

# Outcomes of 3 hours part-time occlusion treatment combined with near activities among children with unilateral amblyopia

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## ABSTRACT

**الأهداف:** تقييم نتائج وضع الرقععات العينية بدون الأنشطة القريبة لدى المرضى الذين يعانون من مرض الغمش الأحادي.

**الطريقة:** شملت هذه الدراسة 130 مريض يعاني من مرض الغمش الأحادي والذين تم وصف الرقععات العينية لهم، وتمت متابعتهم لمدة 12 أسبوع في عيادة العيون للأطفال وعبادة تقويم البصر، مستشفى جامعة الملك عبدالعزيز، الرياض، المملكة العربية السعودية. ولقد أجريت لهم هذه الدراسة خلال الفترة من يناير 2010م إلى نوفمبر 2010م. وقد تم تقسيم مجموعة الدراسة إلى قسمين: القسم الأول (65) مريض طلب منهم القيام بأنشطة بصرية قريبة (مثل قراءة كتاب) خلال الترقيع، بينما طلب من المجموعة الثانية (65) مريض عدم القيام بأي أنشطة قريبة خلال فترة الترقيع.

**النتائج:** لقد تحسنت حدة البصر بمعدل  $6.7 \pm 2.37$  وحدة خط م.أ.ر في مجموعة الترقيع التي قامت بأنشطة قريبة مقارنة مع مجموعة الترقيع التي لم تقم بأي أنشطة قريبة  $5.3 \pm 2.04$ . كما تحسنت كل أنواع الغمش (النوع الحولي، ومتفاوت الانكسار، والمختلط) بشكل ملحوظ بعد الترقيع مع الأنشطة القريبة. وتحسن الغمش المعتدل والحاد بشكل كبير في المجموعة التي قامت بالأنشطة القريبة مقارنة بالمجموعة التي لم تقم بالأنشطة القريبة.

**خاتمة:** أظهرت هذه الدراسة بأن أداء الأنشطة القريبة خلال الترقيع قد إلى تحسين في حدة البصر مقارنة بالترقيع فقط.

**Objectives:** To evaluate the outcome of part-time occlusion therapy with or without near activities in monocular amblyopic patients.

**Methods:** One hundred and thirty patients who prescribed daily occlusion therapy (part-time occlusion) were followed-up for a 12-week period.

The study was carried out in the Pediatric Ophthalmology and Orthoptics Clinics of King Abdul-Aziz University Hospital, Riyadh, Saudi Arabia for the period from January to November 2010. Sixty-five patients were recommended to undertake the 3 hours of near visual activities (such as reading a book during patching) while the other 65 patients were not advised to do any near activity. Main outcome measures were best corrected visual acuity (VA) for both groups and line improvement.

**Results:** The total line of VA improved from baseline by an average of  $6.7 \pm 2.37$  line log MAR (logarithm of the minimum angle of resolution) units in the group of patching with near activities and by an average of  $5.3 \pm 2.04$  line log MAR units in the group of patching without near activities. All type of amblyopia (strabismic, anisometropic, and mixed types of amblyopia) improved significantly after patching with near activities. Both moderate and severe amblyopia improved significantly in the group of near activities compared with the group without near activities.

**Conclusion:** Performing near activities while patching in the treatment of anisometropic, strabismic, or combined amblyopia improves the VA outcome more than patching alone.

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Amblyopia is known to be the most common cause of monocular visual impairment in children and adults. Using atropine and other cycloplegic drops, for occlusion therapy and pharmacologic penalization, represent 2 of the most common forms of treatment.<sup>1,2</sup> Other forms of treatment, including levodopa and carbidopa combination,<sup>3</sup> combined optical and atropine penalization,<sup>4</sup> contact lenses, or refractive surgery,<sup>5,6</sup> have been reported to help with treatment. Although occlusion therapy has been the mainstay of treatment of amblyopia, opinions vary on the number of hours of patching per day.<sup>7-9</sup> Some have questioned the effectiveness of part-time occlusion therapy. As for full-time occlusion therapy, occlusion amblyopia, and poor compliance are factors contributing to a non-favorable treatment outcome.<sup>10</sup> Compliance with patching is always problematic; no child enjoys wearing a patch and being forced to use an eye that does not function to the standard of their "good" eye. Additionally, skin irritation, and social/psychological reasons may prevent the child from wearing the patch, and thus affect the treatment success. It is generally accepted that the response to treatment is best when it is initiated at an early age, particularly by age 2 or 3, and is poor when attempted after the 8 years of age.<sup>11</sup> In this study, we evaluated the effect of part-time occlusion combined with 3 hours near visual activities (attractive near work such as reading a book, tracing pictures, completing a puzzle is usually prescribed to attract the child and persuade him to continue patching) on the treatment outcome of amblyopic children.

