



Steroids in Oral surgery

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ABSTRACT

Corticosteroids have become an indispensable component of oral surgical procedures for their known anti-inflammatory potential which has proved to be quite effective in reducing the associated post-operative complications. Due to potent anti-inflammatory action, steroids have transformed the management of various acute, chronic as well as debilitating conditions of the oral and maxillofacial region. Although the steroids offer commendable results, there still have been certain restraints on their use as they can trigger various adverse-effects as well. The article will therefore focus on the anti-inflammatory mechanism of action of steroids and their role in oral surgical procedures, thereby, highlighting the contraindications and adverse effects of their prolonged and crude use.

Keywords: Anti-inflammatory action, Glucocorticoids.

Introduction

Various chemical substances, specifically known as hormones regulate the physiological functioning of the human body. These hormones are naturally produced by the human body. Corticosteroids are one such group of hormones that are secreted by the outer portion of the adrenal gland which is the adrenal cortex. The two major corticosteroids produced by the adrenal cortex include the mineralocorticoid and glucocorticoid hormones which serve a wide range of functions from the regulation of sodium and water retention to the regulation of metabolism, blood pressure, and cardiac functions, respectively (Zandi, 2012, Munro IR et al (1986), Low LF et al (2017)).^{1,2,3} With the discovery of the anti-inflammatory and immune-modulating properties of corticosteroids in 1949, their synthetically produced derivatives have been widely used by both medical and dental practitioners (Hench et al (1949), Buyukkurt MC et al (2006), Ericson-Neilson W et al

(2014), Kang SH et al (2010), Andresan et al (2012)).^{4,5,6,7,8} Due to the potent anti-inflammatory and immunosuppressive functions, corticosteroids are being extensively used by oral and maxillofacial surgeons for the treatment of oral diseases, conditions, and disorders (Bhanot et al (2016), Shaikh S et al(2012), Butler RC et al (1993), Kormi E et al(2016).^{9,10,11,12} While their use has baffled many dental practitioners across the world, yet they have been of great help in limiting the postoperative complications or morbidities of oral surgical procedures in patients (Kim et al (2009), Holland CS et al (1987), Smith Bk et al (1991), Coulthard P et al (2013), Donald MC et al (2017), Krishnan et al (2018).^{13,14,15,16,17,18} But till date, steroids lack a standardized dosage protocol which is very much required, so that the steroids could effectively and appropriately be used by oral surgeons (Zandi M (2012), Williams VM (2018), Kent S(2020), Balakrishnan R et al (2014).^{19,20,21,22} The review will discuss the use of corticosteroids by oral and maxillofacial surgeons, thereby highlighting the adverse impacts of extensive and inappropriate usage of steroids.

Steroid hormones secretion in the human body

Steroids production within the human body occurs by hypothalamic-pituitary-adrenal axis (HPA mechanism) as shown in Fig 1. This production takes place in a circadian pattern (Williams, 2018).²⁰

