

Role of Corticosteroids in Oral and Maxillofacial Surgery

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Abstract

Corticosteroids are potent anti-inflammatory drugs that resemble cortisol, a naturally produced hormone by the body. Their main use is to reduce inflammation, especially when the body mistakenly triggers inflammation where it shouldn't exist. Corticosteroids are widely used in the treatment of diseases, disorders and conditions affecting the oral and maxillofacial area and the adjacent associated structures. The diseases of the oral and maxillofacial region may be either local or the manifestation of systemic problem. Corticosteroids have their widest application in the management of acute and chronic conditions which have an allergic, immunologic, or inflammatory basis. Most of the oral and maxillofacial surgeons utilize corticosteroids based on their efficacy to control outcomes of surgery and to yield a comfortable post-surgery period. This paper reviews the uses of corticosteroids in oral and maxillofacial surgery.

Key Words: Corticosteroids, hydrocortisone, glucocorticoids, anti-inflammatory action, oral surgery, dexamethasone

INTRODUCTION

Corticosteroids (CS) are known to reduce inflammation, fluid transudation and edema. Corticosteroids (Glucocorticoids) represent the most efficacious anti-inflammatory agents and that is the reason why they are often used in several different conditions [1]. The mechanism of action of corticosteroid has been largely reviewed by several authors and that are mostly preferred in maxillofacial surgery include dexamethasone (administered orally), dexamethasone sodium phosphate (IV or IM), dexamethasone acetate (IM), methylprednisolone (orally), methylprednisolone acetate and methylprednisolone sodium succinate (IV or IM). In the past, betamethasone has been used as well. Often used in oral surgery are long-acting corticosteroid compounds. Among these, the most frequently used is dexamethasone that is about 25–30 times more potent than cortisol [2]. It is available in oral, parenteral and topical formulations and is largely used in oral surgery, pre- or only post-surgery due to its long half life and high efficacy. The use of steroids in oral surgical procedures may present as an area of ambiguity for many practitioners. Some practitioners may consider the use of steroids only as a supplement in patients undergoing extensive oral surgery procedures, but steroids such as dexamethasone can be a valuable tool when performing moderate to moderately severe oral surgical procedures [3]. The use of corticosteroids can decrease the severity of postoperative sequelae in many patients and hence, decreasing the morbidity after oral surgery.

PHYSIOLOGY OF CORTICOSTEROIDS

There are three groups of steroid hormones produced in the adrenal cortex: the glucocorticoids, androgens and mineralcorticoids (Fig 1). Adrenal cortex secretes glucocorticoids and steroids have widespread effect on the metabolism of protein and carbohydrates. The zona fasciculata secretes glucocorticoids, cortisol and corticosterone as well as small amount of adrenal androgen and estrogens [4]. The secretion of these cells is controlled by hypothalamic pituitary axis (HPA) via adrenocorticotropic hormone (ACTH). The chemical structure of cortisol is depicted in Fig 2.

