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RESEARCH ARTICLE

EFFICACY OF DIODE LASER IN THE MANAGEMENT OF ORAL LICHEN PLANUS:A SYSTEMATIC REVIEW.

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Oral lichen planus (OLP), diode laser and low level laser therapy (LLLT).

Abstract

Diode laser have great benefits in treating oral lichen planus (OLP) due to its small size and its ability to denaturant proteins in the diseased epithelium.

Aim: of this systematic review is to synthesize evidence about safety and efficacy of diode laser in the treatment of OLP compared to other management techniques.

Methods: A computer literature search was conducted using relevant keywords (oral lichen planus and Diode Laser). Records were screened for eligible studies. The quality of included studies was assessed using the Cochrane Risk of Bias assessment tool and National Institutes of Health, and National Heart Lung and Blood Institute. "Quality assessment tool for before-after (pre-post) studies with no control group. Data were extracted and evidence was synthesized in a qualitative and quantitative methods. For comparisons and outcomes reported by more than one study, the effect estimates were pooled with their 95% confidence intervals in the meta-analysis model using Review Manager Software.

Results: Data available from clinical studies and case series support the use of diode laser in management of these (erosive-atrophic/ unresponsive to local treatment) lesions as it is a potent, well-tolerated, and safe procedure.

Conclusions: Current evidence suggests that diode laser is effective for the treatment of OLP. However, the gained benefit should be weighed against its cost in future cost-effectiveness analysis.

Introduction:-

Oral lichen planus (OLP) is a chronic disease affecting the skin, scalp, nails, and mucosa, with possible rare malignant degeneration (Chaudhary, 2004). OLP affects approximately 1-2 % of the general adult population the female to male ratio is 1.4:1 (Sugerman et al., 2002). OLP is originated due to multiple factors, most of the time idiopathic with an immune-pathogenesis involving T –cells (Scully et al., 1998).

OLP is a potential source of significant morbidity unlike cutaneous lesions, which are self-limiting in the majority of cases. In addition, oral lesions are often refractory to conventional treatments (Eisen, 2003). Many lines of treatments have been used in the management of OLP like corticosteroids, retinoids, calcineurin inhibitors

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(cyclosporine, tacrolimus, and pimecrolimus), phototherapy, CO2 laser and recently, diode laser. The most common treatment of OLP involves the use of topical steroids; steroids are effective in the treatment of OLP because of their anti-inflammatory effect and anti-immunologic properties of suppressing T-cell function (Radfar et al., 2008).
Prolonged using of corticosteroids cause adverse effects such as candidiasis, dry mouth, bad taste, nausea, sore throat, and, uncommon moon face, and inhibition of the hypothalamus-pituitary-adrenal axis (Thongprasom and Dhanuthai, 2008).

"Recently, there has been much interest and controversy regarding the use of laser in medicine. CO2 laser is considered as one of the earliest lasers used in the medical field (Pick and Powell, 1993).

The CO2 laser has a low power of penetration to tissues that reaches about 0.05 mm. It works only superficially and eliminates the superficial layers of the injured area. In OLP the deeper layer of subepithelial connective tissue and lymphocytic infiltrate cannot be reached (MLA Anderson, 2000).

Diode lasers provide great benefits over many other lasers because of its small size comparable to other types of laser. Application of diode 980 in 8w power in defocused continuous mode will elevate the temperature of affected tissues to above 50 degrees and less than 100 degree; this temperature results in protein denaturation which causes destruction of the diseased epithelium with its surface antigen, in addition to all the immune reaction components present in the range of diode laser treatment, as antigen antibodies, cytotoxic proteins and subepithelial lymphocytic infiltrate due to its deeper penetration which gives long remission duration. Besides, it provides a dressing layer for the treatment site that helps to decrease post-operative pain, and accelerate healing with less risk of secondary infection (Catone and Alling, 1997).

Using diode laser seems to be an easy and effective treatment option for OLP failing to respond to steroids or in cases where the cosmetic sequelae are an issue (Sivolella et al., 2012).

Although multiple studies have evaluated the efficacy of diode laser for the treatment of OLP, there is a lack of class one evidence in this regard. Therefore, we conducted this systematic review to synthesize evidence from published literature. About the safety and efficacy of Diode Laser for the treatment of OLP.

Methods:-

We followed the PRISMA checklist during the preparation of this systematic review and Meta-analysis. All steps were performed in strict accordance to the Cochrane Handbook for systematic Review of interventional studies.

