

Postoperative Changes in the Skin of Maxillofacial Region, Blood Glucose Level and Blood Pressure Following Corticosteroid Therapy in Orthognathic Surgery: An Evaluative Study

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ABSTRACT

Background: Steroids are commonly advocated for the reduction of postoperative pain, swelling, trismus, nausea and vomiting in patients having orthognathic surgery. It has been noted that certain short-term complications like hyperglycemia, hypertension, steroid-induced acne, delayed wound healing is associated with the usage of steroids in orthognathic surgery. In this study, our primary objective is to evaluate the postoperative changes in skin of maxillofacial region (acne/ skin eruptions), serum glucose level and blood pressure following intravenous administration of in patients undergoing orthognathic surgery.

Materials and Methods: The study was conducted on 152 patients who underwent orthognathic surgery and received intravenous dexamethasone postoperatively. All patients' maxillofacial region were inspected for any skin eruptions on 1st, 2nd, 3rd postoperative days and on 1st, 2nd, 3rd and 4th week. Blood Glucose level and blood pressure recorded preoperatively and postoperatively on 1st, 2nd, 3rd and 8th day.

Results: Sample size was 152 out of which 32 patients had facial skin eruptions post operatively. Maximum skin eruptions noted on 2nd week. The mean blood glucose concentration increased from the baseline level of 89.9 mg/dl to 112.9 mg/dl on the first postoperative day and 123.6mg/dl on 2nd postoperative day, on the third day it was 121.9 mg/dl, and on 8th day it was 99.4 mg/dl. Very mild increase and decrease in blood pressure values noted postoperatively.

Discussion: Dexamethasone caused steroid induced acne in 21% of orthognathic surgery patients. Dexamethasone also caused a transient rise in blood sugar levels, and there was no significant change in the blood pressure values.

Keywords: Orthognathic surgery; glucocorticoids; steroid induced acne; steroid induced hyperglycemia.

INTRODUCTION

Orthognathic surgery is a unique surgical procedure done commonly in young adults to improve function and cosmetics of jawbones and face and occlusal function enhancing the patient's well-being and

sense of self.¹ Steroids are used to reduce the postoperative swelling, pain, nausea and vomiting, but it causes short term effects such as steroid induced acne, hyperglycemia and hypertension.²

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This often causes a great deal of concern to the patient. Most common complications following short-term treatment with glucocorticoids include steroid-induced acne, hyperglycemia, delay in wound healing, increased hypertension/cardiovascular risk, increase in pre-existing peptic ulcer disease, change in mood/psychosis.^{2,3} Steroid induced acne in orthognathic surgery turns to be a great deal of concern to the patient, especially in younger patients without a history of acne. The patient should be reassured that steroid acne is quite different from that of acne-vulgaris in that the steroid acne usually resolves spontaneously and leaves no scars behind.⁴ Hyperglycemia is one of the most common side effects of glucocorticoids.⁵ Glucocorticoids oppose insulin action and stimulate gluconeogenesis especially in the liver resulting in a net increase in hepatic glucose output. Drug dependent mineralocorticoid effects of exogenous mineralocorticoids manifest in the body as fluid retention. Eventually, this will lead to an increase in blood pressure both in patients with or without hypertension.⁶ Steroid acne after orthognathic surgery usually turns out to be a great deal of concern to the patient, particularly when there is no history of past problems with acne. Hyperglycemia and the risk of hypertension are also associated with the use of corticosteroids. Steroids are magical drugs when it is used judiciously. Hence patient selection is very important before starting steroid therapy. Patient with acne-prone history and hyperglycemia alternative measures can be sought. This study aims to evaluate the postoperative changes in the skin of the maxillofacial region (steroid induced acne), serum glucose level and blood pressure in orthognathic surgery patients who were administered with dexamethasone postoperatively.

MATERIAL AND METHODS

This study was carried out from 1st June 2018 to 31st August 2019 for a period of 15 months among patients availing treatment. The samples collected as per formula and ethical clearance were taken from committee of the institution with Approval No - IEC/MES/64/2017 dated 09/11/2017. Healthy adults, both males and females with age greater than or equal to 18 and underwent an orthognathic surgical procedure and treated with a short course of intravenous corticosteroid therapy to control

postoperative edema following orthognathic surgery.

Graph 1: comparison of postoperative changes in skin of maxillofacial region.