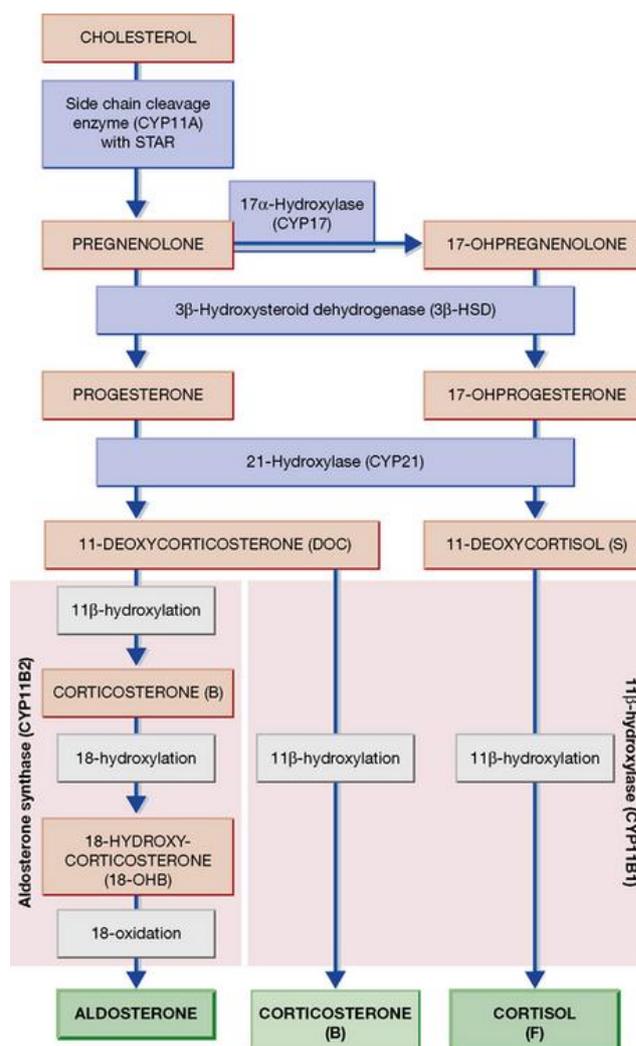


Fig 1. Biosynthesis of Corticosteroids

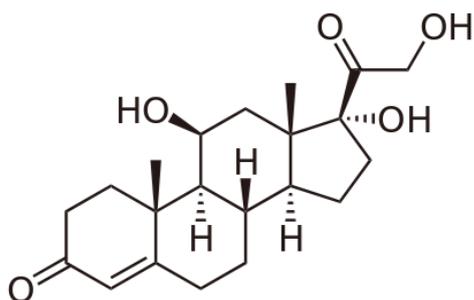


Fig 2. Chemical structure of Cortisol

MECHANISM OF ACTION OF CORTICOSTEROIDS

The classic signs of inflammation, which includes edema, erythema, pain and loss of function, commonly occurs after a routine or difficult surgical procedure. The inflammatory process is necessary for the healing to occur, but often excessive inflammation which causes the patient unnecessary pain, trismus and edema. Corticosteroids reduce inflammation via the inhibition of phospholipase A₂, which is the first enzyme involved in the conversion of phospholipids into arachidonic acid, therefore blocking the synthesis of other products such as prostaglandins, leukotrienes and substances related to thromboxane A₂. In essence, corticosteroids prevents the formation of these end products which is a broth of potent inflammatory mediators causing the signs and symptoms described above [5]. They also have the ability to stabilize lysozyme membranes, reduce the release of inflammation-causing lysozymes, and decreases the permeability of capillary which prevents diapedesis. There is also a decrease in the formation of bradykinin, a powerful vasodilating substance [6]. The mechanism of action of corticosteroids at the cellular level is described in Fig 3.

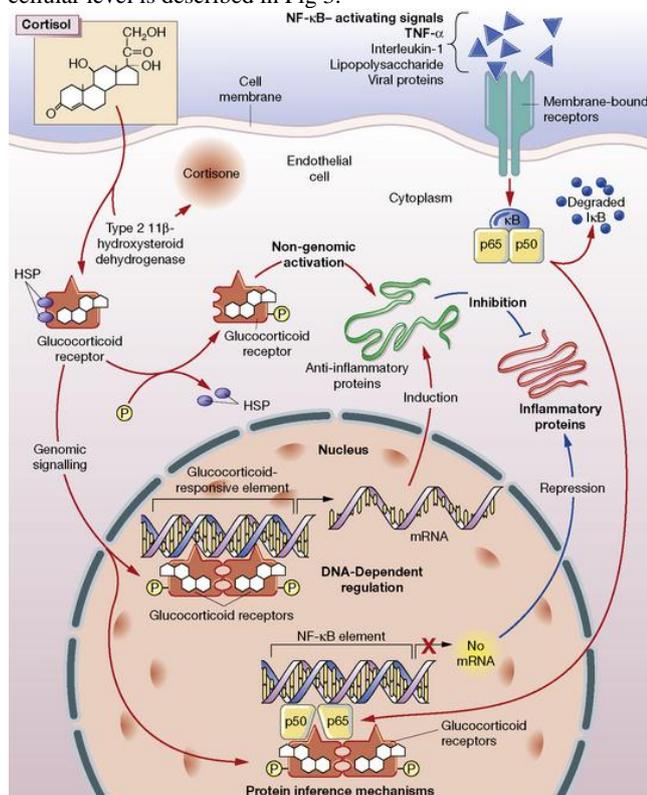


Fig 3. Three general mechanisms of action of glucocorticoids and the glucocorticoid receptor in the inhibition of inflammation: non-genomic activation, DNA-dependent regulation, and protein interference mechanisms.

USES OF CORTICOSTEROIDS IN ORAL SURGERY

The surgical extraction of impacted mandibular third molars is one of the most commonly performed procedures in oral surgery. Patients experience a range of uncomfortable signs and symptoms after extraction including pain, trismus, facial oedema, and functional discomfort of the oral cavity, because of muscular oedema and spasm. Corticosteroids exert an important anti-inflammatory action, reducing liquid transudation and oedema formation, decreasing cell exudates, inhibiting vascular dilatation and reducing fibrin deposit around the inflamed area. The mechanisms responsible for these effects include inhibiting the leukocyte chemotaxis to the inflammatory focus, inhibition of fibroblast function and endothelial cells, and suppression of the production of numerous chemical inflammation mediators. Although corticosteroids are most effective during the first 24 hours post-surgery, their effect can also be noticed for 3 days. A number of authors have reported a statistically significant reduction in pain after the postoperative administration of 40 mg of methylprednisolone, 25 mg of prednisolone or 0.5 mg of betamethasone [7,8]. One study has demonstrated the effectiveness of the oral administration of 8 mg dexamethasone before surgery, which significantly reduced pain and inflammation [9].

