What's new for the clinician?

Summaries of and excerpts from recently published papers

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1. Is orthodontics prior to 11 years of age evidence based?

Sunnak R, Johal A, Fleming PS. Is orthodontics prior to 11 years of age evidence-based? A systematic review and meta-analysis. Journal of Dentistry 2015; 43: 477-486

One of the most confusing things about getting more than one orthodontic consultation (a second opinion) is that two seemingly similarly qualified doctors can offer such different approaches to the same problem. Not only are their treatment plans different, many times they even disagree about the best time to start treatment, Preventive and interceptive orthodontic procedures may be undertaken to alleviate developing problems. Interceptive treatment involves the elimination of existing interferences, removing or minimising the need for further orthodontic treatment in the permanent dentition or aiming to reduce the severity of the developing malocclusion.[1] Interceptive treatment may also be an element of 'two-phase' treatment representing the first phase prior to a definitive second phase in adolescence.

The claimed advantages of early treatment include the possibility of optimal compliance, particularly among those performing well at school.[1] While definitive orthodontics with fixed appliances is deferred until the establishment of the permanent dentition, more limited treatment can be initiated at an earlier stage to address localised malocclusions, for example, anterior or posterior crossbites, ectopic teeth and crowding. These may be undertaken in the mixed dentition and appear to be effective in addressing specific problems although the level of evidence to support some of even the more accepted interventions has been criticised.[1] Although a considerable amount of orthodontic treatment is instituted prior to the age of 11 years, there has been no systematic appraisal of the relative merits of interventions prior to this age. Sunnak and colleagues (2015)[1] undertook a systematic review to assess the effectiveness of a range of orthodontic interventions undertaken prior to the age of 11 years both in the short-term and long-term.

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MATERIALS AND METHODS

A comprehensive search strategy using the terms 'orthodontic, interceptive and early treatment' was undertaken using the following electronic databases: MEDLINE through PubMed (until January 2014), Ovid via MEDLINE (until January 2014), the Cochrane Oral Health Group's Trials Register (until January 2014), and the Cochrane Central Register of Controlled Trials (CENTRAL). Non-English language databases including LILACS and BBO were also accessed. Unpublished literature was searched electronically using ClinicalTrials.gov (www.clinicaltrials.gov) and the National Research Register (www.controlled-trials.com) using the terms 'orthodontic, interceptive and early treatment'. In addition, international databases and Pro-Quest Dissertation Abstracts and Thesis database were searched. References from included studies were screened for relevant research.

The following **inclusion criteria** were used.

- Study design: Randomised and controlled clinical trials.
- Type of participants: Patients aged under 11 years at the start of treatment with a malocclusion or dental condition requiring interceptive orthodontic correction or other procedure.

The following **exclusion criteria** were applied:

- Patients with oro-facial anomalies (e.g. cleft lip and palate).
- Medical conditions influencing treatment.

The Type of interventions included:

- Interceptive extractions of primary teeth or first permanent molars of poor prognosis.
- Use of fixed or removable space maintainers.
- Correction of anterior/posterior crossbites with associated displacement.
- Growth modification to address sagittal, vertical or transverse skeletal discrepancy
- Orthodontic treatment to address crowding with fixed or removable appliances.
- Habit dissuasion.

Comparators included:

- Untreated controls (negative controls) or participants undergoing alternative active intervention (positive controls).

1a	Headgear			Control				Mean Difference	Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI	IV, Fixed, 95% CI
Mantysaari *et al* 2004	2.6	1.53	25	4.2	2.34	29	29.4%	-1.60 [-2.64, -0.56]	
Tulloch *et al* 1997	4.83	1.5	52	5.7	2	54	70.6%	-0.87 [-1.54, -0.20]	
Total (95% CI)			77			83	100%	-1.08 [-1.65, -0.52]	

Heterogeneity: Chi² = 1.33, df = 1 (P = 0.25): I² = 25%
Test for overall effect: Z = 3.77 (P = 0.0002)

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Favours [experimental] Favours [control]