**Methods.** The study adhered to the tenets of the Declaration of Helsinki and all legal guardians of the participated amblyopic children signed an informed consent approved by the Institutional Board Review (IRB) of College of Medicine, King Saud University, Riyadh, Saudi Arabia.

One hundred and thirty children (70 males [54%] and 60 females [46%]) suffering from anisometropic, strabismic amblyopia or combination of both were recruited in this study. The study was carried out in the Pediatric Ophthalmology and Orthoptics Clinics of King Abdul-Aziz University Hospital, Riyadh, Saudi Arabia for the period from January 2010 to November 2010. The mean age was  $6 \pm 2.1$  years.

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**Inclusion and exclusion criteria.** Children with age range from 3-11 years were diagnosed with amblyopia were included in the study. Congenital malformations of the eye, congenital glaucoma, congenital cataract, or any neurological disease patient were excluded from the study. The evaluation and plan of treatment were prescribed in the initial visit and followed on subsequent 3 follow-up visits (4 weeks apart).

The amblyopic children were divided into 2 groups: Group I (n= 65), received treatment plan of part-time occlusion therapy with 3 hours near activities (near visual activities such as reading a book, tracing pictures, completing puzzles, computer or video games during patching) and Group II (n= 65), received treatment plan of part-time occlusion therapy without near activities. Full instructions to the parents and their children were given to ensure perfect patching and exercise technique. At the first visit, best-corrected visual acuity (VA) was measured monocularly by using logarithm minimum of angle resolution (log MAR) chart at 6 meters (20 feet) with standard room illumination. Measurement of cycloplegic or manifested refraction, spectacle measurement, ocular motility examination, cover test, and full ophthalmoscopy and slit lamp examination were performed. At every visit, measurement of VA, manifested refraction, and ocular motility examination was performed. Occlusion therapy was continued until the vision of the amblyopic eye had no further improvement despite good compliance. Treatment success was defined as VA more than 20/30, 3 lines of improvement from baseline, or both. After stabilization of VA maintenance patching is prescribed. For comparison purpose patients were divided into 2 age groups (<7 years and  $\geq 7$  years).

Student's t-test was used to compare 2 proportions from the same sample. A *p*-value less than 0.05 indicated statistical significance. The statistical programs used for the analyses included SPSS version 15.0 software, StatsDirect statistical software, and StatPac Gold Statistical software.

**Results.** Of 130 amblyopic patients, the identified amblyopic factors were anisometropia in 35 (27 %), strabismus in 53 (41%), and mixed amblyopia in 42 (32 %). The different causes of amblyopia are shown in Table 1.

The VA for all patients was performed in an initial evaluation session and 3 follow-up visits using the log MAR chart. Measurement of total VA improvement by log MAR line in amblyopic patients for both groups of patching with and without near activity was performed and found a significant difference between the 2 groups.

**Table 1** - Breakdown of amblyopia type in 130 children suffering from anisometropic, strabismic amblyopia or combination of both (N=130).

Type/diagnosis	n	(%)
<b>Strabismus (n=53)</b>		
Totally refractive accommodative esotropia	16	(30.2)
Partially accommodative esotropia	14	(26.4)
Non-refractive accommodative esotropia	11	(20.8)
Intermittent exotropia	7	(13.2)
Hypertropia	2	(3.8)
Dissociated vertical deviation	3	(5.7)
<b>Anisometopia (n=35)</b>		
Hypermetropia	20	(57.1)
Myopia	6	(17.1)
Astigmatism	9	(25.7)
<b>Mixed (n=42)</b>		
Hypermetropia with esotropia	28	(19.0)
Myopia with esotropia	6	(14.3)
Hypermetropia with exotropia	3	(7.1)
Myopia with exotropia	5	(11.9)

**Table 2** - The total visual acuity improvement by logarithm of the minimum angle of resolution (log MAR) line in amblyopic patients for both groups of patching with and without near activity (N=130)

Cause of amblyopia	Strabismic amblyopia (n=53)	Anisometropic amblyopia (n=35)	Mixed amblyopia (n=42)
With near activity group (n=65)	7.10	7.07	6.11
Without near activity group (n=65)	5.04	5.76	5.05
Unpaired t-test (p-value)	<0.0004	<0.001	<0.001

With near activities, the baseline VA before treatment was 0.863 for strabismic, 0.871 for anisometropic, and 0.738 for mixed amblyopia. Without near activities, the baseline VA before treatment was 0.787 for strabismic, 0.0852 for anisometropic and 0.852 for mixed amblyopia.

Comparison between both groups is shown in Table 2. Similar measurement was conducted according to the severity of amblyopia and we found a significant difference between the patched group with near activity and those without near activity as shown in Table 3. Comparison was made between both age group (<7 years and ≥7 years) and found to have more or higher improvement in both age groups when they use near activities with patching as shown in Table 4.

