for proper review. The third molar was removed in due course at a different appointment. All surgical extractions were performed under local anesthesia taking full aseptic precautions. An antibiotic (usually Amoxicillin 50 mg/ kg body weight/ day; if allergic to penicillin Ciprofloxacin 500 mg/ 3 times daily) and a non-steroidal anti-inflammatory drug (Diclofenac Sodium 50 mg 2 times daily) were prescribed along with 0.2% Chlorhexidine gluconate rinses 3 times a day for 7 days. The control group was given the routine verbal instructions following 3rd molar surgery and the study group was given verbal instructions along with that a printed paper having postoperative instructions. The instructions were reinforced over phone on the second day of surgery. After 7 days suture removal was done by the surgeon.

The patients were given a questionnaire to be filled on day 7 after surgery, immediately after suture removal. The questionnaire is designed to evaluate the physical domains of Quality of Life after third molar surgery³ using **Post-operative Symptom Severity (PoSSe) scale**⁴. It is comprised of different parameters addressing speech, eating ability, taste sensation, appearance, pain, sickness and daily activity. The patients were also provided with a 100-mm visual analogue scale (VAS) with pictorial representation of pain. On day 7, the patient is asked to record the severity on the scale. Patient who did not return the questionnaire were excluded from the study

Statistical analysis

Data was analyzed using SPSS version 20 (SPSS Inc., Chicago, IL). The level $P < 0.05$ was considered as the cutoff value or significance.

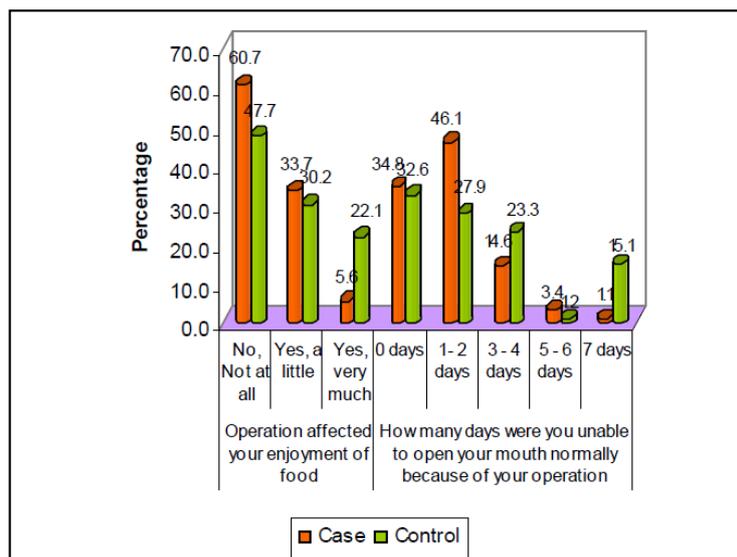
III. Result

Role of working memory in the quality of life(QOL)of the patients following surgical removal of third molar was explored in the present study. The physical domains quality of life like *enjoyment of food, mouth opening, speech, sensation of lips and tongue, appearance, pain, level of sickness, Interference with daily activities* were assessed using PoSSe scale.

It is well known that enjoyment of food can have a positive impact on your life. Enjoyment of food was “not at all affected” in 60% of the people in study group compared to the 47 % in the control group. Enjoyment of food was a “little affected “in 33% of the study group while it was 30.2 % in control group. It was “very much affected “in 5.6% of the case group where it was 22.1 % in control group. This show according to this study “enjoyment of food” is affected more in the control group than in study group.

