Abstracts of Theses Approved for the MSc and PhD at the School of Dental Sciences, Universiti Sains Malaysia, Health Campus, Kubang Kerian, Kelantan, Malaysia

CLINICAL AND RADIOLOGICAL STUDY OF IMMEDIATE PLACEMENT OF CORAL COATED DENTAL IMPLANT

Dr Ali Abdul Kawi Ali Taher
MSc Dentistry

School of Dental Sciences, Universiti Sains Malaysia Health Campus, 16150 Kelantan, Malaysia

Objectives: The study was conducted to determine clinically the efficacy of bone healing of immediate dental implantation with coral augmentation at the bone-implant interphase and to compare radiographic bone density around immediate dental implants with and without coral augmentation

Material and Methods: A comparative vertical prospective study design was employed, comparing 2 groups of patients receiving dental implants in Hospital Universiti Sains Malaysia. A group of patients received implants (Frialit-2 implant system, Germany) coated with natural coral (obtained from the National Tissue Bank, Universiti Sains Malaysia) and the other group received non-coated implants. All the implants were placed immediately into the extracted tooth socket. The inclusion criteria were healthy patients, age 18–40 years old, indicated for single tooth extraction, no endodontic and periodontic lesions at site of extraction, and extraction socket was left with intact 4 walls. The exclusion criteria were patients with systemic disease and if the extraction socket has lost 1 or more wall. Out of 13 patients selected, 8 patients had immediate implant with coral coating (test group) and 5 patients had non-coated implant (control group). However, 2 patients in the test group dropped out of the study. Clinical and densitometric assessments were done after 1, 2, 3, and 12 weeks post-operation.

Results: Clinically, all the 11 patients in both groups showed normal wound healing. Densitometric analysis showed that the bone density was significantly higher in the immediate coral-coated implant group compared with the control group on at least 1 point around the implant ($P < 001$). The values for densitometric analysis at 5 different points were higher in coral-coated implant group. However, the difference was significant only at the coronal mesial and midway distal points, with $P < 0.002$ and $P < 0.024$, respectively.

Conclusion: Locally produced coral (obtained from the National Tissue Bank) is a suitable material for coating the surface of implants since it was shown to provide primary stability to the immediate placement of the coated implants in the extraction sockets. This primary stability will ensure new bone growth to provide the more stable secondary stability. The biocompatibility of the coral graft and its role as an osteoconductor would have encouraged this very useful phenomena in dental implantology.

Supervisor:
Professor Dr Ab Rani Samsudin
Co-supervisor:
Dr Sam'an Malik Masudi

DENTAL CAST AND CEPHALOMETRIC ANALYSIS OF UNILATERAL CLEFT LIP AND PALATE USING FINITE ELEMENT ANALYSIS

Dr Amjad Mahmoud Alomari
MSc Dentistry

School of Dental Sciences, Universiti Sains Malaysia Health Campus, 16150 Kelantan, Malaysia

Objective: The purpose of this study was to localize differences of Malay population between non-cleft (NC) and unilateral cleft lip and palate (UCLP) in terms of the size and shape of the maxilla and mandible using Finite Element Analysis (FEA).

Material and Methods: In this cross sectional study, 31 subjects with UCLP and NC (6–12years old) were selected, and their dental casts and lateral cephalometrics were compared. The mean (SD) age was 9.4 (1) years for UCLP compared with 9.5 (1.17) years for NC. No patient had received orthodontic treatment. Dental casts were digitized into 6 elements with 12 homologous landmarks while lateral cephalometrics were digitized into 7 elements with 11 homologous landmarks.

Results: The maxilla was more affected by cleft in all dimensions than mandible. Difference in the size and shape of the mandible between UCLP and NC were limited.

Conclusion: Size and shape differences between UCLP and NC can be identified with finite element analysis.