Criteria for considering studies to this review:-

1. We included studies that meet the following inclusion criteria:
2. Study design: studies that were prospective observational studies randomized controlled trials, quasi experimental studies, and single arm studies.
3. Population: studies whose population patients were suffering from OLP.
4. Intervention: studies where OLP patients received treatment with lasers
5. Comparison: studies with/without control group

We excluded retrospective studies, thesis, and conference abstracts. We also, excluded studies whose data were not reliable for extraction or analysis.

Literature search and screening:-

We searched PubMed through May 2017 using relevant keywords: (OLP, diode laser and LLLT)). Titles and abstracts of retrieved records were screened for eligibility according to the previously mentioned criteria.

Data extraction:-

A uniform online data extraction sheet was constructed. The sheet includes data extracted in four domains: (1) characteristics of study design, (2) characteristics of study population, (3) risk of bias domains, and (4) data of the safety and efficacy of the laser.

Quality assessment:-
The quality of randomized controlled trials was assessed by the Cochrane Risk of bias assessment tool, Cochrane handbook of systematic reviews of interventions 5.1.0 (Higgins and Green, 2011). The non-controlled studies were assessed by quality assessment of before-after (Pre-Post) studies with no control group (NIH and NHLBI, 2014). The quality of the included studies was acceptable.

Data analysis:-
The proportion of patients who achieved clinical improvement in each study was pooled together using the Mantel Hansel method in a random effect model meta-analysis. The mean decrease in visual analogue score and area of lesion were pooled as mean difference with 95% confidence intervals in a random effect model. Heterogeneity was assessed by I-square and Chi-square tests. The analysis was carried out using the Review manager software.

Results:-
Results of literature search:-
Our search strategy retrieved 1034 records. Following title and abstracts screening, 16 articles were found relevant to our research question. Of them, 14 articles were found relevant to our research question and met our eligibility criteria and were included in this systematic review and meta-analysis. The PRISMA flow diagram for the study selection process is shown in diagram 1.