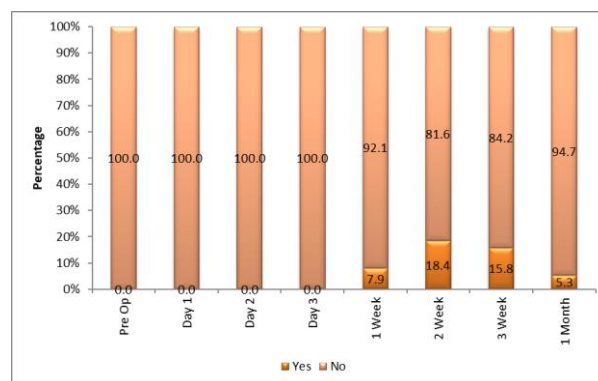


Table 1: Percentage distribution of postoperative skin eruptions.

Postoperative changes in Skin eruption	Yes		No		Z#	p
	Count	Percent	Count	Percent		
Pre Op	0	0.0	152	100.0	-	-
Day 1	0	0.0	152	100.0	0	1.000
Day 2	0	0.0	152	100.0	0	1.000
Day 3	0	0.0	152	100.0	0	1.000
1 Week	12	7.9	140	92.1	1.73	0.083
2 Week	28	18.4	124	81.6	2.65**	0.008
3 Week	24	15.8	128	84.2	2.45*	0.014
1 Month	8	5.3	144	94.7	1.41	0.157

Wilcoxon Signed Rank Test**: - Significant at 0.01 level, *: - Significant at 0.05 level

Table 2: Postoperative Serum Glucose Level.

Stage	Mean	SD	N	Group	Mean difference	Paired 't'	P
Pre-Op	89.9	7.1	38	-	-	-	-
1st Day	112.9	15.7	38	Day1 Vs Pre	23.0	8.62	p<0.01
2nd Day	123.6	18.8	38	Day2 Vs Pre	33.7	10.59	p<0.01
3rd Day	121.9	12.1	38	Day3 Vs Pre	32.0	13.93	p<0.01
8th Day	99.4	13.9	38	Day8 Vs Pre	9.5	4.09	p<0.01

Table 3: Changes in systolic blood pressure.

Stage	Mean	SD	N	Group	Mean difference	Paired 't'	p
Pre-Op	119.8	8.6	38	-	-	-	-
1st Day	120.5	8.4	38	Day1 Vs Pre	0.7	0.54	0.596
2nd Day	119.6	8.2	38	Day2 Vs Pre	0.2	0.15	0.885

3rd Day	118.9	7.8	38	Day3 Vs Pre	0.9	0.61	0.543
1 Week	116.8	7.0	38	1Week Vs Pre	3.0	2.31*	0.027

Table 4: Changes in postoperative diastolic blood pressure.

Stage	Mean	SD	N	Group	Mean difference	Paired t'	P
Pre-Op	75.8	6.8	38	-	-	-	-
1st Day	76.5	6.7	38	Day1 Vs Pre	0.7	0.49	0.624
2nd Day	77.4	6.0	38	Day2 Vs Pre	1.6	1.1	0.279
3rd Day	77.3	5.6	38	Day3 Vs Pre	1.5	1.12	0.270
1 Week	74.8	5.9	38	1Week Vs Pre	0.9	0.66	0.516



Fig 1a: Pre-Op Front View & 1b- Post-Op- Skin Eruptions - Front View.



Fig 2a: Pre-op - lateral view & 2b- post-op- skin eruptions - lateral view.



Fig 3a: pre-op lateral view & 3b- post-op- skin eruptions - lateral view.

Patients with pre-existing systemic diseases like diabetes mellitus, hypertension, peptic ulcer and open-angle glaucoma were excluded from the study. Patients with a past history of acne or presence of skin eruptions and patients taking corticosteroids in any form before surgery were excluded from the study. All patients included in the study were treated on an inpatient basis and received a short course of intravenous corticosteroid therapy. All patients received 8 mg dexamethasone thrice on an operative day, twice on 1st postoperative day and one dose on 2nd postoperative day (total 48 mg dexamethasone) All patients are followed up on 1st, 2nd, 3rd postoperative days and on 1st, 2nd, 3rd and 4th week. Maxillofacial region of all patients' was inspected for any skin changes or eruptions that were not present before surgery. It was inspected for skin eruptions on 1st, 2nd and 3rd day postoperatively. Follow up visit and examination of the maxillofacial region were done on consecutive 1st, 2nd, 3rd weeks and on 1st month. RBS also was recorded prior to surgery. Blood Glucose level measurements made postoperatively by finger prick test on 1st, 2nd, 3rd and 8th day. Blood glucose estimation was done at specific time period (between 11:00 am- 12:00pm). Blood pressure measurements were recorded preoperatively and post operatively on 1st, 2nd, 3rd and 8th day using conventional sphygmomanometer. Data were coded and entered in MS Excel and analysis was done using SPSS 20. Descriptive analysis was done. Proportions were expressed in percentage. Mean and standard deviation calculated for continuous variables. Wilcoxon signed rank test was done to assess facial skin eruptions. Paired t test was used to compare the changes in blood sugar and blood pressure values.