1b	Functional appliance			Control				Mean Difference	Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI	IV, Fixed, 95% CI
O' Brien *et al* 2003a	3.85	1.8	87	7.35	7.8	74	17.8%	-3.50 [-5.32, -1.68]	
Tulloch *et al* 1997	4.82	2.08	41	5.77	2.08	54	82.2%	-0.95 [-1.79, -0.11]	
Total (95% CI)			128			128	100%	-1.40 [-2.17, -0.64]	

Heterogeneity: Chi² = 6.22, df = 1 (P = 0.01): I² = 84%
Test for overall effect: Z = 3.59 (P = 0.0003)

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Favours [experimental] Favours [control]

Figure 1: (a) Change in ANB with early headgear appliance treatment and untreated control group. **(b)** Change in ANB with early functional appliance treatment and untreated control group

Outcome measures:

- Improvement in the intra-arch or inter-arch occlusal features including overjet and overbite.
- Frequency of favourable positional changes or autonomous eruption of ectopic or impacted teeth.
- Occlusal changes using validated scales including Peer Assessment Rating (PAR) and Little's irregularity index.
- Change in skeletal discrepancy using accepted cephalometric measures e.g. ANB differential, Wits analysis.

Secondary outcomes included:

- The requirement for a second phase of orthodontic treatment.
- Patient satisfaction measured using validated questionnaires or scales.
- Duration of orthodontic treatment, and number of visits during active treatment, scheduled and unscheduled.
- Harm arising during orthodontic treatment.
- Need for orthodontic extractions.

The quality of the eligible trials and the data was extracted independently and in duplicate by two review authors and any disagreements were resolved by discussion. Quality was assessed using the Cochrane Collaboration's risk of bias tool. The following domains were assessed as at low, high or unclear risk of bias: Sequence generation (selection bias); allocation concealment (selection bias); blinding of participants and personnel (performance bias), and outcome assessors (detection bias); incomplete outcome data addressed (attrition bias); selective outcome reporting (reporting bias); and other bias. An overall assessment of risk of bias (high, unclear, low) was made for each included trial. Studies with one or more criterion considered to be at high risk of bias were considered to be at high risk of bias overall and excluded from the meta-analysis. Authors were contacted to clarify data as required, including exact age of the patients at the start of treatment, missing data, method of randomisation, blinding and withdrawals.

A weighted treatment effect was calculated and the results expressed as mean differences (MD) and 95% confidence intervals (CI) for continuous outcomes and odds ratios (OR) and 95% CI for dichotomous outcomes. In general, random-effects models were to be used for all meta-analyses. Statistical heterogeneity was assessed by inspecting a graphical display of the estimated treatment effects from the trials with emphasis on the overlap of 95% confidence intervals. The quality of evidence was assessed using GRADE to assess the overall quality of the evidence body initially on the premise that RCTs possess high level

2a Early Headgear appliance				Control				Mean Difference	Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI	IV, Fixed, 95% CI
Mantysaari *et al* 2004	3.9	1.55	25	3.7	1.6	29	49.5%	0.20 [-0.64, 1.04]	
Tulloch *et al* 1997	7.8	2.48	52	8.94	1.84	54	50.5%	-1.14 [-1.97, -0.31]	
Total (95% CI)			77			83	100%	-0.48 [-1.07, 0.12]	

Heterogeneity: Chi² = 4.91, df = 1 (P = 0.03): I² = 80%
Test for overall effect: Z = 1.58 (P = 0.12)

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Favours [experimental] Favours [control]

2b	Functional appliance			Control				Mean Difference	Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI	IV, Fixed, 95% CI
O' Brien *et al* 2003a	3.7	2.27	87	10.71	2.4	84	64.9%	-7.01 [-7.71, -6.31]	
Tulloch *et al* 1997	5.38	2.67	41	8.94	1.84	54	35.1%	-3.56 [-4.51, -2.61]	
Total (95% CI)			128			138	100%	-5.80 [-6.36, -5.24]	

Heterogeneity: Chi² = 32.67, df = 1 (P < 0.00001): I² = 97%
Test for overall effect: Z = 20.13 (P < 0.00001)

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Favours [experimental] Favours [control]

Figure 2: (a) Change in overjet with early headgear appliance treatment and untreated control group. (b) Change in overjet with early functional appliance treatment and untreated control group.