Supervisor:
Dr Zainul Ahmad Rajion
Co-supervisor:
Dr Rozita Hassan

MICROLEAKAGE OF REPAIRED FISSURE SEALANT USING NANO-FILLED RESIN: IN VITRO STUDY

Dr Ghalib Qadri Waleed Qadri
MSc Dentistry

School of Dental Sciences, Universiti Sains Malaysia Health Campus, 16150 Kelantan, Malaysia

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Objectives: The aims of this study were to investigate whether differences in the technique of repair influence a seal of a repaired nano-filled, resin-based fissure sealant and to determine the effect of different curing time on microleakage of a repaired fissure sealant.

Materials and Methods: A total of 108 extracted molars were randomly allocated to 1 of 4 groups of 28 teeth each. A light cured, nano-filled, resin fissure sealant (Filtek Z350) was placed on their occlusal surface following cleaning by prophylaxis and acid etching. Following storage in artificial saliva for a week, duplication of sealant failure was carried out. The teeth were then subjected to 4 different methods of repair: Group 1, a slow-speed prophylaxis brush followed by acid etching and 10 seconds curing time (control); Group 2, prophylaxis brush, acid etching, application of bonding agent, and 10 seconds curing time; Group 3, prophylaxis brush, acid etching, and 5 seconds curing time; and Group 4, prophylaxis brush, acid etching, and 20 seconds curing time. Then, they were stored for 1 week in artificial saliva, painted with 2 layers of impermeable varnish. Their apices were sealed with wax, and the teeth were immersed in 1% methylene blue for 48 hours. The teeth were then sectioned longitudinally in a mesiodistal plane to achieve 3 cuts resulting in a maximum of 4 blocks, i.e., 6 surfaces per tooth. A total of 648 surfaces from 108 teeth were scored for microleakage using scoring system on the intact and the repaired side of the fissure sealant.

Results: Chi-square analysis indicated no significant different between the tested techniques of repair, except for Group 3 that resulted in the highest number of surfaces exhibited maximum score of microleakage ($P = 0.027$).

Conclusion: The present data did not demonstrate any single method of repair to be superior to the control method, which was the use of prophylaxis brush without any medium, followed by acid etching, applying fissure sealant, and light curing for 10 seconds. The control method seems to be the simplest and the most appropriate method of repair; therefore it is recommended.

Supervisor:
Dr Siti Noor Fazliah Mohd Noor
Co-supervisor:
Dr Dasmawati Mohamed

THE APICAL SEALING ABILITY EVALUATION OF A NEW EXPERIMENTAL NANO HYDROXYAPATITE-FILLED EPOXY RESIN BASED ENDODONTIC SEALER: IN VITRO STUDY

Dr Jalal Jafar Alshakhshir
MSc Dentistry

School of Dental Sciences, Universiti Sains Malaysia
Health Campus, 16150 Kelantan, Malaysia

Objectives: The study was conducted to evaluate the apical sealing ability of experimental nano hydroxyapatite (HA)-filled epoxy resin-based endodontic sealer and compare it with the commercial AH26 sealant.

Material and Methods: School of Dental Science, Universiti Sains Malaysia (USM) had prepared a new experimental nano HA-filled epoxy resin based endodontic sealer. The HA nano crystal, sizes ranging 40–60 nm, were synthesized at the School of Chemical Sciences, USM by wet chemical method using calcium hydroxide, $Ca(OH)_2$, and phosphoric acid, H_3PO_4, as the Ca and P precursors, respectively. The components of experimental nano HA-filled epoxy resin sealer were nano HA, bismuth (III) oxide, hexamethylene tetramine, and epoxy resin. A total of 76 extracted human anterior teeth were instrumented using nickel–titanium (NiTi) files and randomly divided into 2 test groups of 33 teeth each and 2 control groups of 5 teeth each. The first group was obturated using gutta-percha with AH26 sealer. The second group was obturated with the nano HA-filled epoxy resin based sealer. All teeth were coated with nail polish, except 2 mm from foramen apical, and then suspended in 2% methylene blue for 7 days. All teeth were sectioned longitudinally for the measurement of penetration of the dye using stereo-microscope (36 x magnification). The maximum length of the dye penetration in each root was examined and measured by Imaging System (LEICA, UK). All the measurements were then noted and tabulated. Every measurement was repeated twice by 2 blinded researchers, the mean of the 2 measurements was recorded for each case. Intraclass correlation coefficient (ICC) was nearly 0.983, which suggest that the measurement was almost identical or with negligible errors of measurements.

