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Literature Review

Benefits and Risks of Orthodontic Treatment: A Scooping Review

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ABSTRACT

Background: Malocclusion is one of the main problems of oral and dental health, ranked third after caries and periodontal diseases. In Asian population, the percentage of class II and III Angle malocclusion is 21.42% and 5.76% respectively. Thus, orthodontic treatment is still needed by the people. However, not every patient knows the potential risks that orthodontic treatment, and whether the treatment will bring them benefits they want to achieve. **Purpose:** this study aimed to describe benefits and risks of orthodontic treatment on the patient and operator through scooping review. **Review(s):** The search of literatures show that orthodontic treatment increases patient's oral health related quality of life, reducing the risk of traumatic dental injuries in children with large overjet, and reducing the incident of muscle tenderness, and myofascial pain. However, orthodontic treatment poses the risk of damage to the teeth, oral and mucosal pain, speech problems, allergic reactions, and orthodontics relapse. **Conclusion:** Orthodontic treatment can provide benefits to patients' oral health related quality of life, as well as reducing the incidence of temporomandibular disorder and traumatic dental injuries in children with large overjet. But these benefits must outweigh the risks that can occur in the patient such as teeth damage, oral and mucosal pain, speech problems, allergic reactions, and the probability of relapse must also be minimized.

Keywords: orthodontic; malocclusion; dentistry; quality of life; medicine

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INTRODUCTION

In 1922, British Society of Orthodontics suggests the following definition for Orthodontics: Orthodontics is the study which especially covers the growth of the face and jaws, and generally the body, by affecting the position of the teeth; study about action and reaction of internal and external factors to development, and the prevention and correction of delayed or abnormal growth and development.[1] According to Mitchell, orthodontics is a branch of dentistry which is associated with facial growth, development of teeth and occlusion, and the diagnosis, intervention, and treatment of occlusal abnormality.[2]

Malocclusion is one of the main problems of oral and dental health, ranked third after caries and periodontal diseases. In Asian population, the percentage of class II and III Angle malocclusion is 21.42% and 5.76% respectively.[3] Malocclusion has negative effects to facial aesthetics, hence affecting patient's confidence. This shows that malocclusion treatment in orthodontics is important and needed by the people to this date.

Orthodontic treatment increases the patient's teeth function and aesthetics, and also improves the patient's psychological condition. However, orthodontic treatment is not risk-free. Orthodontic treatment may cause enamel demineralization, enamel trauma, enamel wear, pulpal reactions, damage to periodontal tissue, root resorption, allergic reaction, and trauma.[4]

Understanding the benefits and risks of orthodontic treatment is a matter of high importance. Patients that intend to receive orthodontic treatment also needs to know the benefits and risks of the treatment. These understanding and knowledge are important so that both the dentist and patient can act cautiously during the duration of the treatment. This review aims to describe the benefits that orthodontic treatment gives, and possible risks that comes with it.

REVIEW(S)

The list and summary of the literatures that used in this study can be seen in Table 1. Table 2 and Table 3 showed systematic reviews and research synthesis checklist from JBI (part 1 and part 2). In addition, Critical appraisal checklist for cross sectional study and cohort studies by JBI can be seen in Table 4 and Table 5.

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Table 1. Summary of Literatures used in the review.