3a	Headgear appliance			Adolescent group				Mean Difference	Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI	IV, Fixed, 95% CI
Pavlow *et al* 2008	44.4	15.6	61	30	14.4	57	49.2%	14.40 [8.99, 19.81]	
Tulloch *et al* 2004	45.1	13.03	47	34.5	13.85	51	50.8%	10.60 [5.28, 15.92]	
Total (95% CI)			108			108	100%	12.47 [8.67, 16.26]	

Heterogeneity: Chi² = 0.96, df = 1 (P = 0.33): I² = 0%
Test for overall effect: Z = 6.44 (P = 0.0001)

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Favours [experimental] Favours [control]

3b	Functional appliance			Adolescent group				Mean Difference	Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI	IV, Fixed, 95% CI
O' Brien *et al* 2009	31.74	14.03	64	24.39	13.02	73	40.3%	7.35 [2.80, 11.90]	
Pavlow *et al* 2008	48	12	59	30	14.4	57	35.7%	18.00 [13.17, 22.83]	
Tulloch *et al* 2004	40.5	14.37	39	34.5	13.85	51	24.0%	6.00 [0.10, 11.90]	
Total (95% CI)			162			181	100%	10.83 [7.94, 13.72]	

Heterogeneity: Chi² = 13.28, df = 2 (P = 0.001): I² = 85%
Test for overall effect: Z = 7.35 (P < 0.0001)

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Favours [experimental] Favours [control]

Figure 3: (a) The overall treatment duration with early headgear treatment and adolescent treatment. (b) The overall treatment duration with early functional appliance treatment and adolescent treatment.

of evidence, but downgrading as appropriate based on the following domains:
(a) study limitations (Risk of Bias);
(b) inconsistency of results;
(c) indirectness of evidence;
(d) imprecision of results;
(e) publication bias.

RESULTS

Four hundred and seventy-six trials were initially deemed potentially relevant to the review. The abstracts were reviewed and 22 met the inclusion criteria. All twenty-two studies had parallel group designs, six of which involved three groups and one involved four groups.

Overall, twenty studies were deemed to be at low or unclear risk of bias. As the remaining studies were judged to be at high risk of bias with respect to random allocation procedures and allocation concealment, these studies were not considered appropriate for inclusion in the meta-analysis.

Three studies considered the short-term effects of growth modification treatment with early headgear or functional appliances for skeletal II correction.

Early treatment with headgear alone resulted in a statistically significant mean reduction in the SNA of –1.33 degrees (WMD: –1.33, 95% CI: –1.68, –0.97).30 and similarly, a reduction in the ANB was seen in both studies and the result was statistically significant (WMD: –1.08, 95% CI –1.65, –0.52; Fig. 1a); however, there was a significant degree of statistical heterogeneity (I^2 = 88%). A statistically significant reduction in ANB in the functional appliance group compared to the control was seen in the meta-analysis with a mean reduction of 1.4 degrees (WMD: –1.4, 95% CI: –2.17, –0.64; Fig. 1b). The heterogeneity between the studies was high (I2 = 84%); therefore, the meta-analysis should be interpreted with caution.

Overall, the overjet reduction in the headgear group was statistically significant when compared to the control group (WMD: –0.48, 95% CI: –1.07, –0.12; Fig. 2a). Comparing functional appliance therapy to control, however, a statistically significant reduction in overjet was found in the treatment group (WMD: –5.80, 95% CI: –6.36, –5.24; Fig. 2b). The studies, however, were not homogenous (I2 = 97%); the results should therefore be interpreted with caution.

No statistically significant differences in cephalometric and occlusal outcomes were found between the early treatment groups and the adolescent group. Three studies considered the overall treatment duration and found it to be protracted in the early treatment groups with headgear (WMD: 12.47 months, 95% CI: 8.67, 16.26; Fig. 3a) and functional appliances (WMD: 10.83 months, 95% CI: 7.94, 13.72; Fig. 3b) compared to adolescent treatments. There was, however, considerable heterogeneity between the early functional appliance studies (I2 = 85%).