Results: Statistical analysis of the results was performed using independent sample *t* test. The mean penetration distances of methylene blue across the AH26 silver-free sealer and experimental nano HA sealer was 0.44 (SD 0.63) mm and 0.75 (SD 0.81) mm, respectively. The result showed that there was no statistically significant difference ($P > 0.05$) in apical sealing ability between AH26 silver-free sealer and experimental nano HA sealer.

Conclusions: Experimental nano HA-filled epoxy resin endodontic sealer provided an adequate apical seal against dye penetration in similar level with AH26 silver-free and could be used as an alternative to the commercial available endodontic sealer. Further study should be carried out to determine the setting time, radio-opacity, solubility, and antibacterial properties of nano HA root canal sealer.

Supervisor:
Dr Sam'an Malik Masudi
Co-supervisors:
Dr Dasmawati Mohamad
Dr Norhayati Luddin

VARIATIONS IN TOOTH SIZE, DENTAL ARCH DIMENSIONS, AND SHAPE AMONG MALAY SCHOOL CHILDREN

Dr Khalid Waleed Hussein
MSc Dentistry

School of Dental Sciences, Universiti Sains Malaysia Health Campus, 16150 Kelantan, Malaysia

Objectives: The aims of the present study were to measure the mesiodistal tooth size and dental arch dimensions in Malay schoolchildren with Class I, Class II, and Class III, and compare the tooth size and arch dimensions among different classes of malocclusion.

Materials and Method: The current study consisted of dental casts of 150 subjects: 78 males and 72 females aged 12 and 16 years. Every malocclusion group consisted of 50 subjects. An electronic digital caliper was used to measure the individual mesiodistal tooth width of all maxillary and mandibular permanent teeth (except 2nd and 3rd molars). Inter-canine and inter-molar widths were also measured. To measure maxillary and mandibular arch perimeter and length, AutoCAD software was used.

Results: The teeth width and arch dimensions were significantly larger in males than in females except for lower arch perimeter and upper arch length ($P < 0.05$). Moreover, the arch widths were significantly smaller in Class II compared with Class I normal occlusion. Significant difference was observed only in the mandibular inter-canine width ($P < 0.05$). There were no significant differences neither in arch perimeter or arch length in the maxillary and mandibular dental arches.

Conclusion: Knowledge of arch width and tooth size that is associated with malocclusion is helpful in determining orthodontic treatment goals and likely post-treatment sequence for the malocclusion.

Supervisor:
Dr Zainul Ahmad Rajion
Co-supervisor:
Dr Rozita Hassan
Dr Siti Noor Fazlia Mohd Noor

EVALUATION OF APICAL SEALING ABILITY OF A NEWLY DEVELOPED NANO HYDROXYAPATITE SEALER USING COLD LATERAL AND CONTINUOUS WAVE CONDENSATION TECHNIQUES: AN IN VITRO STUDY.

Dr Manal Abdulrahman Farea Ali
MSc Dentistry

School of Dental Sciences, Universiti Sains Malaysia Health Campus, 16150 Kelantan, Malaysia

Objectives: The study was designed to evaluate in vitro apical sealing ability of experimental nano hydroxyapatite (HA)-containing endodontic sealer and compare it with AH 26 sealer using cold lateral and continuous wave condensation techniques.