Title	Authors and Publisher	Purpose	Methods	Article Summary
Impact of Third Molars on Mandibular Relapse in Post-Orthodontic Patients: A meta-analysis	Hsin-Ching Cheng, Bou-Yue Peng, Hsueh-Yin Hsieh, Ka-Wai Tam.[5]	To evaluate the effect of removing third lower mandibular molar on mandibular arch relapse after orthdontic treatment	Online databases were searched for relevant literatures. Evaluation of mandibular relapses after orthdontic treatments were performed.	The presence of third molar is not the main cause of post-orthodontic changes. However, it is recommended to extract the mandibular third molar tooth to prevent the irregularity of mandibular incisor in the long term.[5]
Relationship between orthodontic treatment and dental caries: results from a national survey	Yoon Young Choi.[6]	To evaluate the increased probability of dental caries in patients who receive orthodontic treatment.	Data was taken from National Health and Nutrition Examination Survey in Korea between 2013 to 2015 for patients older than 19 years old. Logistic regression analysis and chi-squared test are used to compare the DMFT index score of orthodontic and non-orthodontic patients.	The presence of fixed orthodontic appliance increases stagnation area and complicates the cleaning of tooth plaque. This increases the risk of tooth caries during orthodontic treatment. Orthodontists need to emphasize the importance better oral hygiene during orthodontic treatment.[6]
Comparison of Oral Health-Related Quality of Life in Treated and Non-Treated Orthodontic Patients	Kenan Demirovic, Jasmin Habibovic, Vildana Dzemidzic, Alisa Tiro, Enita Nakas[7]	To analyze the difference of oral health quality of life between orthodontic and non-orthodontic treatment patient.	178 participant's data were collected from a dental office and was grouped into untreated subjects and subjects who are in retention phase. OHIP-14 was used to determine patient's oral health quality of life.	Malocclusion and dental abnormality cause negative effects on oral health related-quality of life. Psychological and physical pain are the most affected areas. Patients that recieved orthodontic treatment shows improvement on oral health related quality of life.[7]
Allergies in Orthodontics: From Causes to Management.	Raj Kumar Singh, Nishant Gupta, Varun Goyal, Gurkeerat Singh, Ankit Chaudari.[8]	To review current literatures on cases of allergy in orthodontic treatment and its implications, also the management of allergic patients during the treatment.	Literatures with related topics on allergies in orthodontic treatment were searched and compiled.	Nickel, latex, acrylic resin, and kromium causes allergic reaction in patients with different manifestations for each material.[8]
Orthodontic treatment-related risks and complications: part I dental complication	Alisa Tiro.[9]	To provide a present view of the main risks and complication associated with orthodontic treatment in clincal practice.	"Risk management in orthodontics: expert's guide to malpractice," is used as a base for the review. Then search was performed with combination of keywords: complication, orthodontic treatment, risks, side effects and include journal published 2004 or lalter.	Risks of orthodontic treatment are: tooth decalcification, decay, erosion, fracture, discoloration, root resorption, premature closure of the root, pulpitis, pulpal ischemia, gingivitis, periodontitis, gingival recession, reduction in alveolar bone level, dehisence, fenestration, interdental fold, and dark triangle. Gingival laceration, ulceration, and stomatitis can occur. Lack of aesthetic or functional aspect, and relapse can also occur.[9]
Psychososial impact of dental aesthetics and desire for orthodontic treatment among Chinese undergraduate students	Song Yi, Chuqin Zhang, Chulei Ni, Ying Qian, Jun Zhang.[10]	To evaluate dental aesthetics effect on psychosocial aspect in undergraduate students, and examine associations between the need of orthodontic treatment, dental aesthetics effect on psychosocial aspect, and the urge of receiving orthodontic treatment	Cross-sectional study is conducted including 374 adolescents between 19 to 24 years old. They filled the PIDA Questionnaire and explain their desire for orthodontic treatment. IOTN is also used to objectively assess the malocclusion severity.	The negative impact from malocclusion increases with the severity of the malocclusion. Malocclusion affects patient's confidence, psychological condition, and social life.[10]
Psychological well-being, dental esthetics, and psychosocial impacts in adolescent orthodontic patients: A prospective longitudinal study	Xiao Deng, Yun-ji Wang, Feng Deng, Pang-li Liu, Yan Wu.[11]	To determine changes to adolescent orthodontic patient's psychological attributes and dental aesthetics pre-treatment and post-treatment.	Adolescent orthodontic patients that wanted to receive orthodontic treatment filled questionnaire measuring their psychologial well-being and 3 PIDA compontents before and after the treatment. IOTN-AC was used to measure dental aesthetics indicators.	Teeth aesthetic have high influence on oral health quality of life, and improvement to teeth aesthetic using orthodontic treatment can reduce the negative impact resulted. Improvement of oral health quality of life post-orthodontic treatment is showed by increased result in 3 PIDA components.[11]