Protraction facemask, with or without expansion, for the early correction of Class III skeletal discrepancies was considered in six studies. ANB increased in the treatment groups in all the studies as a result of an increase in SNA and/or reduction in SNB. A meta-analysis of the two studies that were considered to be at low risk of bias showed the increase in ANB was statistically significant in the protraction facemask group (P < 0.00001; WMD: 3.12, 95% CI: 2.40, 3.84; Fig. 4); however, the heterogeneity between the studies was relatively high (I2 = 68%).

	Protraction facemask			Control				Mean Difference	Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI	IV, Fixed, 95% CI
Mandall *et al* 2000	2.1	2.3	33	-0.5	1.5	36	60.8%	2.60 [1.67, 3.53]	
Vaughn *et al* 2004	3.88	1.83	29	-0.05	1.976	17	39.2%	3.93 [2.78, 5.08]	
Total (95% CI)			62			53	100%	3.12 [2.40, 3.84]	

Heterogeneity: Chi² = 3.11, df = 1 (P = 0.08): I² = 68%
Test for overall effect: Z = 8.48 (P < 0.00001)

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Favours [experimental] Favours [control]

Figure 4: Change in ANB with early protraction facemask treatment and untreated control group.

Meta-analyses were not possible for comparisons of other interceptive treatments due to heterogeneity and methodological limitations.

The degree of heterogeneity between studies in the meta-analyses was variable, with I^2 ranging from 0% to 97%. Statistical assessment of publication bias was also not indicated, as no more than three studies were included in any meta-analysis. The overall quality of the evidence based on the GRADE assessment suggested that the level of evidence was low to moderate.

CONCLUSIONS

The results suggest a lack of evidence to prove that early treatment carries additional benefit over and above that achieved with treatment commencing later; however, this does not imply that early treatment is ineffective. The additional cost and burden to the patient, parent and clinician may, therefore, generally negate early treatment. Further trials of high quality of evidence are required assessing the effectiveness of interceptive treatment for a range of occlusal problems, particularly those not known to hinge on growth potential, with long-term follow up to ascertain whether short-term effects are maintained once growth has ceased and to delineate the effects of intervention timing on the overall treatment duration.

IMPLICATIONS FOR PRACTICE

This meta-analysis provided evidence that whilst early interceptive orthodontics may have no additional benefits over delayed treatment, the quality of the studies included in this review require that these results be interpreted with caution mainly due to high heterogeneity between the studies. Thus no conclusive statement can be made when trying to answer the research question.

Reference

1. Sunnak R, Johal A, Fleming PS. Is orthodontics prior to 11 years of age evidence-based? A systematic review and meta-analysis. Journal of Dentistry 2015; 43: 477-486

2. Periodontally compromised vs. periodontally healthy patients and dental implants: A systematic review and meta-analysis

Chrcanovic BR, Albrektsson T, Wennerberg A. Periodontally compromised vs. periodontally healthy patients and dental implants: A systematic review and meta-analysis, Journal of Dentistry 2014; 42:1509-1527.

Although dental implants have become a reliable procedure for replacing missing teeth, it is still considered a challenge to place an implant in compromised sites with successful results. There is evidence that patients with a history of periodontitis are more at risk for peri-implant disease than healthy patients and also experience higher levels of implant complications and failure.[1] A pertinent question in relation to implant therapy in patients susceptible to periodontitis is whether these patients may also show an elevated risk for peri-implant tissue destruction. Chrcanovic and colleagues (2014)[1] reported on a systematic review with meta-analysis that sought to compare the survival rate of dental implants, postoperative infection, and marginal bone loss of dental implants inserted in periodontally compromised patients (PCPs) and in periodontally healthy patients (PHPs).

MATERIALS AND METHODS

An electronic search without time or language restrictions was undertaken in March 2014 in the following databases: PubMed, Web of Science, and the Cochrane Oral Health Group Trials Register. Hand-searching was also done in selected journals and the reference list of the identified studies and the relevant reviews on the subject were also scanned for possible additional studies.