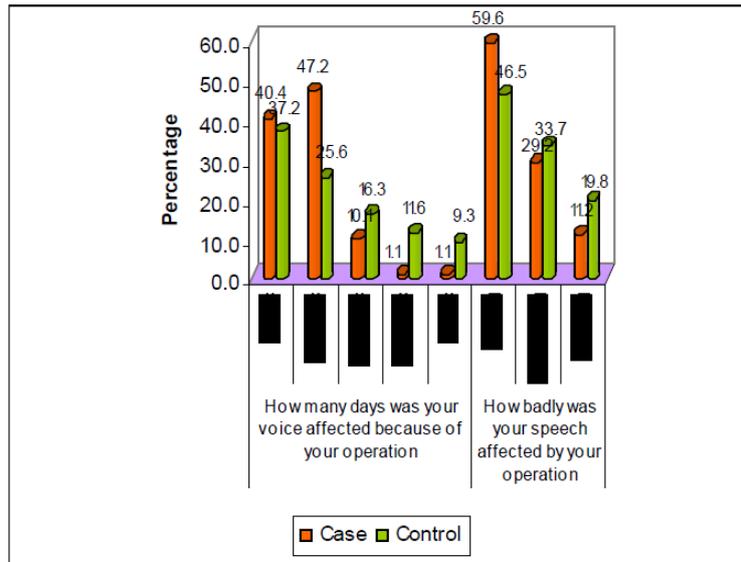
Mouth opening was “not at all restricted” in 34.8% of people in studygroup when compared to 32.6 % of people in control group on the first day of surgery. In the “first two days” mouth opening was restricted in 46.1% of people in study group and 27.9 % in control group. 23.3% of the people incontrol group suffered a restricted mouth opening for “3-4 days” whencompared to 14.6% in the study group. 3.4% of the people in study groupsuffered “a restricted mouth opening for 5-6 days” when compared to 1.2% incontrol.15.1% of the control group suffered restricted mouth opening “for aweek” when comparing to the 1.1% in the study group.

Fig.1.Comparison of eating based on group



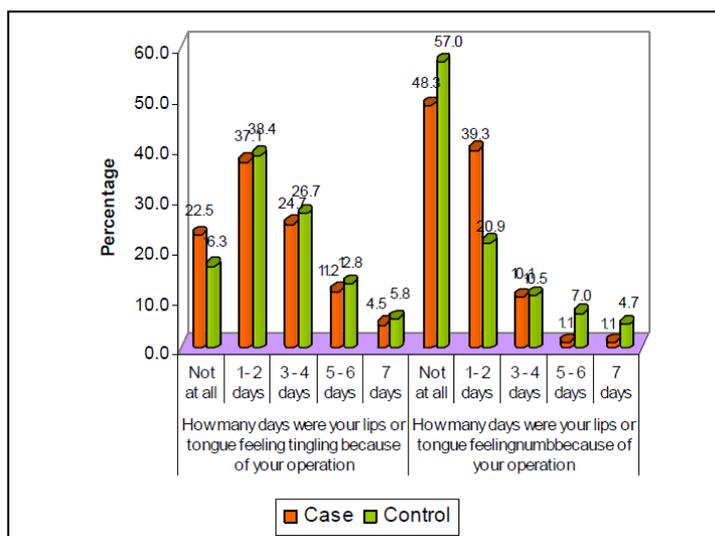
Speech is also showing significant difference between study and control group, with the study group found to be less affected than those in control group. Voice was “not at all affected” in 40.4% of people in the study group when compared to 37.2% of people in control group on the first day. It was “affected for 1-2 days” in 47.2% and 25.6% of people in study group and control group respectively. 10.1% of the people in control group were “affected for 3-4 days” in control group when compared to 14.6% in the study group. When compared after “5- 6 days” 1.1% of the people in study group were “affected” when compared to 11.6% in control. After “a week “9.3% of the control group and 1.1% in the study group were affected. The operation had “slightly affected” the speech in 59.6% of the people instudy group when compared to 46.5% in the control group. 29.2% of peoplewere “moderately affected” speech in study group when compared to 33.7% inthe control group.11.2% of the people study group had “badly affected speech “when compared to 19.8% in the control group.

Fig 2. Comparison of speech based on group



The sensation of lips and tongue were found to have no significant difference in this study between case and the control group so is the numbness of tongue and lips. Patient having “no tingling sensation of lips or tongue” was 22.5% compared to 16.3% of people in the control group. For “1-2 days” 37.1% of people in study group were having “tingling sensation of lips or tongue” where 38.4% in control group. 26.7% of the people in control group had “tingling sensation of lips or tongue for 3-4 days” and 24.7% in the study group. For a period of 5-6 days 11.2% of patients in the study group had “tingling sensation of lips or tongue” where it was 12.8% the control group. After “a week” 5.8% of the control group and 4.7% in the study group had “tingling sensation of lips or tongue”.