Clinical effectiveness of orthodontic treatment on smile esthetics: a systematic review	Terpsithea Christou, Anna Betlej, Najd Aswad, Dorothy Ogndon, Chung How Kau.[12]	To identify the effects of different orthodontic treatment to aesthetics of the smile after the treatment.	Systematic search on 5 electronic databases was done, including articles until October 2017. Only articles that was written in English and had patients in any age and gender who received orthodontic treatment were included.	It cannot be concluded that a certain orthodontic appliance result in improvement or impair smile aethetics. Tooth extraction doesn't affect the width of the smile and buccal corridors. Intrusion arch and flat bite planes can cause flat smiles.[12]
The association of overjet size and traumatic dental injuries-A systematic review and meta-analysis	George P. Arraj, Giampiero Rossi-Fedele, Esma J. Dogramaci.[13]	To describe overjet sizes effects on the possibility of dental trauma in multiple ages and dentition phases.	Three-phase search is conducted on electronic databases. Only tudies with low bias risk and high methodological quality are included.	Patients who have large overjet, have higher risk to traumatic dental injuries. Interceptive orthodontics can reduce patient's overjet, thus reducing the risk of traumatic dental injuries.[13]
Evaluation of long-term hard tissue relapse following surgical-orthodontic treatment in skeletal class II patients: A systematic and meta-anyalysis	L. Gaitan-Romero, S. Shujaat, H. Ma, K. Orhan, E. Shaheen, D. Mulier, G. Willems, C. Politis, R. Jacobs.[14]	To evaluate the stability of hard tissue in the long-term and factors that influence relapse in skeletal class II patients that recieves orthodontic surgery.	Literature search was performed using Embase, Cochrane Central, Web of Science, and Pubmed. Assessment of bias risk is done using Cochrane handbook. Then 1079 patients are followed up for 5-13 years.	Patients with high mandibular plane angle has reduced stability, higher sagittal relapse, and higher condylar resorption. Relapse predispotition in open bite patients is associated with anatomical condition of the condylar, affecting mioskeletal balance and skeletal stability.[14]
Psychological impact of orthodontic treatment on quality of life – A longitudinal study	Harpeet Grewal, Pranav Sapawat, Palash Modi, Sakshi Aggarwal.[15]	To assess changes to the psychosocial, functional, aesthetic, quality of life, and evaluate malocclusion severity in young patients pre and post orthodontic treatment.	Young adults between 18.1 and 25.3 year old are assessed using the PIDA Questionnaire to determine their self perception before and after orthodontic treatment.	Untreated malocclusion decreases psychosocial aspect of oral health related quality of life. Orthodontic treatment reduces the negative effects on social and psychosocial aspect and reduces patient's concern on aesthetics and functional aspect that leads to significant increase to oral health related quality of life.[15]
Retention and relapse in clinical practice	SJ Littlewood, S Kandasamy, G Huang.[16]	To give a summary of retention and relapse in the field of orthodontics and review the responsibilities of both patients and operators on post-treatment.	Search of literatures were conducted on relevant topics on retention and relapse after orthodontic treatment and then compiled in the article.	Relapse can occur because of unfinished periodontal tissue and gingival remodeling, abnormal occlusion load to a tooth, tooth that is not positioned in the neutral zone, and physiological relapse.[16]
Does orthodontic treatment before the age of 18 improve oral health-related quality of life? A systematic review and meta-analysis	Hanieh Javidi, Mario Vettore, Philip E. Benson.[17]	To establish the effects of orthodontic treatment on OHRQoL in children and teenagers using current literatures.	Electronic databases are searched without restricting any language. Study assessment was performed using The Newcastle-Ottawa scale.	Orthodontic treatment on patients younger than 18 years old increases patient's oral health related quality of life, especially in the emotional and social aspect.[17]
Determining Risk Factors for the Development of Temporomandibular Disorder during Orthodontic Treatment	Alessandro Ugolini, Federico Gabarino, Luca Di Vece, Francesca Silvestrini-Biavati, Valentina Lanteri.[18]	To evaluate the effect of orthodontic treatment on myofacial pain and disc displacement.	224 orthodontic adult patients were evaluated for disc displacement and myofacial pain using clinical evaluation and organized interview pre-treatment, shortly post-treatment, and twelve months after treatment.	Any kind of abnormal occlusion increases the chance of disc displacement to occur. During orthodontic treatment, abnormal occlusion can occur before a proper bite is formed. This condition only occurs momentarily. Orthodontic treatment also reduces symptoms of miofacial pain and muscle tenderness.[18]
Large overjet as a risk factor of traumatic dental injuries: a prospective longitudinal study	Jean-Paul Schatz, Enrico Ostini, Magnus Hakenberg, Stavros Kiliaridis.[19]	To evaluate large overjet in school children, and if they experience higher risks to traumatic dental injuries compared with children who have normal or small overjet.	Data with trauma cases on 1.413 children were gathered to identify the amount and types of injuries, the effect of larger overjet to TDI, and relationships between trauma, gender, and age.	Young patients with larger than normal overjets are more vunarable to traumatic dental injuries. Orthodontic interceptive treatment will reduce the abnormal overjet, thus reducing the risk of trauma on the teeth.[19]