Materials and Methods: This was a randomized controlled single-blind experimental study involving 232 freshly extracted single rooted human teeth. Crowns of the teeth were amputated at the cemento–enamel junction using Exakt cutting system. The root canals were prepared using a crown-down technique with ProTaper nickel–titanium rotary system and randomly divided into 4 experimental groups to be obturated by the nano HA sealer and cold lateral condensation technique ($n = 53$), the AH 26 sealer and cold lateral condensation technique ($n = 53$), the nano HA sealer and continuous wave condensation technique ($n = 53$), and the AH 26 sealer and continuous wave condensation technique ($n = 53$). The remaining 20 teeth served as positive and negative control groups of 10 teeth each. All teeth were stored in an incubator, at 37 °C for 7 days to allow adequate setting of sealers. Root surfaces were covered with 2 layers of nail polish except for the apical 2 mm and then placed in an aqueous solution of 2% methylene blue dye. After 72 hours, the teeth were rinsed under running tap water and dried, and the nail polish was removed. Each specimen was then embedded in isobornyl methacrylate resin to facilitate their mounting in a hard tissue cutter. Six transverse sections of 1 mm thickness were taken starting at the apical limit of the preparation and ascending apico–coronally to a total of 6 mm of each tooth. The coronal surface of each consecutive section was assessed for dye penetration using stereomicroscope supported by image analyzer software. Overall dye penetration for each tooth was then calculated as the ratio between the total methylene blue infiltrated surface areas and the total dentinal surface areas of the 6 levels. Data was entered into SPSS software and analyzed using two-way ANOVA where $P < 0.05$ was considered as statistically significant.

Results: The positive controls demonstrated maximum dye penetration at all levels in all teeth. In contrast, the negative controls showed no evidence of leakage at any level in any of the samples. Means of overall apical dye penetration were 9.33% for nano HA sealer and 8.94% for AH 26 sealer with no significant difference ($P = 0.087$) between the 2 tested sealers. The means of overall apical dye penetration were 12.15% and 6.11% for cold lateral condensation and continuous wave condensation techniques, respectively. Cold lateral condensation leaked significantly more ($P < 0.001$) than continuous wave condensation technique.

Conclusion: Experimental nano hydroxyapatite sealer provided a comparable apical seal to that obtained by AH 26 sealer and could be used as an alternative to the commercial available endodontic sealer. In addition, continuous wave condensation technique using system B created a better apical seal than conventional cold lateral condensation technique.

Supervisor:
Dr Sam'an Malik Masudi
Co-supervisor:
Dr Wan Zaripah Wan Bakar

GENOTOXIC EVALUATION OF LOCALLY PRODUCED DENTAL PORCELAIN USING THE AMES SALMONELLA AND COMET ASSAYS

Dr Mohammed Noushad
MSc Dentistry (Prosthodontics)

School of Dental Sciences, Universiti Sains Malaysia
Health Campus, 16150 Kelantan, Malaysia

Objectives: The study was conducted to determine the genotoxicity of locally produced dental porcelain (Universiti Sains Malaysia, MY) using the Salmonella/mammalian-microsome mutagenicity assay (Ames assay) and the single cell gel electrophoresis assay (Comet assay).

Materials and Methods: In the Ames assay, 4 genotypic variants of the Salmonella strains (TA98, TA100, TA1535, and TA1537) carrying mutations in several genes were used. The dental porcelain was incubated with these 4 strains at 5 different concentrations (0.3125, 0.625, 1.25, 2.5, and 5 mg/plate) along with concurrent appropriate positive and negative controls, both in the absence and presence of metabolic activation (S9). The results were assessed based on the number of revertant colonies per plate in comparison with that of the negative control. In the Comet assay, L929 (CCL-1 ATCC, USA) mouse fibroblast cells were treated with the locally produced dental porcelain at 3 different concentrations (50, 100, and 200 mg/mL) along with concurrent negative and positive controls. Fifty cells were captured randomly from each slide and scored under a fluorescence microscope. The mean value of tail moment was used as a measurement of DNA damage.

Results: For a substance to be considered mutagenic in the Ames assay, the number of revertant colonies per plate containing the test material must be at least more than double the number of colonies per plate containing the negative control. The test material do not show more than double the number of colonies than the negative control or any dose-dependent increase in the number of revertant colonies both in the absence and presence of metabolic activation. The results of the Comet assay showed that the mean tail moment with the test material was similar to that of the negative control; there was also no dose-dependent relationship on the tail moment.