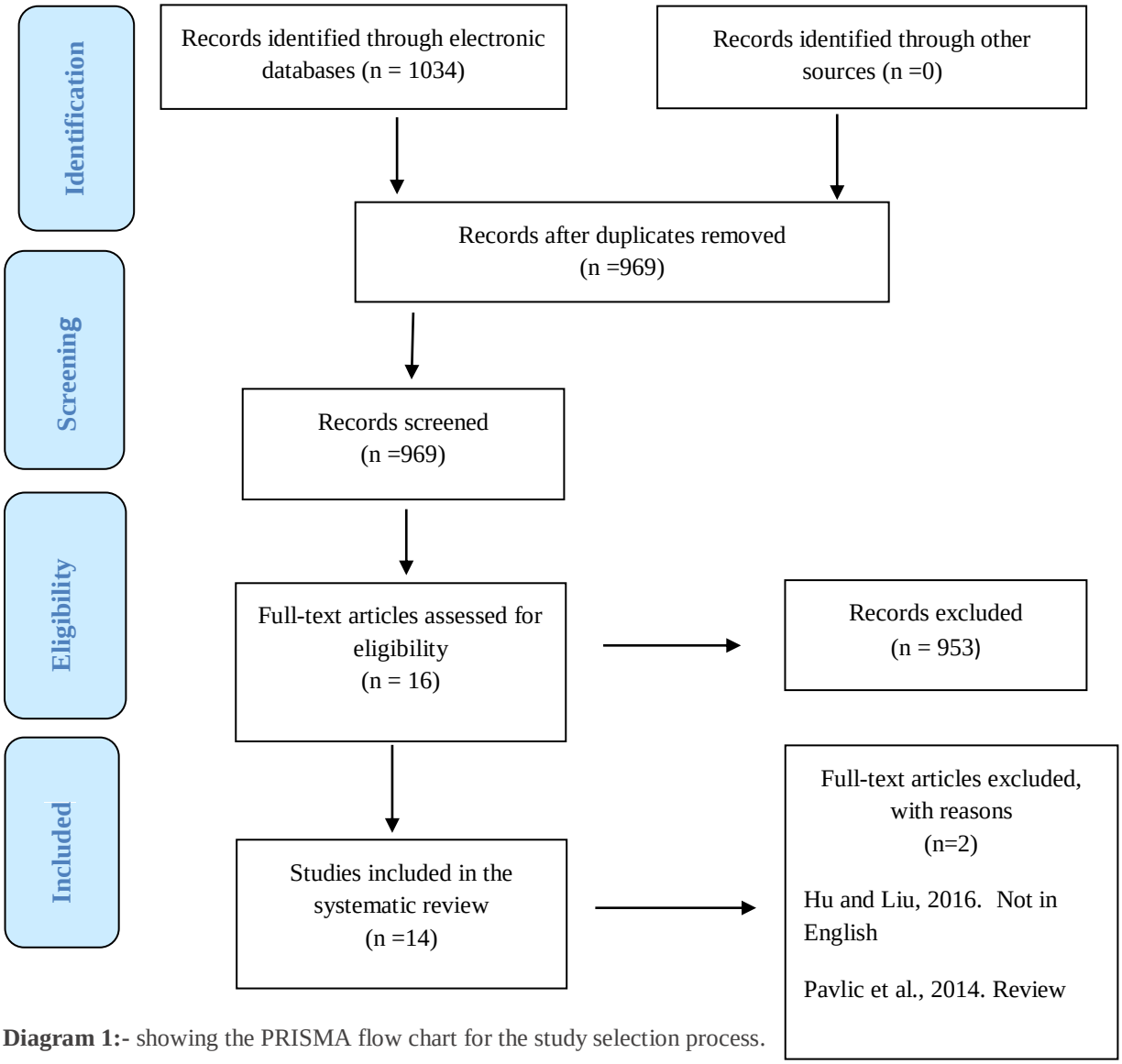

Diagram 1:- showing the PRISMA flow chart for the study selection process.

Characteristics of the included studies:-

Of the 14 included studies, 5 RCT (randomized control trail), 6 cases series studies, 2 were case report studies and 1clinical study. The summary of study design, population characteristics and diode laser information of each study is shown in tables 1& 2.

Table (1):-Demographic data for included studies:

Study	design	No .of patients	males	females	Age /mean	Type of OLP	Other oral lesions
Tandon et al.,2016	Case series	2	NI	NI	NI	Erosive-atrophic	aphthous ulcer
Reddy Kundoor et al.,2015	Case series	10	NI	NI	35-65	Reticular	leukoplakia
Misra et al., 2013	Case report	1	male	NI	25	Reticular	NO
Agha-Hosseini et al., 2012	RCT	28	7	21	50.7	Erosive-atrophic	NO
Cafaro A et al., 2014	Case series	30	11	19	64.5	Erosive	NO
Elshenawy et al., 2015	Case series	10	NI	NI	45-65	NI	NO
Elshenawy & Eldin, 2015	RCT	24	5	19	53.6	Erosive-atrophic	NO
Kashmoola & Salman, 2008	Case series	6	2	4	25-51	Erosive reticular& linear	NO
Soliman et al., 2005	Clinical study	25	9	16	44-62	NI	NO
Cafaro et al., 2010	Case series	13	5	8	60.9	Erosive-atrophic	NO
Dillenburg et al., 2014	RCT	42	7	35	58.2	Erosive-atrophic &atrophic	NO
Jajarm et al., 2011	RCT	30	NI	NI	>20	Erosive-atrophic	NO
Kazancioglu & Erisen, 2015	RCT	120	56	64	42.6 (28–55)	Erosive-atrophic	NO
Mahdavi et al., 2013	Case report	2	1	1	53-38	Erosive-ulcerative	NO

* OLP: oral lichen planus, ** NI: no information

Table (2):- all information about diode laser.

Study	Wave length	Power output (W/MW)	Fluency (J/cm2)	Duration	Sessions no./ total time	Follow up
Tandon et al.,2016	940nm	5 W	800J	3-4 m	Twice/week 10 sessions	1y
Reddy Kundoor et al.,2015	980nm	4 W,	NI	NI	4week	6 m
Misra et al., 2013	940nm	NI	NI	NI	Twice/week 2 months.	7m
Agha-Hosseini et al., 2012	633; 890nm	NI	0.3-0.5J	5s	5 sessions every other day	3m
Cafaro A et al., 2014	980nm	300 MW	4J	NI	One/ week until the resolution of signs	26.6 m