Impact of orthodontic treatment on self-esteem and quality of life of adult patients requiring oral rehabilitation	Vanessa de Couto Nascimento, Ana Claudia de Castro Ferreira Conti, Mauricio de Almeida Cardoso, Danilo Pinelli Valarelli, Renata Rodrigues de Almeida-Pedrin.[20]	To evaluate whether adults that requires oral rehabilitation have increased confidence and quality of life post-orthodontic treatment	Total of 102 adult patients who requires orthodontic treatment filled Rosenberg's Self Esteem Scale and questionnare concerning their quality of life based on OHIP-14. The questionnaires were filled at the start of treatment and 6 months after. The data is analyzed with paired t-test, and data about quality of life is evaluated using descriptive statistics	There is an increase of self esteem for long period of time after orthodontic treatment is completed, increasing patient's quality of life. Orthodontic treatment also alleviates speech problems on patients. One of the patient's complain during orthodontic treatment is oral pain, especially during the first three months. This pain causes a decrease in quality of life, but alliviates as the treatment goes on.[20]
Long-term changes in oral health-related quality of life of standard, cleft, and surgery patients after orthodontic treatment: A longitudinal study	Grace A. L. Nichols, Joseph S. Antoun, Peter V. Fowler, Azza H. Al-Ani, Mauro Farella.[21]	To evaluate long-term changes and explain the change of oral health related quality of life on patients who recieved cleft, surgery, and standard orthodontic treatment.	Standard, cleft, and orthognatic surgery patients filled the Oral Health Impact Profile (OHIP-14) pre-treatment, immediately post-treatment, and 5 years post-treatment.	Patients with severe malocclusion and dentofacial deformities has increased quality of life as soon as the treatment is completed. Short-term improvements to oral health related quality of life are also found in patients that recieves orthognatic surgery, and the benefit is sustained long-term[21]
Potential risks of orthodontic therapy: a critical review and conceptual framework	M. Wishney.[22]	To give overview from literatures about the potential risks of orthodontic treatment	Using keyowrds relating to the risks of orthodontic treatment, electronic databases were searched. Full texts of all relevant articles were accessed.	Problems that potentially occur in orthodontic treatments are: gingivitis, gingival resorption, opened gingival embrasure, pain due to mucosal ulceration, pulpal or periodontal pain, root resorption, temporomandibular disorder, decalcification and enamel damage, and speech problems.[22]
Do malocclusion and orthodontic treatment impact oral health? A systematic review and meta-analysis	Richard Macey, Badri Thiruvenkatachari, Kevin O'Brien, Klaus B.S.L. Batista.[23]	To give information concerning relation between malocclusion and oral health, and orthodontic treatment effects from randomized controlled trials and prospective cohort studies.	Randomized controlled trials and prospective cohort studies were searched and the retrieved articles were quality assessed. The impact of malocclusion on oral health articles were assessed using the Appraisal tool for Cross-Sectional Studies. The evidence of orthodontic treatment on oral health were assessed using Newcastle-Ottawa scale for bias assessment.	Orthodontic treatment to young patients to reduce abnormal overjets will reduce patient's likelihood to experience incisal trauma. However, the authors stated that further investigation needs to be done on this topic.[23]
Effect of orthodontic pain on quality of life of patients undergoing orthodontic treatment	Sujoy Banerjee, Rajlakshmi Banerjee, Usha Shenoy, Sanket Agarkar, Sangeeta Bhattacharya.[24]	To assess the connection between orthodontic treatment pain and quality of life, and evaluate whether pain and discomfort is affected by patient's motivation and counseling	Pain intensity and severity, patient's quality of life during orthodontic treatment are determined using McGill-Short-Form with visual analog scale and present pain intensity and Oral Health Impact Profile-14 indices. A total of 200 adolescents are evaluated.	Pain and uncomfortable sensation during orthodontic treatment leads to negative effects on patient's quality of life. Pain perception is associated with patient's motivation to obtain orthodontic treatment, and knowledge and mindfulness on the possibility of discomfort during the treatment.[24]
Changes in oral microbiota due to orthodontic appliances: a systematic review	Alessandra Lucchese, Lars Bondemark, Marta Marcolina, Maurizio Manuelli.[25]	To investigate associations on changes of oral microbiota quality and quantity and orthodontic appliances from available evidences.	The search of literatures is conducted using related keywords on medical databases. Methodological quality of the articles were assessed with Swedish Council on Technology Assessment in Health Care Criteria for Grading Assessed Studies method.	Orthodontic appliance increases the number of oral bacteria and is affected by the duration of use. Removable appliance has lesser bacterial impact than fixed appliance.[25]