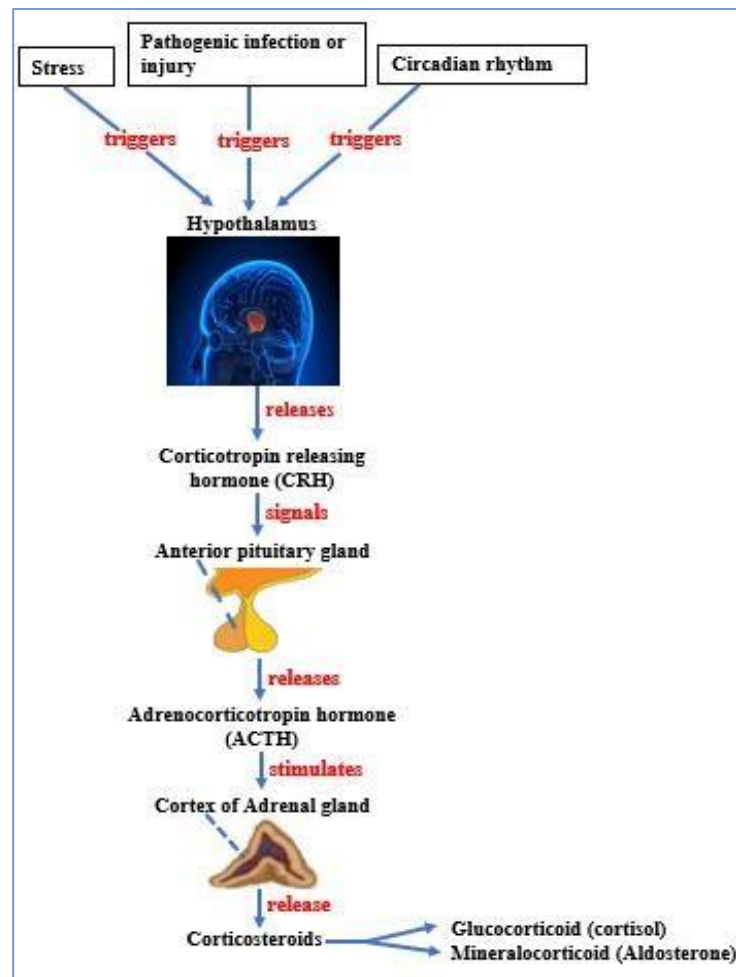


Figure.1: Steroid Secretion in Humans

Mechanism of anti-inflammatory action of Steroids

The anti-inflammatory response is produced chiefly by the glucocorticoids. On administration, glucocorticoids (GC) penetrate the cell membrane of the cell and binds to the cytoplasmic glucocorticoid receptor (GR) proteins that normally reside within the cytoplasm bounded to chaperone proteins, typically the heat-shock proteins (HSP-90). The GCGR complex is formed when the glucocorticoids bind to the glucocorticoid receptor, resulting in the release of chaperone (HSP-90) proteins which further causes migration of the GCGR complex into the nucleus. Inside the nucleus, the GCGR complex undergoes dimerization and binds to the glucocorticoid response elements (GREs) on the DNA molecule, resulting in the origination of anti-inflammatory mechanism by three methods namely, transactivation (GCGR dimer binds to +ve GRE), transrepression (GCGR dimer binds to -ve GRE), squelching and tethering (GCGR binds to other transcriptional activators like nuclear factor-B, activator protein-1), as depicted in Fig.2 (Lowe et al., 2008; Sibila O et al., 2015; Williams, 2018).^{2,3,20}