Conclusion: Locally produced dental porcelain is non-genotoxic by both Ames and Comet assays under the present test conditions.

Supervisor:
Dr Adam Husein
Co-supervisor:
Dr TP Kannan

PREVALENCE OF ORAL MUCOSAL LESIONS AND THE ASSOCIATION BETWEEN DIABETES MELLITUS AND ORAL PRECANCEROUS LESIONS AMONG MALAY PATIENTS ATTENDING HOSPITAL UNIVERSITI SAINS MALAYSIA

Sadeq Ali Al-Maweri
MSc Dentistry

School of Dental Sciences, Universiti Sains Malaysia
Health Campus, 16150 Kelantan, Malaysia

Objectives: The study aimed to determine the prevalence of oral mucosal lesions among Malay diabetic patients, and the association between oral mucosal lesions and diabetes factors, as well as diabetes and oral precancerous lesions.

Materials and Methods: This cross-sectional study involved 420 diabetic patients and 420 non-diabetic subjects in Hospital Universiti Sains Malaysia, Kota Bharu, Kelantan, from January until August 2009. Demographic information, duration and type of diabetes, glycosylated hemoglobin values (HbA_{1c}), and previous and current uses of medication were obtained from medical records. Detailed oral examination of the oral cavity was done based on international criteria and World Health Organization codes. The number of remaining teeth and presence of dentures were also noted.

Results: The frequency of oral mucosa lesions was significantly higher in diabetes patients, 45%, in comparison with 38.3% in controls ($P < 0.05$). There were 12 types of oral mucosal lesions identified. Specific oral lesions that were found to be of significantly greater frequency in diabetes patients than controls include geographic tongue ($P < 0.01$), denture stomatitis ($P < 0.05$), and angular cheilitis ($P < 0.05$). The prevalence of traumatic ulcers was higher in diabetics; however, this was not significant ($P > 0.5$). About one-third of subjects in both groups used dentures and diabetic patients have a lower mean number of remaining teeth compared to non-diabetics ($P < 0.001$). There was an association between the prevalence of oral mucosal lesions and metabolic control ($P < 0.05$). However, no association between diabetes mellitus and oral precancerous lesions was found.

Conclusions: Diabetic patients showed higher prevalence of oral mucosal lesions than control subjects did. There was an association between oral mucosal lesions and metabolic control of diabetes; however, no association was observed between diabetes and oral precancerous lesions.

Supervisor:
Associate Professor Dr Hj Abdul Rashid Hj Ismail
Co-supervisors:
Dr Rajan Saini
Associate Professor Dr Hjh Noorliza Mastura Hj Ismail

DENTAL AGE IN KELANTANESE MALAY POPULATION BASED ON DEMIRJIAN'S METHOD

Dr Saiffedin Abu Asab
MSc Dentistry

School of Dental Sciences, Universiti Sains Malaysia Health Campus, 16150 Kelantan, Malaysia

Objectives: The purposes of this study were as follows: (1) Examining the applicability of Demirjian's methods for estimating the chronological age of male and female Kelantanese Malay children aged 5 to 16 years; (2) Establishing a new dental age standard, if Demirjian's methods were not applicable on the Kelantanese Malay population; (3) Comparing the dental age curves between Malay children and French–Canadian children; (4) Determining the sexual dimorphism in the dental age assessment of Kelantanese Malay children; (5) Detecting the differences in "dental ages" and "maturity scores" between the lower left permanent teeth and the lower right; and (6) Detecting the median ages of attainment of each stage of dental development according to Demirjian's stages for the lower left 7 teeth.

Materials and methods: A total number of 905 panoramic radiographs (OPG) for healthy Kelantanese Malay children aged 5 to 16 years old were collected from the Radiographic Unit, Hospital Universiti Sains Malaysia (HUSM), and the Orthodontic Clinic, Hospital Kota Bharu. The dental age was assessed cross-sectionally by using Demirjian's methods (1973 and 1976). Children who had any disease that was known to affect the dental development or have agenesis in the lower arch were excluded, as well as those poor quality OPG images.