Parental Acceptance Towards Interceptive Orthodontic Treatment in Children – A Retrospective Study	Ilankizhai RJ., Jessy P., Madhulaxmi M.[26]	To evaluate acceptance to interceptive orthodontic treatment on patients with malocclusion	Data is collected from Saveetha dental college and hospitals between June 2019 to February 2020. Patient's data on who were recommended to receive interceptive treatment and who accepted the treatment were filtered. Then both datas are analyzed.	Parents acceptance to interceptive orthodontic treatment is still relatively low because of the lack of awareness to malocclusion and the importance of early treatment. Factors that influence this is socio-economic status and education.[26]

Table 2. Systematic Reviews and Research Synthesis Checklist from JBI (part 1).

	Cheng, et al., 2018[5]	Christou, et al., 2019[12]	Arraj, et al., 2019[13]	Singh, et al., 2019[8]	Tiro, 2017[9]	Gaitan-Romero, et al., 2021[14]
1. Did the review explicitly and clearly state its question?	Yes	Yes	Yes	Yes	No	Yes
2. Were the criteria for study inclusion appropriate for the review question?	Yes	Yes	Yes	Unclear	Unclear	Yes
3. Was the search strategy appropriate?	Yes	Yes	Yes	Unclear	Yes	Yes
4. Were the search for studies used adequate sources and resources?	Yes	Yes	Yes	Yes	Yes	Yes
5. Were approriate criteria for appraising studies used?	Yes	Yes	Yes	Unclear	Unclear	Yes
6. Were two or more independent reviewers perform the critical appraisal?	Yes	Yes	Yes	Unclear	No	Yes
7. Did methods for minimizing data extraction errors performed?	Yes	Yes	Yes	No	No	Yes
8. Did appropriate methods to combine studies used?	Yes	Yes	Yes	Yes	Yes	Yes
9. Was the assessment of possible publication bias performed?	Yes	Yes	Yes	No	No	Yes
10.Does the reported data support recommendations for policy and/or practice?	Yes	Yes	Yes	Yes	Yes	Yes
11. Were the specific directives for new research appropriate?	Yes	Yes	Yes	Yes	Yes	Yes

Table 3. Systematic Reviews and Research Synthesis Checklist from JBI (part 2).

	Demirovic, et al., 2019[7]	De Couto Nascimento, et al., 2016[20]	Banerjee, et al., 2018[24]
1. Did the article state clear definition for sample inclusion?	Yes	Yes	Yes
2. Were detailed description for study subjects and the setting stated?	Yes	Yes	Yes
3. Was the exposure validly and reliably measured?	Unclear	Yes	Yes
4. Were the condition measured using objective and standard criteria?	Yes	Yes	Yes
5. Were identification of confounding factors performed?	Unclear	No	No
6. Were strategies to deal with confounding factors stated?	No	No	No
7. Were valid and reliable method used to measure the outcomes?	Yes	Yes	Yes
8. Was appropriate statistical analysis used?	Yes	Yes	Yes