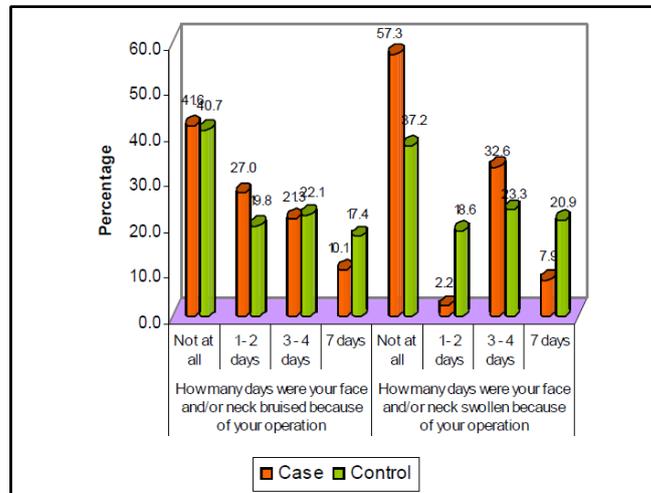
Fig 3. Comparison of sensation based on group



Appearance is assessed by looking for bruising and swelling. It showed significant difference between case and control group, the study group being less affected than the control group. On the first day face and/or neck were “not at all bruised” in 41.6% of people compared to 40.7% of people in the control group. For “1-2 days” 27.0% of people in study group were affected while 19.8% in control group were affected. 22.1% of the people in control group had “bruise for 3-4 days” and 21.3% in the study group. After “a week” 10.1% of the control group and 17.4% in the study group had bruising. On the first day face and/or neck were “not at all

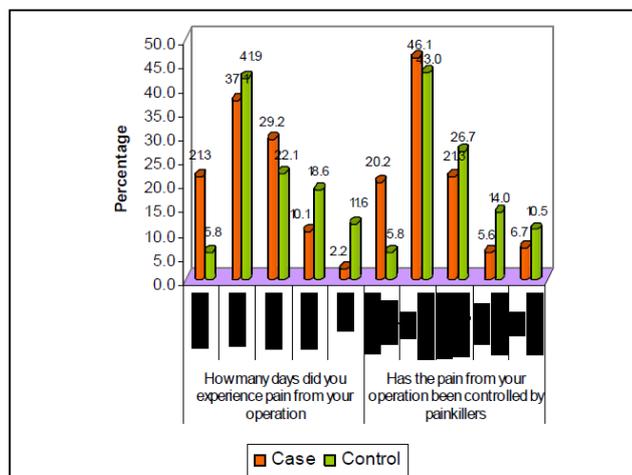
swollen” in 57.3% of people when compared to 37.2% of people in control group. After “1-2 days” 2.2% of people in study group and 18.6% in control group were affected. 23.3% of the control group had swelling on “3-4 days” when compared to 32.6% in the study group. Swelling persisted “for a week” in 20.9% of the control group and 7.9% in the study group which is statistically significant.

Fig 4. Comparison of appearance based on group



21.3% of patients in study group had “no pain after surgery” when compared to 5.8% in the control group. For the “first 2 days” 37.1% of people “had pain” in the study group and 41.9% in the control group. 22.1% of the people in control group suffered “pain for 3-4 days” in control group when compared to 29.2% in the study group. 10.1% of the people in study group and 18.6% control group suffered “pain for 5-6 days” while 11.6% of the control group 2.2% in the study group suffered pain for “a week”. 20.2% of patients “had no pain” in study group when compared to 5.8% in the control group. It was “well controlled” in 46.1% of people in study group where it was 43.0% in control group. 26.7% of the people in control group suffered “some discomfort even though pain was controlled” when compared to 21.3% in the study group. 5.6% of the people in study group had “poorly uncontrolled pain” when compared to 14.0% in control group. 10.5% of the control group suffered “uncontrolled pain” when comparing to the 6.7% in the study group.

Fig 5. Comparison of pain based on group

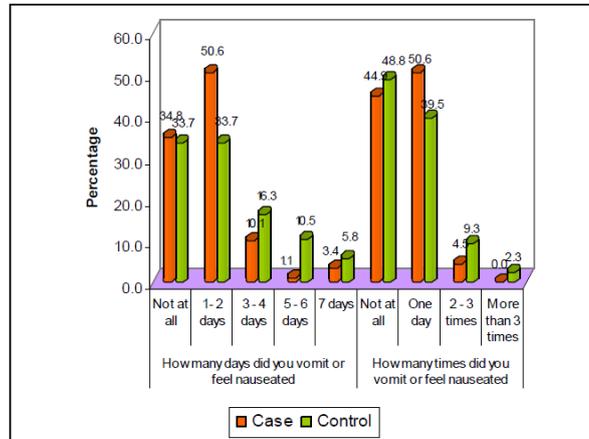


The level of sickness in both study and case group are comparable. Patient who are “not at all nauseated or vomited” was 34.8% in study group compared to 33.7% of people in the control group. For “1-2 days” 50.6% of people in study group were having nausea or vomiting compared to 33.7% in control group. 16.3% of the people in control group “had nausea or vomiting for 3-4 days” and 10.1% in the study group. For a

period of “5-6 days” 1.1%of patients in the study group “had nausea or vomiting” where it was 10.5%the control group. After “a week” 3.4 % of the control group and 5.8% inthe study group had *nausea or vomiting*.