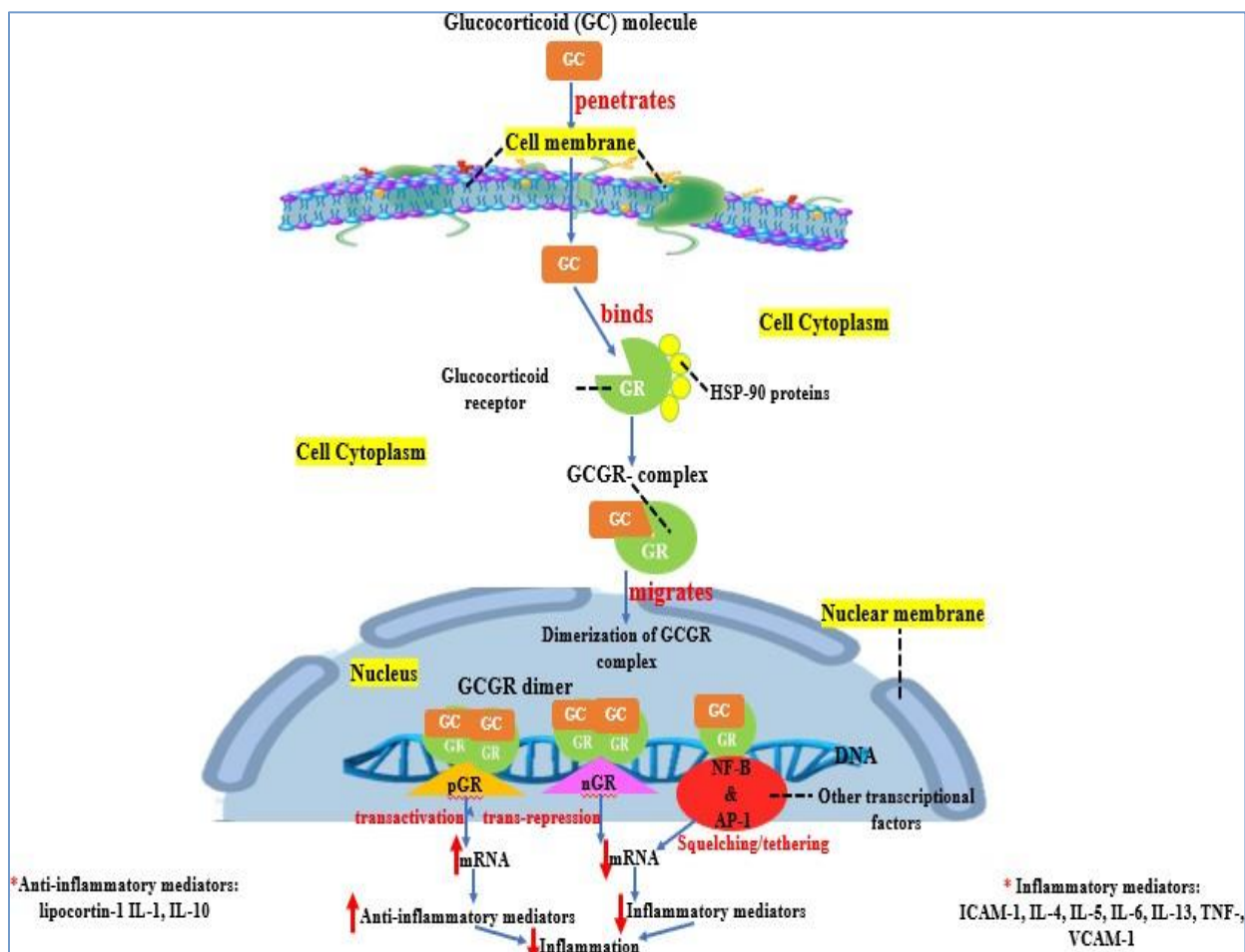


Figure.2: Anti-inflammatory mechanism of action of steroids

Steroids in Oral surgery

Steroids, chiefly glucocorticoids are being potentially used by oral surgeons due to their potent anti-inflammatory properties. Some of the very commonly used glucocorticoids have been mentioned in table 1.



Type of steroid	Name of the steroid	Glucocorticoid (anti-inflammatory) potency	Mineralocorticoid (salt-retaining) potency	Duration of action	Equival anti-inflamm dosage (mg)
Glucocorticoid	Hydrocortisone (cortisol)	1.0	1.0	Short- acting (Biological $t_{1/2}$ < 12 hours)	20
	Cortisone	0.8	0.8		25
	Triamcinolone	5	0	Intermediate-acting (Biological $t_{1/2}$ 12-36 hours)	4
	Prednisolone	4	0.8		5
	Prednisone	4	0.8		5
	Methylprednisolone	5	0.5		4
	Deflazacort	3-4	0		6
	Dexamethasone	25	0	Long-acting (Biological $t_{1/2}$ > 36 hours)	0.75
	Betamethasone	25	0		0.75
	Mineralocorticoid	Fludrocortisone	10	150	Intermediate-acting

Uses of steroids in oral surgery

Various post-operative complications like pain, oedema, trismus, and functional discomfort are substantially stimulated in the head and neck region of the patients after oral surgical procedures. Such post-operative complications generated could be successfully minimized by means of effective and appropriate surgical techniques (Gersema and Baker, 1992; Zandi, 2012).^{24,19} Efficacious use of corticosteroids, more precisely, the glucocorticoids during the perioperative period has resulted in the reduction of post-operative complications quiet successfully (Gersema and Baker, 1992).²⁴

The glucocorticoids have been used very potentially in the management of post-operative signs of inflammation (dolor, calor, rubor, tumor, and function laesa), following the extraction of impacted third molars which is the most frequent and common oral surgical procedure (Gersema and Baker, 1992; Zandi, 2012; Krishnan, 2018).^{24,19,18} The effective use of corticosteroids in the disimpaction of third molars in oral surgery has been discussed in various studies, some of which have been listed in Table 2.

Type of surgery	Steroid used	Result	Reference
Impacted mandibular third molars surgery	Dexamethasone 4 mg (single dose)	Reduced pain, oedema and trismus	Messer and Keller, 1975
Impacted third molars surgery	Betamethasone 4 mg (single dose)	Reduced pain, oedema and trismus	Pederson, 1985
Impacted mandibular third molars surgery	Prednisolone 25 mg (single dose)	Reduced pain, oedema and trismus	Buyukkurt et al., 2006
Impacted third molar surgery	Prednisolone 30 mg (single dose)	Reduced pain, oedema and trismus	Tiigimae-Saar et al., 2010
Bilateral impacted mandibular third molars surgery	Methylprednisolone 40 mg (single dose)	Reduced pain, oedema and trismus	Kaur et., 2011
Impacted mandibular third molars surgery	Methylprednisolone 40 mg (single dose)	Reduced pain, oedema and trismus	Vyas et al., 2014
Impacted third molar surgery	Dexamethasone 4 mg (single dose)	Reduced pain, oedema and trismus	Syed et al., 2017

Table 2: Studies on effective use of corticosteroids for impacted third molars

Temporomandibular joint dysfunctions (TMD's) that involve the temporomandibular joint (TMJ), as well as masticatory muscles or both, are very common among individuals. The TMD's may occur as a result of traumatic injury to the TMJ like fractures or non-traumatic injuries such as neoplasms (osteoma, chondroma, sarcoma), congenital or development anomaly, and rheumatoid arthritis (Gersema and Baker, 1992; Zandi, 2012; Krishnan, 2018).^{24,19,18} The management of acute TMD's for reducing or eliminating the pain, tenderness of masticatory muscles, and altered jaw movements have been successfully done by using glucocorticoids. Many oral steroids listed in table 3 have proved to be very effective (Gersema and Baker, 1992; Zandi, 2012; Krishnan, 2018).^{24,19,18} Restoration of the adequate and normal functioning of the TMJ has been excellently achieved by the intra-articular steroidal injections into the TMJ region.