Elshenawy et al., 2015	970nm	3W	180J	4m	Twice/week 2 months max.10 sessions	NI
Elshenawy & Eldin, 2015	970nm	3W	NI	8m	Twice/week (maximum 10)	2m
Kashmoola & Salman, 2008	904nm	5 MW	NI	5m	Twice/week For four visits.	NI
Soliman et al., 2005	980nm	8W	NI	NI	4 W	6m
Cafaro et al., 2010	904nm	7MW	4 J	NI	Twice/week until the resolution of signs	6.46m
Dillenburg et al., 2014	660nm	40MW	6J	6s	3sessions/week (12 sessions)	2m
Jajarm et al., 2011	630nm	10mW	1.5J	2.5m	Twice/week (10 sessions)	12m
Kazancioglu & Erisen, 2015	808nm	0.1W	1.5 J	2.5m	Twice /week 10 sessions	6m
Mahdavi et al., 2013	630nm	10 MW	1.5 J	150 s	10 sessions a month	3m

* J: joule ** W: watt / MW: mille watt ǂ NI: no information

VAS pain score:-

Pooled analysis of three studies (Elshenawy and Eldin, 2015; Kazancioglu and Erisen, 2015; Jajarm et al., 2011). Showed that corticosteroids was better than LLLT in terms of VAS score after the treatment [SMD= 0.45, 95% CI= (0.06, 0.83), p= 0.02]. Pooled studies were homogenous [p= 0.11, I2= 54%]; see figure 1.

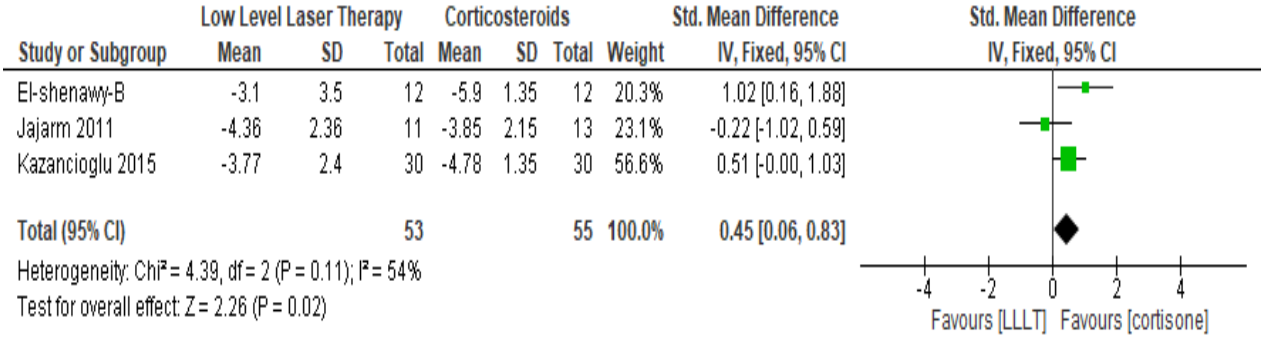

Figure 1:- Shows forest plot of SMD of VAS pain score between the two groups (LLLT vs. Corticosteroids) with 95% confidence interval.

Clinical improvement:-

The symptoms of OLP and the severity of the lesion itself were reported to be improving over time with the LLLT. Two studies reported a comparison between corticosteroids and LLLT in terms of the clinical severity of lesion signs (Kazancioglu and Erisen, 2015; Jajarm et al., 2011). Pooled analysis of their effect estimates yielded no significant different between corticosteroids and LLLT [SMD= 0.13, 95% CI= (-0.30, 0.56), p= 0.54]. Pooled studies were homogenous [p= 0.56, I2= 0%]; see figure 2.

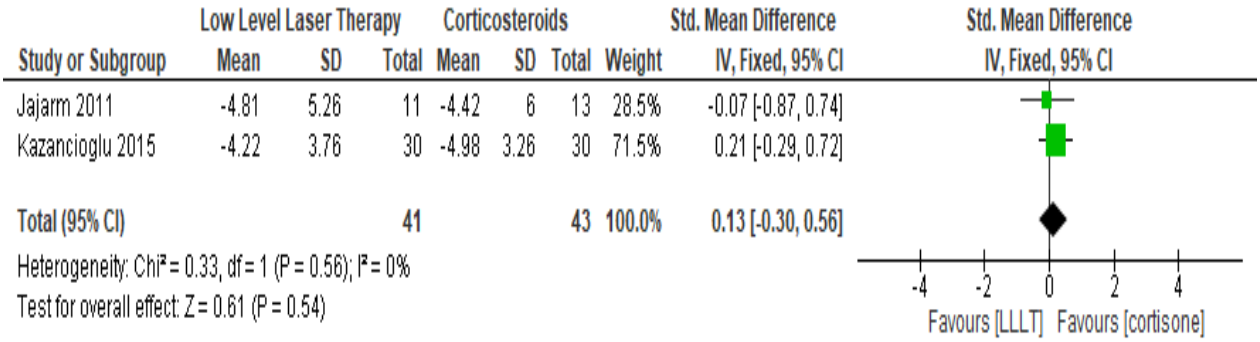

Figure 2:- Shows forest plot of SMD of the clinical severity of lesion signs between the two groups (LLLT vs. Corticosteroids) with 95% confidence interval.