Results: Demirjian's method (1973) overestimated the chronological age by 1.2 years for boys and 1.3 years for girls. The 4 teeth: M_2, M_1, PM_2, PM_1 method overestimated the age by 1.2 years for both sexes, while the 4 teeth: M_2, PM_2, PM_1, I_1 method overestimated the age by 0.6 year for boys and 0.7 year for girls. As the methods of Demirjian's were not applicable on Kelantanese Malay children, new modified specific standards curves and tables were produced for Demirjian's method (1973). An external sample of 47 Kelantanese Malay children (28 boys and 29 girls) randomly selected from HUSM was used to test the accuracy of the modified Demirjian's method on Kelantanese Malay population. The results showed a mean difference between the chronological age and dental age of about 2 months for both sexes. The median ages of attainment of each developmental stage according to Demirjian's stages for the lower permanent left 7 teeth for both sexes were produced. Moreover, girls showed more advancement in dental age compared with boys. In comparison between the dental development between the Kelantanese Malay and French–Canadian children, the results showed that the "dental age" for younger age groups of boys (7.00–9.99 years) and age groups of girls (7.00–8.99 years) was not significantly different from the French–Canadian children. After the age 10 years, the difference increased in boys, whereas in girls, the increase started earlier, i.e., after the age 9 years. The greatest difference between Kelantanese and French–Canadian girls was at age 12 years with mean difference of about 2 years, while for boys was 1 year earlier than the girls with a difference reach about 2 years and 3 months. In the older age groups (14.0–15.99 years) the maturation scores were similar with the French–Canadian children. No significant difference was found in the dental development of the lower left teeth when compared with the right lower teeth.

Conclusion: Demirjian's methods (1973 and 1976) were shown to be less accurate to estimate the chronological age in Kelantanese Malay children samples. Variations in the dental development should be considered especially for the genetic factor and less for non-genetic factors. The modification of the system had resulted in a new dental age system that is more precise and more applicable for the Kelantanese Malay children.

Supervisor:
Dr Siti Noor Fazliah Mohd Noor
Co-supervisor:
Dr Mohd Fadhli Khamis

THE CORONAL SEALING ABILITY OF A NOVEL NANO HYDROXYAPATITE-FILLED ENDODONTIC SEALER

Dr Shadi Mohammad Ali Alomari
MSc Dentistry

School of Dental Sciences, Universiti Sains Malaysia Health Campus, 16150 Kelantan, Malaysia

Objectives: The study aimed to evaluate the sealing ability of a novel nano hydroxyapatite (HA)-containing endodontic sealer in preventing coronal leakage before and after post preparation and to compare it with the commercial AH26 sealant.

Material and Methods: A total of 152 extracted human single-rooted teeth were instrumented using nickel–titanium (NiTi) files and the crowns were then amputated. After cleaning and shaping procedure were completed using step back technique, samples were randomly divided into 2 groups. The 2 groups were obturated with either gutta percha and AH 26 sealer, or gutta percha with the nano HA-containing sealer. All teeth were then stored at 37 °C for 7 days to allow the sealer to set. Each group was then further subdivided into 2 groups: a group was prepared for post using para-post drill and the other group was left intact. All 4 study groups consisted of 38 samples per group. The teeth were then thermal-cycled at 5°C and 55°C in water baths at dwell time of 30 seconds for a total of 500 cycles. External surfaces of the roots were coated with 2 layers of nail varnish that did not cover the coronal opening. Specimens were then submerged in 2% methylene blue dye for 24 hours. Each root was sectioned vertically into 2 halves, and microleakage was measured under microscope (36 x magnifications) by taking

the maximum linear dye penetration corono–apically. Micro leakage readings were analyzed by the independent *t* test (α = 0.05).