Eligibility criteria included clinical human studies, either randomized or not, comparing implant failure rates in any group of patients receiving dental implants that are being inserted in PCPs compared to their insertion in PHPs. For this review, implant failure represents the complete loss of the implant. Exclusion criteria were case reports, technical reports, animal studies, *in vitro* studies, and review papers.

Potentially relevant titles and abstracts were reviewed independently by the three authors. For studies appearing to meet the inclusion criteria, or for which there were insufficient data in the title and abstract to make a clear decision, the full report was obtained. Disagreements were resolved by discussion between the authors.

Quality assessment of the studies was executed according to the Newcastle–Ottawa scale (NOS). According to that quality scale, a maximum of 9 stars/points can be given to an observational study, and this score represents the highest quality, where six or more points were considered high quality.

For the outcome variables, Implant failure and postoperative infection were reported as a dichotomous measure. Weighted mean differences were used to construct forest plots of marginal bone loss, a continuous outcome. The statistical unit for the outcomes was the implant. The I^2 statistic was used to express the percentage of the total variation across studies due to heterogeneity, with 25% corresponding to low heterogeneity, 50% to moderate and 75% to high. The inverse variance method was used for random-effects or fixed-effects model. Where statistically significant ($P<0.10$) heterogeneity is detected, a random-effects model was used to assess the significance of treatment effects. Where no statistically significant heterogeneity is found, analysis was performed using a fixed-effects model. The estimates of relative effect for dichotomous outcomes were expressed in risk ratio (RR) and in mean difference (MD) in millimeters for continuous outcomes, both with a 95% confidence

interval (CI). The degree of statistical significance was considered $P < 0.05$. The data were analyzed using the statistical software Review Manager (version 5.2.11).

RESULTS

The initial screening of titles and abstracts resulted in 34 full-text papers of which 12 were excluded because they did not meet the inclusion criteria; thus, a total of 22 publications were included in the review.

All studies except one were rated as high quality.

In this study, a fixed-effects model was used to evaluate the implant failure in the comparison between PCPs vs. PHPs, since statistically significant heterogeneity was not found ($P = 0.87$; $I^2 = 0\%$). The insertion of dental implants in PCPs or PHPs statistically affected the implant failure rates ($P < 0.00001$; Fig. 2), in favour of PHPs. A RR of 1.78 (95% CI 1.50–2.11) implies that failures when implants are inserted in PCPs are 1.78 times likely to happen than failures when implants are inserted in PHPs.

Only four studies provided information about postoperative infection. A fixed-effects model was used, due to lack of statistically significant heterogeneity ($P = 0.54$; $I^2 = 0\%$). The insertion of dental implants in PCPs or PHPs statistically affected the incidence of postoperative infections ($P = 0.0004$), in favour of PHPs.

Five studies provided information about the marginal bone loss. A random-effects model was used to evaluate the marginal bone loss, since statistically significant heterogeneity was found ($P<0.00001$; $I^2 = 88\%$). There was statistically significant difference (MD 0.60, 95% CI 0.33–0.87; $P < 0.0001$) between the groups concerning the marginal bone loss, favouring PHPs.

The funnel plot showed asymmetry when the studies reporting the outcome 'implant failure' in the comparison between PCPs vs. PHPs are analyzed, indicating possible presence of publication bias.

CONCLUSION

The results of this systematic review should be interpreted with caution due to the presence of uncontrolled confounding factors in the included studies, none of them randomized. Within the limitations of the existing investigations, the present study suggests that an increased susceptibility for periodontitis may also translate to an increased susceptibility for implant loss, loss of supporting bone, and postoperative infection.

IMPLICATIONS FOR PRACTICE

This review has provided evidence that periodontally compromised patients are at higher risk for adverse outcomes when undergoing implant therapy. Clinicians should inform these patients who present for implant therapy about the increased risk for implant complications/failure.

Reference

1. Chrcanovic BR, Albrektsson T, Wennerberg A. Periodontally compromised vs. periodontally healthy patients and dental implants: A systematic review and meta-analysis, Journal of Dentistry 2014; 42:1509-1527.