44.9% in study group “not at all had any nausea or vomiting” during theperiod of our study while it was 48.8% in the control group. 50.6% of peoplein study group had “nausea or vomiting for one day” while it was 39.5% inthe control group. 4.5% of the patients in study group had “nausea orvomiting for 2-3 times “while it was 9.3% in the control group. Percentage ofpatients in study group having “nausea or vomiting more than three times”was zero in study group where it was 2.3% in the control group.

Fig 6.Comparison of sickness based on group



3.9% of patients in study group and 38.4% in the control group could“*continue to work after surgery but their work suffered*”. On analyzing it wasseen that work was affected for “one day” in 20.2% of people in study groupwhere as it was 30.2% in control group. 19.8% of the people in control group“*lost 2-6 working days*” in control group when compared to 13.5% in thestudy group. 12.4% of the people in study group suffered “*work loss for aweek*” when compared to 11.6% in control.Lisure activities were “*mildly affected*” by the operation by 47.2% instudy group as compared to 33.7% in control group. It was “*moderatelyaffected*” by the operation in 39.3 % in study group whereas 50.0% in thecontrol group. Activities were “*severely affected*” in 13.5% of the patients ofthe study group when compared to 11.6% in the control group. The operation“*prevented any kind of social life*” in 4.7% of the control group .Pain “*did not affect the life*” of 30.3% of the people in study group and1.2% in the control group. Pain had “*slightly affected the life*” of 33.7%patients in study group as compared to 38.4% in the control group. In 31.5%of study group “*Life was moderately affected by pain*” when compared to50.0% of patients in the control group. Patient’s life was “*severely affected*”in 4.5% of study group when compared to 10.5% in the control group

Fig 7. Comparison of interference with daily activities based on group

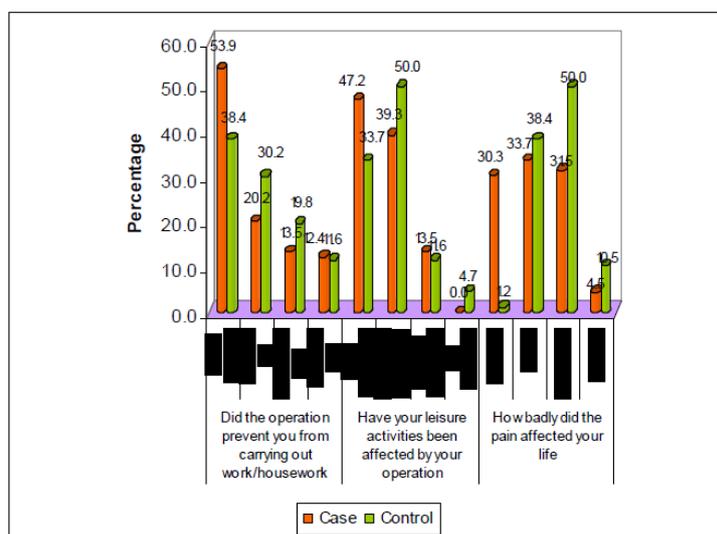
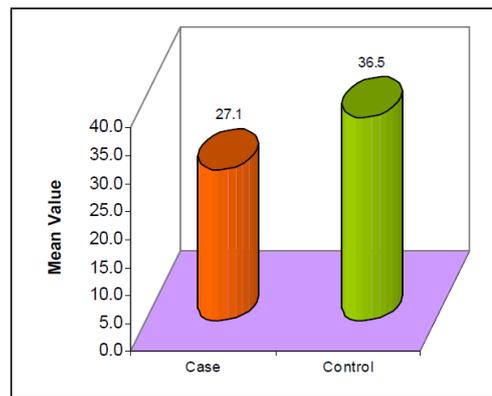
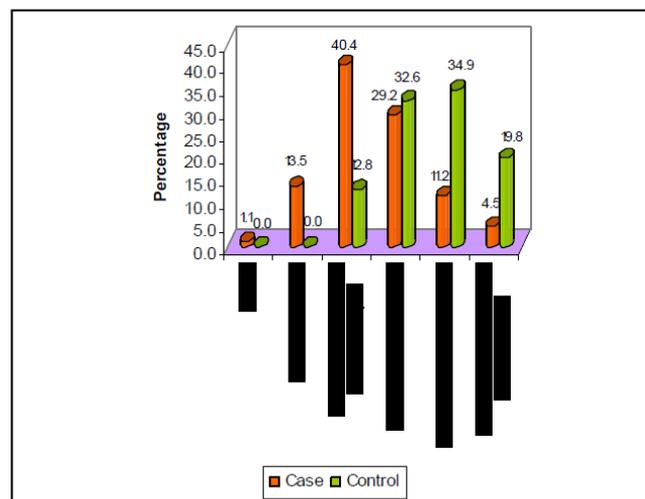