Results: The result showed that there was no statistically significant difference in the coronal sealing ability between the 2 sealers, before and after preparation for post. The experimental nano HA-containing and AH26 sealers with post space preparation showed significantly more leakage compared with sealers with no post space preparation.

Conclusion: Preparation for post caused a significant decrease in the coronal sealing ability of both sealers; however, it did not result in any difference between the performances of the 2 sealers. The novel nano HA-containing sealer tested had a comparable coronal sealing ability with the commercial AH26 sealer.

Supervisor:
Dr Zuryati Ab Ghani
Co-supervisor:
Dr Adam Husein
Dr Sam'an Malik Masudi

ASSESSING AND MANAGING RISK OF OCCUPATIONAL STRESS IN MALE AUTOMOTIVE ASSEMBLY WORKERS IN MALAYSIA

Edimansyah Abdin
PhD Dentistry

School of Dental Sciences, Universiti Sains Malaysia Health Campus, 16150 Kelantan, Malaysia

Introduction: Occupational stress is a major occupational health problem in many industries. Automotive assembly industry workers are among the occupational groups reportedly experiencing disproportionately high levels of occupational stress.

Objectives: The main purpose of this study was to assess and manage the risk of occupational stress in male automotive assembly workers in Malaysia. Other objectives include validating the Malay version of the Job Content Questionnaire (JCQ) and Depression Anxiety Stress Scales (DASS) 21- and 42-item; determining the prevalence and associated factors of self-perceived depression, anxiety, stress, and quality of life (QOL); modeling the relationship between job demand, job control, and social support in relation to the self-perceived depression, anxiety and stress, and QOL; and evaluating the immediate effects of a 4-hour stress management training on the self-perceived depression, anxiety, and stress in male automotive assembly workers.

Material and Methods: As parts of the longitudinal research design, a cross-sectional study and quasi-experimental intervention were carried out between November 2004 and October 2007. A total 728 workers from 2 automotive assembly plants in Selangor and Pahang were enrolled in this study.

Results: The Malay version of the JCQ and DASS (21-item and 42-item) were reliable and valid for assessing job content, self-perceived depression, anxiety, and stress. The prevalences of self-perceived depression, anxiety, and stress were 35.4%, 47.2%, and 31.1%, respectively. Multiple linear regression (MLR) analyses revealed that psychological job demand, job insecurity, and hazardous conditions were positively associated with the DASS-Depression, DASS-Anxiety, and DASS-Stress; supervisor support was inversely associated with DASS-Depression and DASS-Stress. The prevalence of reported good or very good overall self-perceived QOL and general health status was 64.9% and 53.7%, respectively. MLR analyses indicated that created skill was positively associated with physical health and psychological domains of QOL while skill discretion was positively associated with the social relationship and environment domains of QOL. Social support was positively associated with the physical health and environment domains of QOL while co-worker support was positively associated with the psychological and social relationship domains of QOL. Job insecurity and hazardous condition were negatively associated with all domains of QOL while psychological job demand was negatively associated with the environment domain of QOL. In the structural equation modeling analysis, the final model showed that social support in the workplace was directly related to all 4 domains of QOL (physical health, psychological wellbeing, social relationships, and environmental conditions) and inversely related to self-perceived depression and stress. Job demand was directly related to self-perceived stress and inversely related to the environment domain of QOL. Job control was directly related to the social relationships domain of QOL. Surprisingly, self-perceived stress, anxiety, and depression were also found to be important mediating factors in the relationships between job demand and social support and the 4 domains of QOL. Meanwhile, in the quasy-experimental study, we found that the stress management training significantly improves self-perceived depression and anxiety in the experimental group as compared with the control group.

Conclusion: Reducing psychological job demand, job insecurity, and hazardous condition factors and promoting good support from co-workers and supervisors may improve the worker's self-perceived depression, anxiety, stress, and QOL in the automotive assembly plant. At the individual level, the findings suggest that the stress management training is effective in reducing the self-perceived depression and anxiety.

Supervisor:
Professor Dr Rusli Nordin
Co-supervisor:
Dr Lin Naing