Sr. No.	Name of Corticosteroid used	Dosage (mg/day)
1.	Dexamethasone	0.75-9
2.	Betamethasone	0.6-7.2
3.	Hydrocortisone	20-240
4.	Prednisolone	5-60
5.	Prednisone	5-60

Table 3: Oral corticosteroids used in management of acute TMD's

Steroids are also potent in reducing neural pains and discomfort caused due to trigeminal nerve injuries, traumatic facial nerve paralysis, orthognathic surgeries, allergies, and tumors of the maxillofacial region (Gersema and Baker, 1992; Zandi, 2012; Krishnan, 2018).^{24,19,18} Oral lesions such as an erosive form of lichen planus and severe recurrent aphthous ulcers are also being effectively managed by the use of injectable corticosteroids (Gersema and Baker, 1992; Zandi, 2012).^{24,19,18} Also, intraoral creams and gels like

beclomethasone, betamethasone, fluocinonide, etc., are being successfully used in treating various oral ulcerative and vesiculobullous lesions such as pemphigoid, pemphigus Vulgaris, recurrent aphthous ulcers, and Behcet's syndrome (Gersema and Baker, 1992; Zandi, 2012; Krishnan, 2018).^{24,19,18}

Contraindications of steroids

While prescribing steroids, the physicians need to be extremely cautious and aware of their patient's medical history. Any negligence may result in severe complications for some patient's present terrible issues with the use of systemic corticosteroids, some with injectable steroids while others with topical steroidal applications (Zandi, 2012; Bhanot and Mago, 2016; Krishnan, 2018).^{19,9,18} Hence, the corticosteroid use is contraindicated in some immune-compromised patients presenting with either of the few situations as listed in table 4.

Route of steroid use	Contraindicated situations
Systemic corticosteroids	In patients with uncontrolled diabetes, hypertension, active peptic ulcer, heart diseases, mental disorders, psychiatric disorders, osteoporosis, cataract, glaucoma, tuberculosis, mycobacterial diseases, herpes simplex infection, varicella zoster infection, immune deficiency, underactive thyroid, and pregnancy.
Injectable corticosteroids	In patients with hypersensitivity to corticosteroids, infections, and active tuberculosis.
Topical corticosteroids	In patients with primary bacterial infections such as impetigo, furuncles, carbuncles, erysipelas, cellulitis and lymphangitis.

*Zandi, 2012; Bhanot and Mago, 2016; Krishnan, 2018

Table 4: Contraindications of steroids in immune-compromised patients on basis of route of steroid administration

Adverse effects of steroids

Although steroids have been highly potent in the treatment and management of various oral and maxillofacial diseases and disorders, at the same time they have also resulted in various adverse effects. Depending upon the duration of steroid use, the dosage prescribed and the route of administration of steroids into the human body, the adverse effects vary extensively. (Zandi, 2012; Bhanot and Mago, 2016; Krishnan, 2018).^{19,9,18}

The use of systemic corticosteroids may lead to weight gain, impaired growth, adrenal insufficiency, electrolyte abnormalities, increased vulnerability to infections, hypertension, myopathy, osteoporosis, fractures, cataract, glaucoma, psychological problems like insomnia, Cushing's syndrome, diabetes, and peptic ulcers in patients (Zandi, 2012; Bhanot and Mago, 2016; Krishnan, 2018).^{19,9,18} The use of topical corticosteroids can also cause side-effects, such as skin atrophy, contact dermatitis, hypopigmentation, oral thrush, subcutaneous fat wasting, and cushingoid effects in patients while injectable steroids can result in mucosal atrophy and intralesional use of corticosteroids may cause a sterile abscess, skin atrophy, hypopigmentation, panniculitis, and skin necrosis (Zandi, 2012; Bhanot and Mago, 2016).^{19,9}

Conclusion: Steroids have become an indispensable tool for oral surgeons, owing to their effectiveness and credibility in the post-operative management of oral surgical procedures. Due to their advantageous life-protecting nature at one end and their disadvantageous life-risking nature at another end, they are considered to a mixed blessing. Although, steroids have revolutionized the management of post-operative

morbidities caused by oral surgical procedures to a greater extent, their misuse or inappropriate use in terms of dosage and their usage in immune-compromised patients have resulted in severe adverse effects of which some have been life-threatening as well. The article has discussed the impactful use of corticosteroids in oral surgery as well as their contraindications and adverse effects on patients. Also, the life-risking nature of steroids has called for the need for an adequate standardized dosage system which is still lacking, in order to curb its adverse effects.

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