Fig 7. Comparison of total score based on group



When analyzing the visual analogue scale there were one patient “had no pain” at all from the study group while all the patients had pain in the control group. Patients with “mild annoying pain” were 13.5% in study group when compared to nil score in the control group. Only 12.8% of the patient in the study group suffered a “nagging, uncomfortable, troublesome pain” while it was 40.4% in the control group. “Distressing miserable pain” in the study group was 29.2 while it was 32.6% in the case group. “Intense, dreadful, horrible pain” was noticed in 11.2% of patient in study group when compared to 34.9% in the control group. “Most unbearable, excruciating pain” was suffered by 4.5% of the study group during 7 days whereas the number increased to 19.8% in the control group.

Fig 8. Comparison of pain based on group



IV. Discussion

Psychologists use the term ‘working memory’² to describe the ability we have to hold in mind and mentally manipulate information over short periods of time. Working memory is often thought of as a mental workspace that we can use to store important information in the course of our mental activities. We typically use working memory as a sort of mental jotting pad in situations when there is no other external record such as written notes or a calculator. Some of the situations that often lead to the loss of information from working memory include

- Distraction: An unrelated thought springing to mind, or an interruption such as a telephone ringing or someone speaking to us, can be sufficient to divert attention the contents of working memory so that its contents are rapidly lost.
- Trying to hold in mind too much information: There is a limit to how much information can be held in working memory
- Engaging in a demanding task. Activities that require difficult mental processing reduce the amount of space in working memory to store information. This can result in a loss of other information that is already held. Once information has been lost from working memory it is gone for good.

Laboratory research has found that stress impairs decision making when it causes individuals to feel “frazzled” (Arnsten, 1998), such as when participants are stressed by the threat of a shock (Keinan,1987) or made anxious by a secondary task (Cumming & Harris,2001).Both human and nonhuman studies have found that stress compromises executive functions, and especially working memory(al’Absi et al., 2002; Arnsten, 1998; Arnsten& Goldman-Rakic,1998; Hartley & Adams, 1974; Hockey, 1970), which in turnimpairs cognitive performance, such as mental arithmetic (al’Absiet al., 2002; Veltman& Gaillard, 1993). In addition, because neurochemicals released in response to stress, such as glucocorticoids (Roosendaal,McReynolds, &McGaugh, 2004; Sapolsky,1992) and dopamine (Adler et al., 2000; Koepp et al., 1998;Pappata et al., 2002), all have receptors in the prefrontal cortex(PFC), it is reasonable to hypothesize that decision-making processes that rely on orbitofrontal portions of the PFC canalso bedirectly affected by stress. Patient immediately after surgery will be in a state of significant amount of stress thereby weakening the working memory³.

The only possible way forward is to start again the process of entering information into working memory. This can be easily aided by giving a written pamphlet and further reinforcing over phone next day after surgery which reduces the demand on working memory.

V. Conclusion

This study included 89 patients in the group where working memory following 3rd molar surgery was reinforced with a pamphlet and again through phone on the next day of surgery while 86 patients was kept as control where post-operative instructions are given routine verbal means. Study group showed better results than the control group in domains like Eating, Speech, Appearance, Mouth opening, Speech, Leisure activities. Pain and Swelling, Pain and interference with Daily Activities, Sickness, tingling sensation of lips and tongue have showed no difference between the groups. A gender difference in stress and decision making is consistent with a rapidly growing body of literature in brain and behaviour research. In our study we didn’t had any difference in response based on gender. Reinforcement of working memory of the patient with the aid of pamphlet and the next day over phone helped the patient to faithfully follow the post-operative instructions. This reinforcement of working memory has found to be effective in improving the overall quality of life of the patient after surgery.

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