Recurrence:-
No cases of recurrence were reported in all the included studies except for the study (Soliman et al., 2005). Where three patients treated with LLLT had a recurrence of the disease after three months in one case and after four months in the other two.

Complications:-
There were no complications mostly resulting from using the treatment. Functional disability was reported in the study (Soliman et al., 2005). The argued that this disability was a result of pain and edema associated with laser therapy.

Therapy side effects:-
Edema found in cheeks sites in all patients just after 3 days' post-treatment. This edema had a regressive course over two weeks then was no traces of its study (Soliman et al., 2005).

Decrease in size of lesion:-
Most studies reported positive results supporting rapid healing of the treated lesions that could be up to a mean of 90% ± 10.6% (Elshenawy et al., 2015).

Functional disorders (scarring and bleeding):-
There was better symptomatology post-treatment in almost all studies. 79.27% of the patients had been relieved just after four sessions (Cafaro et al., 2014).

Discussion:-

Summary of findings:-
In this systematic review, we have reviewed the evidence regarding the potential of treating OLP lesions using LLLT. Diode laser seems to be a safe and well tolerable method for relieving the symptoms and burden OLP. Post-operative pain reported on VAS was significantly lower after the operation and on the long follow-up. Laser therapy had almost no events of therapy side effects, complications, and recurrence rates.

Data available from clinical studies and case series support the use of diode laser in management of these (erosive-atrophic/ unresponsive to local treatment) lesions as it is a potent, well-tolerated, and safe procedure.

Previous studies:-
Previous studies have concluded that LLLT is a good and feasible alternative modality for treatment of OLP lesions with reducing clinical symptoms and no recurrence rates (Agha-Hosseini et al., 2012; Soliman et al., 2005). CO2 laser therapy showed positive results in the treatment of OLP but with less significant efficacy than LLLT (Agha-Hosseini et al., 2012). Local steroids provided less improvement in pain scores than that provided by LLLT (Agha-Hosseini et al., 2012).

Cafaro et al., 2014 showed that local steroids provided less improvement in pain scores than that provided by LLLT. In one study, topical steroids achieved more pleasant outcomes than LLLT after treatment (Elshenawy and Eldin,

2015). This difference was not clinically significant at the follow-up period. But, this effect is overrated as corticosteroids decrease symptoms rather than treating the underlying condition. Moreover, LLLT can be applied to patients with contraindicated corticosteroids and has fewer side effects than corticosteroids (Burgess, 2017). LLLT can be applied as a good treatment for other oral lesions like oral leukoplakia (Reddy Kundoor et al., 2015). And aphthous ulcers (Tandon et al., 2016). Ozone laser was used effectively and proved superior efficacy of the short term course over LLLT (Kazancioglu and Erisen, 2015).

Regarding LLLT, there are some issues that limit its use such as its high cost in comparison to local steroids (Dillenburg et al., 2014). And that it might have no effect on hyperkeratotic areas (Kashmoola and Salman, 2008).

Strength points and limitations:-

The strength points of this review are: (1) the clear and well-defined eligibility criteria, (2) we performed an extensive literature search, (3) included studies deemed of acceptable quality according to critical appraisal checklists, and (4) the evidence was synthesized in narrative and quantitative manners whenever possible.

This study has many limitations including the small sample size of participants in each study, limited number of published RCTs, and no head-to-head comparison with active treatments for OLP.

Recommendations for future research:-

Future studies are recommended to study the efficacy and safety of diode laser therapy in larger well-randomized controlled trials with longer follow up periods. Upcoming trials should compare LLLT with active drugs or operations like Ozone laser and CO2 lasers.

Authors' conclusion:-

Current evidence suggests that diode laser is effective for the treatment of OLP. However, the gained benefit should be weighed against its cost in future cost-effectiveness analysis. Future large, randomized, controlled, studies are still needed to provide head-to-head comparison against other treatment options.

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