RESULTS

Gender wise distribution:

The gender distributions showed that number of females were more than males. There were 96 female Patients (63.2%) and 56 male patients (36.8%) in the study group.

Postoperative changes in skin of maxillofacial region

Out of 152 patients, 32 patients had developed postoperative steroid-induced acne. (table 1) Only 1 patient had severe acne that existed for 4 weeks and was made to consult with the Dermatology department (Fig 1,2,3). Postoperatively steroid-induced acne was noted in 12 patients in the first week (7.9%), 28 patients (18.4 %) had skin eruptions in 2nd week; of which 12 patients were pre-existing cases, and 16 cases were new which was statistically significant at 0.01 level. 24 patients had skin eruptions in 3rd week (15.8 %) ;in which 20 were pre-existing cases and 4 new cases, and was statistically significant at 0.05 level. 8 patients had skin eruptions in 4th week (5.3 %) and all the cases were pre-existing. (Graph 1) In all cases except one skin eruptions regressed and resolved spontaneously. One case has consulted with dermatology department, advised clear gel application once daily and regressed on 6th week

Postoperative blood glucose level

Mean blood glucose level for the patients preoperatively was 89.9 mg/dl. It was 112.9 mg/dl on the first postoperative day, 123.6 mg/dl on 2nd postoperative day and 121.9 mg/dl on 3rd postoperative day. On 8th day it was 99.4 mg/dl. There was a statistically significant $p < 0.01$ change in glucose levels in all patients. (Table 2)

Changes in blood pressure

Postoperatively there was no significant change in blood pressure. Mild increase and decrease were noted in the systolic and diastolic blood pressure following steroid therapy in orthognathic surgery patients. (Table 3&4)

DISCUSSION

Orthognathic surgery or corrective jaw surgery designed to correct different conditions of the jaw and face related structures, TMJ disorders, growth abnormalities malocclusion problems owing to skeletal disharmonies, obstructive sleep apnoea, and other orthodontic problems that cannot be easily treated with conventional orthodontic treatment.⁷ The first description of a surgical intervention to correct a malocclusion was by Hüllihen in 1849.⁸ Typically during orthognathic

surgery, bone is cut, moved, modified, and realigned to correct a dentofacial deformity. Some of the commonest complications of orthognathic surgery are pain, trismus, swelling, nausea and vomiting, , hemorrhage, nerve injuries, relapse, TMJ dysfunction.⁹ The anti- inflammatory action of corticosteroids was first discovered by Hench and co-workers in the treatment of rheumatoid arthritis in 1949.¹⁰ Corticosteroids significantly reduce edema and pain.^{11,12} Steroids can be taken by mouth, intramuscular injection or intravenous methods.¹³ Corticosteroids have numerous effects on body function. They influence carbohydrate, protein, fat, and purine metabolism; electrolyte and water balance; and the function of the cardiovascular system, the kidney, skeletal muscle, the nervous system, and other organs and tissues. Perhaps one of the most important actions of corticosteroids is the prevention or suppression of body's inflammatory response by interfering with capillary dilatation, fibrin deposition, leukocyte migration, oedema formation and phagocytosis.¹⁴ Similar finding was described by Schaberg et al. that patients who received methylprednisolone had significantly less postoperative facial oedema when compared with the control group in which steroids were not administered.¹⁵ A total of 152 patients were included in this study, in which 96 [63.2%] were female patients, and 56 [36.8 %] were male patients. Mean age of the study population was 21.4 years. A most common procedure performed in this study was BSSO set back of mandible in 36 patients.

Steroid induced acne:

In our study, 32 out of 152 patients had skin eruptions postoperatively (30 female patients and 2 male patients). In all cases except one skin eruptions regressed and resolved spontaneously. Steroid-induced acne is different from acne vulgaris is that the former usually resolves spontaneously and leaves no scars. Patients can be advised to wash with water only and to avoid the use of all cosmetics on the affected area that until the skin is free of eruptions.⁴ patients with severe eruptions can be referred for a dermatology consultation. Otto H. Mills et al. in 1973 reported that steroid-induced acne is common in patients with kidney transplants and who receives corticosteroids for immunosuppressive therapy. Treatment consisted solely of topical application of a 0.05% solution of tretinoin (Retin-A).¹⁶ In 1986, Goldstein GD et al. also