Table 4. Critical Appraisal Checklist for Cross-Sectional Studies by JBI

	Littlewood, et al., 2017[16]	Wishney, 2017[22]	Macey, et al., 2020[23]	Lucchese, et al., 2018[25]	Javidi, et al., 2017[17]
1. Did the review explicitly and clearly state its question?	Yes	Yes	Yes	Yes	Yes
2. Were the criteria for study inclusion appropriate for the review question?	Not applicable	Not applicable	Yes	Yes	Yes
3. Was the search strategy appropriate?	Yes	Yes	Yes	Yes	Yes
4. Were the search for studies used adequate sources and resources?	Yes	Yes	Yes	Yes	Yes
5. Were approriate criteria for appraising studies used?	Not applicable	Not applicable	Yes	Yes	Yes
6. Were two or more independent reviewers perform the c ritical appraisal?	No	No	Yes	No	Yes
7. Did methods for minimizing data extraction errors performed?	No	No	Yes	Yes	Unclear
8. Did appropriate methods to combine studies used?	Yes	Yes	Yes	Yes	Yes
9. Was the assessment of possible publication bias performed?	Unclear	Not applicable	Yes	Yes	Yes
10.Were recommendations for policy and/or practice supported by the reported data?	Yes	Yes	Unclear	Yes	Yes
11. Were the specific directives for new research appropriate?	Yes	Yes	Yes	Yes	Yes

Table 5. Critical Appraisal Checklist for Cohort Studies by JBI.

	Deng, et al., 2018[11]	Schatz, et al., 2020[19]	Grewal, et al., 2019[15]	Ugolini, et al., 2020[18]	Nichols, et al., 2018[21]	Ilankizhai RJ, et al., 2020[26]
1. Were the two groups recruited from the same populations and similar?	Yes	Yes	Yes	Yes	Yes	Yes
2. Were measurement of the exposures similarly performed to divide people to both exposed and unexposed groups?	Not applicable	Not applicable	Yes	Not applicable	Not applicable	Yes
3. Was reliable and valid way to measure the exposure being used?	Yes	Yes	Unclear	Yes	Yes	Yes
4. Were identification of confounding factors performed?	Yes	Yes	Yes	Yes	No	No
5. Were there statements concerning strategies to deal with confounding factors?	Yes	No	Yes	Yes	No	No
6. At the start of the study or at the moment of exposure, were the groups/participants free of the outcome?	Yes	Yes	Yes	Yes	Yes	Yes
7. Were reliable and valid way to measure the outcomes being used?	Yes	Yes	Yes	Yes	Yes	Yes
8. Was there sufficient follow up time for outcomes to occur and was the time reported?	Yes	Yes	Yes	Yes	Yes	Unclear
9. Was follow up complete, and if not, were the reasons to loss to follow up described and explored?	Yes	Yes	Yes	Yes	Yes	Not applicable
10. Were utilization of strategies to address incomplete follow up used?	Not applicable	Yes	Unclear	Unclear	Yes	No
11. Was appropriate statistical analysis used?	Yes	Yes	Unclear	Unclear	Yes	Yes

DISCUSSION

For patients, one of the effects of untreated malocclusion is decreased oral health quality of life, and the psychosocial effect that occurs is greater on women compared to men.[15] The negative effects of malocclusion increase as the malocclusion severity increases, and this impacts patient's confidence, psychological condition, and social life. Women, who pay more attention to their looks, are more vulnerable to the psychosocial impact of malocclusion.[10] Tooth aesthetics has a strong influence on oral health related quality of life. Thus, women have higher desire to obtain orthodontic treatment compared to men.[11]

After acquiring and completing orthodontic treatment, patients received improvement on aesthetics and functional aspects, in increased mastication effectivity and reduce in speech problems. These improvements result in better oral health related quality of life for patients, especially in psychosocial aspect as increased self-confidence and reduced concern to their looks.[15] This increased in self-confidence lasts long-term after orthodontic treatment. Patients with severe malocclusion and dentofacial deformities have positive impact on oral health related quality of life right after treatment. The same can be said for patients who receive orthognathic surgery.[21] Increased oral health related quality of life also occurs in patients under the age of 18, especially in the emotional and social aspect.[17]