A number of studies have reported anti inflammatory actions with usage of CS [7-9]. Studies found facial swelling to be up to 42% less intense 48 hours after surgery in the group administered with methylprednisolone [8,10,14]. Many studies have used CS in combination with other drugs to evaluate their effect upon trismus, pain and swelling and found corticosteroids to be very effective in reducing post-operative complications [10,11,13,14]. Significant reduction in pain and swelling have been reported when CS are used in combination with drugs such as diclofenac [14].

TMDs are clinical problems involving the temporomandibular joints (TMJs), the masticatory muscles, or both. TMDs affect a significant number of individuals, and are the most common musculoskeletal disorders that cause orofacial pain. The most common signs and symptoms of TMDs are pain, trismus, masticatory muscle tenderness and altered mandibular movements. Oral corticosteroids are used mainly for treatment of acute TMJ discomforts, TMJ arthritis or for diagnostic purposes [15,16]. Oral corticosteroids used in TMDs are mainly hydrocortisone with dosage of 20-240mg/day, prednisone with dosage of 5-60mg/day, prednisolone with dosage of 5-60 mg/day, dexamethasone with dosage of 0.75-9 mg/day or betamethasone with dosage of 0.6-7.2mg/day. Intra-articular injections of glucocorticoids into TMJ have yielded excellent results in many studies and normal function of TMJ has been restored [17-19]. In addition to the above indications, corticosteroids are also proven to be successfully used in the management of acute trigeminal nerve injuries, chronic facial pain, traumatic facial nerve paralysis, for orthognathic surgeries and several allergic diseases involving maxillofacial area [20-22].

CONTRAINDICATIONS OF CORTICOSTEROIDS

During the prescription of corticosteroids, physicians must be aware that some patients are poor candidate for locally injected, systemic, or topical corticosteroid therapy. Systemic corticosteroids must be used with the caution in patients with diabetes, active peptic ulcer, uncontrolled diabetes, heart diseases, psychiatric disorders, osteoporosis, cataract, infections, glaucoma, tuberculosis, mycobacterial diseases, pregnancy, herpes simplex infection, varicella zoster infection, underactive thyroid, mental disorders and immune deficiency [23]. Injectable corticosteroid use is contraindicated in patients with hypersensitivity to

corticosteroids, active tuberculosis and infections. Use of topical corticosteroids is absolutely contraindicated in the treatment of primary bacterial infections such as impetigo, furuncles, erysipelas, carbuncles, cellulitis and lymphangitis. Topical corticosteroids are also contraindicated in patients with history of hypersensitivity to any of the components of the preparation [21]. Currently, less fact is known about the safety of topical corticosteroids in pregnancy. Studies have reported an association between very potent topical corticosteroids and congenital abnormality including low birth weight and oro-facial clefts, hence, usage of these drugs in pregnancy is not recommended [21].

SIDE EFFECTS OF CORTICOSTEROIDS

The side effects of prolonged CS use are well known, and are often dependent upon the duration of treatment and dose employed. It includes weight gain, impaired growth, adrenal insufficiency, increased susceptibility to infection, myopathy, osteoporosis, osteonecrosis, fractures, glaucoma, cataract, hypertension, peptic ulcer, insomnia and diabetes [24]. Doses in excess of 20 mg of hydrocortisone (> 4 mg of methylprednisolone) or 50 mg of prednisolone (> 40 mg of methylprednisolone) in long-term administration can cause adrenal gland suppression. Such suppression can also be observed when the physiological levels are elevated for more than 5 days, or when CS administered for over 1-2 weeks. This explains why such medication should be suspended gradually (dose tapered down) [24].

CONCLUSION

The usage of corticosteroids is vast but crucial. No wonder, Cortisol (hydrocortisone) is called the "life-protecting hormone" and Aldosterone, the "life-saving hormone." Corticosteroids are used for the treatment of various diseases relating to the oral and maxillofacial region. They are also widely used to minimize the post-operative morbidities such as edema and pain after oral and maxillofacial surgeries. Because of their anti-inflammatory and anti-allergic actions, they have their widest application in the management of acute and chronic conditions which have allergic, immunologic, or inflammatory basis. However, corticosteroids have side effects which are sometimes severe and life threatening. Therefore, benefits from corticosteroids should always be weighed against their potential risks in each patient. Prescribing the least potent type of corticosteroids and minimal dosage necessary to produce a given therapeutic effect, simultaneous use of non-steroidal agents to reduce the dose of corticosteroids, and also administering corticosteroids for a short period of time are some of the methods to reduce the adverse effects of corticosteroids.

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