reported steroid induced acne as a cutaneous complications of heart transplantation.¹⁷ The incidence of steroid-induced acne in orthognathic surgery patients was first described by D.s Precious et al. in 1992. They noted steroid-induced acne in 8 women patients out of 1276 patients. All these patients were in the age group of 24-36 years.⁴ But in our study, 21% of the patients had skin eruptions (32 out of 152 patients). In our study, steroid-induced acne maximum noted in the second week. This was consistent with the findings of D.S Precious et al. According to their study steroid acne typically occurs within 2 weeks of the start of systemic corticosteroid therapy and usually involutes and disappears without scarring once the medication is discontinued. Steroid-induced acne in paediatric patients is also reported.¹⁸ Another case of steroid-induced acne was reported in a 21-year-old Malay lady who underwent orthognathic surgery and received dexamethasone perioperatively.¹⁹ Farida Tabri reported a case of severe striae and steroid acne as a side effect of long term systemic corticosteroid treatment in a 16-year-old girl who was diagnosed with lupus nephritis.²⁰ The pathogenesis behind the steroid-induced acne is not completely understood. There is the complex interplay of hormones like estrogen, growth hormone, insulin, corticotropin-releasing hormone, melanocortins and glucocorticoids. Glucocorticoids promote sebocyte differentiation in the pilosebaceous unit, and the differentiation is mediated through a steroid-induced activation of toll-like receptor-2, which is a pro-inflammatory mediator.²¹ Interestingly we noted the steroid-induced acne in our trauma patients who undergone open reduction and internal fixation under general anaesthesia and received dexamethasone postoperatively.

Postoperative blood glucose level changes:

Mean blood glucose level for the patients preoperatively was 89.9 mg/dl. It was 112.9 mg/dl on the first postoperative day, 123.6 mg/dl on 2nd postoperative day and 121.9 mg/dl on 3rd postoperative day. On 8th day it was 99.4 mg/dl. There was a statistically significant $p < 0.01$ change in glucose levels in all patients. Dexamethasone causes hyperglycemia in susceptible patients. Since most of the patients for orthognathic surgery are in the age group of 18-30 years and are healthy non diabetic individuals, hyperglycemia is not severely

affected, but significant increases in the blood glucose levels are noted. So continuous monitoring of blood glucose level is advisable. Blood sugar levels are back to normal within one week of stoppage of the drug. This was consistent with the findings of Rishu Bhanot and Jyoti Mago in 2016.²² Hyperglycemia induced by glucocorticoids is transient and reversible. Sometimes a long term use may affect the pancreatic function and develop diabetes mellitus.²³

Effect of steroid therapy on blood pressure:

Mild increase and decrease noted in the systolic and diastolic blood pressure following steroid therapy in orthognathic surgery patients. Mean systolic blood pressure preoperatively was 119.8 mm/hg, on the first postoperative day was 120.5 mm/hg, 119.6 mm/hg on 2nd postoperative day, 118.9 mm/hg on 3rd postoperative day and 116.8 mm/hg on 1st-week review. Similarly mean diastolic blood pressure preoperatively was 75.8 mm/hg, on the first postoperative day was 76.5 mm/hg, 77.4 mm/hg on 2nd postoperative day and 77.3 mm/hg on 3rd postoperative day and on 8th day it was 74.8 mm/hg. There was no significant change in blood pressure following corticosteroid therapy in orthognathic surgery patients. This may be because of mineralocorticoid sparing activity of dexamethasone and study group consists of healthy young individuals. Newer synthetic steroids like dexamethasone, betamethasone causes an only slight increase in plasma volume and increase in blood pressure and they lack mineralocorticoid activity when compared to methylprednisolone and hydrocortisone. This may be the possible reason for insignificant changes in blood pressure.^{24,25} Dexamethasone induced hypertension is associated with increased total peripheral resistance and heightened pressor response to vasoconstrictors.

CONCLUSION

It was observed that steroid therapy causes steroid-induced acne in susceptible patients. 32 out of 152 patients had postoperative steroid-induced acne. All cases regressed and healed without scarring. Significant increase in blood sugar levels noted in orthognathic surgery patients. Post operatively there was no significant change in blood pressure. Corticosteroids are magical drugs and can be described as a double edged sword. There are also

reported articles which proves that short-term steroid therapy can give rise to possible long-term complications.²⁶⁻²⁸ If it is judiciously used, it can reduce postoperative edema, trismus, pain, nausea, vomiting and aids in better recovery of orthognathic surgery patients. Patients with acne-prone history, impaired glucose control, alternative measures such as enzyme therapy can be used.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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