Patients with large overjet has increased risk of experiencing traumatic dental injuries. This is especially frequent in children and adolescents.[13] Reducing overjet through interceptive orthodontic treatment will reduce traumatic dental injuries risks, especially if it is done to children before the age of 10-12 years.[19,23] Other than patient's quality of life and reduced risks of traumatic dental injuries, orthodontic treatment can reduce myofascial pain and the incidence of muscle tenderness also reduces after receiving orthodontic treatment.[18]

However, parental acceptance towards interceptive orthodontic treatment to their children is still lacking. Possible reasons are low awareness to malocclusion and the importance of treating malocclusion as early as possible. Other factors are the possibility of speech problem and dietary problems during orthodontic treatment to their children. Socio-economic status and education status is also a factor that influence parents view towards orthodontic treatment.[26]

Although we have mentioned the benefits that orthodontic treatment can bring, it is important to note that those benefits also come with risks. To the teeth, orthodontic treatment especially using fixed appliance potentially damage the crowns where the orthodontic brackets attach. The damage can occur in the form of decalcification, decay, erosion, fracture, and discoloration.[9] Fixed appliance also expands stagnation areas in the patient's oral cavity, increasing the attachment area of debris, plaque, and calculus. Furthermore, orthodontic fixed appliance makes oral hygiene procedures more difficult to perform. These factors increase the risk of tooth caries during orthodontic treatment.[6]

Fluoride is an important substance to prevent caries. The use of bonding materials that releases fluoride is a viable option in caries prevention for orthodontic patients.[27] Fluor application around the braces every six weeks can reduce the development of white spot lesions.[28] Fluoride use in orthodontic treatment will decrease the risk of caries that was presented by orthodontic appliances. It is important to remember that one of the patient's requirements in order to receive orthodontic treatment is good oral hygiene and low caries activity.[29] Resin infiltration is also an option to cover white spot lesions after the removal of orthodontic appliances, but this technique must be done as soon as possible after appliance removal to produce good result.[30]

Pain is also an issue during orthodontic treatment, especially during the first three months of the treatment.

The pain causes discomfort and will reduce patient's quality of life.[20] The source of the pain can come from periodontitis, mucosal ulcerations, pulpal pain, periodontal pain, and gingival ulceration or laceration.[22] Pain sensation is a subjective between one patient and another. Patient's motivation to obtain orthodontic treatment and patient's knowledge and awareness on the possibility of orthodontic pain influences the degree of pain sensation.[24] Orthodontic treatment increases the risk of disc displacement, especially when a perfect occlusion is not formed yet due to unfinished tooth movement. However, this condition only lasts momentarily and will heal by itself after a perfect occlusion is formed.[18]

Pain in patients can occur starting from four hours after the placement of orthodontic wires, and peaks at twenty-four hours, then recedes slowly. The use of analgesics can ease the pain. There were concerns that NSAIDs will slow down the rate of orthodontic tooth movement. However, the dosage administered during the clinic is low, and by the time tooth movement starts, the dosage is already removed from the body.[31] Other than pharmacological approach, mechanical approach such as oral vibration, chewing gums, and acupuncture can be done. Behavioral approach such as physical activity, behavioral cognitive therapy, and listening to music is also an option. Orthodontic pain usually comes with anxiety and stress, so it is important to assure the patient that orthodontic pain is controllable.[32] The use of chlorhexidine gel or oral rinse, and aloe vera gel can ease the pain from ulcerations. Covering orthodontic brackets will also increase patient's comfort.[33]

Gingivitis, gingival recession, alveolar bone degradation, dehiscence, fenestration, interdental folds, and dark triangle can also affect esthetics [9]. In addition, open gingival embrasures, root resorption, enamel damage and decalcification, and speech problems due to lingual or palatal appliance can occur in patients. However, this speech problem will resolve after patient's adaptation.[22] The use of intrusion arch and flat bite planes can cause flat smiles. They also found little evidence that tooth extraction will not affect the width of the smile and patient's buccal corridors.[12]

There are correlations between root resorptions and large continuous forces, intrusive forces, and lengthy treatment duration.[34] Patient that is treated using two-phase therapy have less risk of experiencing root resorptions because of healing time between phases.[35] It is advised that combination of heavy and continuous forces are avoided, and large amount of root movements are done in long durations.[36]