**Discussion.** At the end of follow-up visits of the current study, we found that VA improved from baseline by an average of  $6.7 \pm 2.37$  line log MAR unit in the group of patching with near activities, and by average of  $5.3 \pm 2.04$  line log MAR unit in

**Table 3** - The total visual acuity improvement by log MAR line in amblyopic patients for both groups of patching with and without near activity according to the type of amblyopia.

Type of amblyopia	Severe amblyopia	Moderate amblyopia
With near activity group (n=65)	7.69	4.35
Without near activity group (n=65)	6.04	3.42
Unpaired t-test (p-value)	<0.0001	<0.0001

Log MAR - logarithm of the minimum angle of resolution, moderate amblyopia - visual acuity of 20/40 to 20/100, severe amblyopia - visual acuity of 20/100 or worse.

**Table 4** - The average improvement of visual acuity log MAR lines according to the age group (N=130).

Cause of amblyopia	Strabismic amblyopia	Anisometropic amblyopia	Mixed amblyopia
<b>Group with near activity</b>			
<7 years (n=35)	6.66	7.33	6.25
≥7 years (n=30)	7.75	5.40	6.00
Unpaired t-test (p-value)	<0.0001	<0.0003	<0.0001
<b>Group without near activity</b>			
<7 years (n=35)	5.00	6.15	5.53
≥7 years (n=30)	5.16	5.12	4.42
Unpaired t-test (p-value)	<0.0004	<0.0001	<0.0001

Log MAR - logarithm of the minimum angle of resolution

group of patching without near activities. This result agrees with that of Park et al,<sup>12</sup> who found at the end of patch therapy, VA improved from baseline by an average of  $3.7 \pm 2.4$  lines. Although many practitioners recommend children to do near activities that need hand-eye coordination while patching, it was unclear whether near activities enhance the effect of occlusion treatment or not. A pilot study<sup>13</sup> by PEDIG suggested that children receiving occlusion treatment combined with near activities actually spent more time performing those activities. The current study revealed a remarkable effect of patching with near activities in both severe and moderate amblyopia, where the average improvement of VA in severe amblyopic patients was  $7.6 \pm 1.93$  log MAR lines as compared to  $6.08 \pm 1.78$  log MAR lines in those who had no near activities. Similar results were observed among moderate amblyopic patients treated with patching and near activities who improved by  $4.41 \pm 1.33$  log MAR lines as compared to  $3.1 \pm 1.29$  log MAR lines of patients treated with patching without near activities. Our results matched those observed by Park et al,<sup>12</sup> who showed at the end of patch therapy,

VA improvement by  $5.22 \pm 3.24$  log MAR lines in severe amblyopia, and by  $2.59 \pm 1.46$  log MAR lines for moderate amblyopia.<sup>12</sup> However, our finding partially disagreed with that of the pediatric eye disease investigator group which found that the effect of near activities on outcome VA was only seen in patients with severe amblyopia and not in patients with moderate amblyopia (pediatric eye diseases investigator group).<sup>14,15</sup> A possible explanation for this discrepancy is that they use a large cohort at 44 different clinical sites, which may raise questions regarding compliance and consistency with the prescribed treatment regimes among various centers. The improvement of VA in the current study is more than that found by Holmes et al,<sup>15</sup> found a greater improvement in amblyopic eye VA in those assigned to near visual activities (mean 2.6 lines) than those assigned to no near visual activities (1.6 lines).<sup>15</sup> On the other hand, the current study findings disagree with the study of Pediatric Eye Disease Investigator Group (PEDIG) who reported no difference in VA improvement between the group of patching with near activities and the group of patching without near activities (mean of 2.6 lines without near activities group and mean of 2.5 lines with the near activities group).<sup>15,16</sup> Additionally, our current study demonstrated better outcome compared to the study of Repka et al<sup>14</sup> wherein children with near visual activities improved by a mean of 1.6 lines) and the children without near visual activities improved by a mean of 0.4 lines. The greater treatment outcome, in the current study, may be due to the larger number of patients, strict treatment-regimen compliance and duration of follow-up.<sup>14</sup>

**Study limitation.** Our study is limited by the number of patients enrolled, the degree of patching compliance at home and the level of children cooperation during clinical exam. More studies addressing the mentioned factors are needed to yield further results.

We conclude that performing near activities during patching in treatment of anisometric, strabismic or combined amblyopic patients resulted in clear improvement in VA more than patching without near activities. Moreover, it enhances compliance with patching specially for those with highly structured near activities that aimed at improving accommodation. Based on our findings, we highly recommend that near activities should be combined with patching therapy in amblyopia treatment.

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