Material that is being used on orthodontic treatment can potentially cause allergic reactions to the patient, such as nickel, latex, acrylic resin, and chromium. Symptoms of nickel allergic reaction are gingival hyperplasia, gingivitis, lip desquamation, burning mouth syndrome, metallic taste, angular cheilitis, and periodontitis. Removable appliance made of acrylic resin can also cause type IV hypersensitivity.[8]

The use of orthodontic appliance increases the quantity of oral bacteria. This condition is affected by the duration which the appliance is used, and the type of appliance used by the patient. Higher increase in bacterial number is found on patients using fixed appliance compared to patients with removable appliance. The bacteria include gram positive and negative bacteria such as *S. mutans, Lactobacillus spp., P. gingivalis, T. forsythia,* and *T. denticola*.[25]

Lateral cephalometric radiograph is often used in orthodontics for diagnosing patients and planning their treatment. Hwang *et al.* states that the use of x-rays is associated with brain and thyroid cancers in patients. However, the clinicians or operators is also affected by the accumulation of radiation. Extra caution is needed for children who are more sensitive to radiation, because of more active cell division compared to adults.[37]

Post-treatment relapse is also a risk of orthodontic treatment that is difficult to predict. Relapse can occur because of unfinished remodeling of periodontal and gingival tissue, abnormal occlusion load, teeth that is not positioned in the neutral zone, and physiological activity.[16] Patients with mandibular plane angle equal or larger than 40^{o} has lower stability and increased risk of sagittal relapse, also higher risk of condylar resorption. Factors that influence relapse is the condition of anatomical structure of the condyle, which affects myoskeletal balance and skeletal stability.[14] Although the mandibular third molar is not the main factor to post-treatment relapse, it is recommended to extract it in order to prevent mandibular incisor irregularity in the long term.[5]

The type of orthodontic appliance that is used on the patient can have its own benefits and risks. Compared to removable appliance, fixed orthodontic appliance have the ability to perform broader orthodontic movement, can move several teeth at once, and have the ability to treat broader cases. However, special training is required for the operator, and it can be difficult for the patient to keep their oral hygiene.[1] On the other hand, removable orthodontic appliance doesn't require long sitting time in the dental chair, can be removed if sensitivity or damage to the appliance occurs, economically more affordable, and easier for patients to keep their oral hygiene. But this type of appliance requires longer treatment time if multiple teeth movement is required and requires higher patient cooperation due to the appliance can be taken off themselves.[38] On orthopedics appliances, the appliance allows the operator to guide bone growth, or used as additional anchorage and retention, first molar distalization, space maintaining and regaining, arch contraction, and reducing anterior overjet.[1] But orthopedics appliance asserts higher force that can cause pain, increased risk of root resorption, and possibility of facial trauma if the appliance is released not deliberately.[39] Furthermore, orthopedics appliance can cause concern on patients about their looks. But this will reduce as improvements are seen on the patient.[40]

This review has its limitations, in an ideal scooping review, data extraction and study assessment are performed by two individuals independently, something that unfortunately was not able to be done here. The articles that were included in the review have different subject populations. Although this different population brings

advantage as well as disadvantages, it is something that the author should mention. However, orthodontic treatment has risks, which are tooth decalcification, erosion, fracture, and discoloration, root resorption, premature closure of root apex, gingival recession, gingivitis, fenestration, dehiscence, interdental fold, dark triangle, increased quantity of oral bacteria, speech problems, temporary abnormal occlusion, and possibility of allergic reactions. Pain due to mucosal laceration or ulceration, periodontitis, and pulpitis can also occur. Lastly, post-treatment relapse is a risk that is difficult to predict. This benefits and risks of orthodontic treatment needs to be informed to patients, who are receiving orthodontic treatment, by the operator.

CONCLUSION

Orthodontic treatment has benefits of increasing patient's oral health related quality of life through aesthetics and functional improvements, reduce of concern about their looks, and increased self-confidence. Furthermore, reduced risk of traumatic dental injuries, reduced incident of muscle tenderness, and reduce of myofascial pain is also found. Communication, information, and education is important to ensure that the benefits patients receive outweigh the risks. Risk managements must also be performed by the operator to prevent, reduce, and handle the risks that could occur to the patient.

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